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PRACTICAL AND VALUE COMPATIBILITY: THEIR ROLES IN THE ADOPTION, DIFFUSION, AND SUCCESS OF TELECOMMUTING[1]

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Abstract

Innovation literature has long advocated that an innovation may be compatible or incompatible with an organization's existing systems or resources (Rogers 1983). Compatibility of an innovation has traditionally meant that the innovation is compatible with the existing values, skills, and work practices of potential adopters. However, Tornatzky and Klein (1982) criticized this multi-faceted definition of compatibility as too broad, noting that compatibility may refer to compatibility with the values or norms of potential adopters (value compatibility) or it may represent congruence with existing practices of the adopters (practical compatibility). Much anecdotal evidence exists that employee telecommuting may be incompatible with both value and practical compatibility.

Therefore, this study investigates compatibility and its relationship to telecommuting's adoption, diffusion and success among IS personnel. The organization's ability to secure telecommuting (a dimension of practical compatibility) was found to be a major facilitator of the adoption and diffusion of telecommuting. Group values were found to be major facilitators of diffusion and success, and practical compatibility was found to be a facilitator of success. Implications for research and management are discussed.

Keywords: Telecommuting, capability, IT management, values, corporate culture

1. INTRODUCTION

Predictions concerning the growth of telecommuting[2] have not materialized, despite the potential benefits to both the employer and the employee (Guthrie 1997). While the reasons for this lack of growth are not clear, lack of control of telecommuting

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[2]Telecommuting is defined as the employees' use of telecommunications equipment to carry out their normal day-to-day activities while physically located offsite from the standard workplace.

employees has been cited as one reason and that, while out of sight, employees will engage in opportunistic behavior (Christensen 1992; Handy 1995). A 1995 study by Hewitt Associates found that 63% of companies felt that a major drawback of tele-commuting arrangements was reduced control and supervision by managers (Jones 1996). Such arrangements characteristically lack the same type of controls present in traditional, on-site work arrangements.

Success in telecommuting arrangements is believed to be improved by using outcomes-based measures of employee performance, rather than management by observation (DiMartino and Wirth 1990). Thus, organizations that manage by setting objectives and by enhancing management and employee work skills would appear most compatible with telecommuting arrangements. Recently some researchers (i.e., Belanger and Collins 1998; Kavan and Saunders 1998) have proposed that the compatibility, or fit, of telecommuting, or other similar alternative work arrangements, with the organization, individual, work, and technology is important to the work arrangement's success.

Innovation literature has long advocated that an innovation may be compatible or incompatible with an organization's existing systems or resources (Rogers 1983). Innovations compatible with existing resources imply that the risk of failure in implementing the innovation is reduced. The level of compatibility will likely be seen by the organization as a need for either a major reorientation or merely an adaptation (Downs and Mohr 1976). Moreover, an innovation's fit with the organization's tasks is believed to be a necessary condition for organizational performance improvement (Soh and Markus 1995).

Compatibility of an innovation has traditionally meant that the innovation is compatible with the existing values, skills, and work practices of potential adopters. However, Tornatzky and Klein (1982), in a meta-analysis of innovation adoption and implementation, criticized this dual definition of compatibility as too broad, noting that compatibility may refer to compatibility with the values or norms of potential adopters (value compatibility) or it may represent congruence with existing practices of the adopters (practical compatibility). Similarly, Klein and Sorra (1996) propose a model of innovation implementation success that is explained by both the formal mechanisms creating a climate for the innovation's implementation (practical compatibility) and the fit of an innovation to the targeted users' values at the organizational and group level (value compatibility).

This dual nature of compatibility has some support in telecommuting literature. The need for practical compatibility is supported by evidence that successful telecommuting is related to the ability of employees to telecommute, the existing hardware and software, and competent management (Belanger and Collins 1998; Nilles 1997). The important role of value compatibility is supported by studies on alternative work arrangements or telecommuting (e.g., Kavan and Saunders 1998; Ruppel and Harrington 1995) that have found that middle manager resistance acts as a primary barrier to adoption. Even in situations where telecommuting provides benefits, such as increased employee productivity, increased employee morale, lower turnover and absenteeism, and reduced office and parking space needs, that accrue to the organization and the manager, managers resist adoption (Kavan and Saunders 1998). Based on the findings of their 1998 study, Kavan and Saunders proposed that managers' resistance needs more research and may be due to the lack of the compatibility of the corporate culture or of alternative work arrangements. When managers were allowed to adapt their human resource practices to be more equitable and group oriented, alternative work arrangements were more likely to be adopted by managers.

Yet few, if any, researchers have investigated the dual nature of compatibility, despite its promising potential contribution to our understanding of successful implementation of new technologies (Tornatzky and Klein 1982), and telecommuting in particular. Moreover, little research has examined the relationship between IT use and the processes or social definitions (e.g., values) that affect whether an IT has a positive impact (Soh and Markus 1995). Therefore, a primary objective of this study is to further understand whether the slow growth of telecommuting is due to lack of the organizations' value compatibility or practical compatibility or both. If managers see telecommuting as incompatible with their existing values, employee skills, and work practices, telecommuting may never reach the previous claims for its success.

2. PRACTICAL COMPATIBILITY

IS research has found support for a positive influence of practical compatibility, such as IS sophistication and IS resources, on information technology (IT) adoption, use and success (Premkumar and Ramamurthy 1995; Tornatzky and Klein 1982). Moreover, the information architecture, technology infrastructure and IS human resources are of primary concern to top MIS managers (Niederman, Brancheau and Wetherbe 1991). Compatibility of the IT with the infrastructure (more and easier access

to shared computing resources and services, and IT staff with appropriate levels of technical and business knowledge) may allow organizations to obtain the greatest efficiency in IT assets from a new IT expenditure (Soh and Markus 1995).

While there is no specific list of technologies required for successful telecommuting, appropriate ITs, such as e-mail, electronic white boards, voice mail, etc., act to increase the effectiveness not only of individual telecommuters but also their fellow team members (Nilles 1997). Hardware and software needs must also address system security. The fear of intrusion from outsiders, the potential storage of data off-site, and inadvertent leakage of company data from employees may be one of the barriers to the adoption of telecommuting (Belanger and Collins 1998; DiMartino and Wirth 1990; Nilles 1997).

Some evidence exists that the need for increased security is considered by some managers to be a major disadvantage of telecommuting (cf., DiMartino and Worth 1990; Nilles 1997; Ruppel and Howard 1998). While many managers believe that external networking can be a point of vulnerability to the organization, one study (Loch, Carr, and Warkentin 1992) found that many managers do not believe external networking actually poses a major concern because the point of entry is usually a well-secured mainframe. Thus, those that feel that their security measures are sufficient, such as those with mainframes, would be more likely to believe that telecommuting is compatible with their organization and would be more likely to implement it.

Thus we hypothesize:

> **H1:** **The greater the practical compatibility of telecommuting with the IS organization, the greater the level of adoption, diffusion and success of telecommuting.**

3. VALUE COMPATIBILITY

Management approaches to distributed work arrangements may be determined by the arrangements' compatibility with the organization's values (Belanger and Collins 1998). These values include attitudes toward control mechanisms that maximize performance and manifest themselves in activities such as monitoring employee behaviors, rewarding employees for what is produced, encouraging group behaviors and outcomes, or enabling employee autonomy (Belanger and Collins 1998). A major concern in distributed arrangements has been whether employees are sufficiently empowered while having specific goals (Belanger and Collins 1998).

Quinn and Rohrbaugh (1981) developed a framework for organizational effectiveness that is based on competing organizational values. This framework has been used (e.g., Denison and Spreitzer 1991; Yeung, Brockbank and Ulrich 1991; Zammuto and Krakower 1991) to study organizational cultures and their associated innovations because of its ability to tap into the aspects of organizational effectiveness via different values, assumptions and interpretations that define an organization's culture. The framework suggests that, although an organization may contain multiple values, generally there is one prevailing set of values that comprises the culture.

Organizational values have been found to influence the successful adoption of several IT innovations, including CASE, Lotus Notes, and advanced manufacturing technologies (Orlikowski 1993a, 1993b; Zammuto and O'Connor 1992). Yet Cooper (1994) suggests that organizational culture and its associated values comprise an area that has largely been ignored by IT implementation researchers. Without a match between the values of an organization and the value assumptions embedded in an IT innovation, a costly implementation failure is likely to occur (Romm et al. 1991).

The value dimensions described by Quinn and Rohrbaugh's competing values framework are (1) people vs. the organization, (2) stability and control vs. change and flexibility, and (3) means vs. ends. Based on these dimensions, four value orientations have been identified: (1) **group**: people, flexibility, and human resource development, (2) **developmental**: organization, flexibility, growth, and inventiveness, (3) **rational**: organization, control, goal setting, outcomes, competence, and efficiency, and (4) **hierarchical**: people, control, conservative, procedures, and rule-oriented (cf. Zammuto and Krakower 1991).

It would be expected that group values would be conducive to telecommuting. Group values emphasize flexibility and member participation in decision making, both considered important to successful telecommuting (Nilles 1994). Management openness to ideas and suggestions in decision making leads to higher levels of loyalty, trust, and long-term commitment and aids the

transition to delegated responsibility and decreased employee monitoring by managers (Graen and Cashman 1975; Zammuto and Krakower 1991). Organizations that have the values of sharing and attention to human relationships and employee interests are more likely to achieve open communications among employees and commitment in implementing well-understood solutions (Schein 1996).

While relations between managers and telecommuters may deteriorate after telecommuting adoption, continuation of rich communications, feedback sessions and teams may avoid feelings of telecommuter separation and aid the telecommuter-to-manager relationship that is critical to success (Reinsch 1997). Such ongoing activities are more likely in organizations that value communication and teamwork.

Even so, some (i.e., Hill et al. 1998) suggest that telecommuting tends to negatively influence teamwork while others (i.e., Agpar 1998) suggest that teamwork deterioration is a myth. One answer may be in the nature of the task and the value the organization places in ongoing and appropriate communication. Tasks, such as computer programming, that involve routineness, predictability, technical information, and low interdependence have been found to be performed well with electronic forms of communication (e.g., fax, e-mail, etc.) (Dimitrova and Salaff 1998). Moreover, if the organization values employee communication and the technology is used appropriately, employees are enabled with immediate communication with teammates and shared access to information; contributions take on more of an egalitarian quality (Agpar 1998). In sum, group values that emphasize communication, teamwork and flexibility would encourage the implementation of telecommuting. Therefore:

> ***H2:*** **The stronger the group values of the organization, the greater the level of adoption, diffusion and success of telecommuting.**

Developmental values are characterized by environmental scanning and an assumption of change, but emphasize the organization over the individual. Individuals are motivated by the importance or ideological appeal of the task being undertaken (Zammuto and Krakower 1991). As previously discussed, telecommuting has many potential benefits for the organization such as increased productivity, office space savings and other cost savings. Nilles suggests that telecommuting's growth has been limited to-date because it is one of the better-kept secrets in business: "High benefits with comparatively low cost and risk mean a don't-tell policy regarding competitors" (1997, p. 14). Therefore, developmental values that emphasize flexibility and inventiveness would be conducive to the adoption of telecommuting out of a sense of competition:

> ***H3:*** **The stronger the developmental values of the organization, the greater the level of adoption, diffusion, and success of telecommuting.**

Rational values reflect an underlying belief in the need to perform analytical appraisals of performance following clear statements of purpose and targets. These values emphasize goals and management evaluation of performance (Greenwood and Hinings 1993). Where outcomes-based measures are used, telecommuting success is likely to be enhanced, for employee performance monitoring is no longer based on the employee being present or simply appearing busy (Belanger and Collins 1998; DiMartino and Wirth 1990). Similarly, in cases where the values emphasize output, rather than process, greater delegation and trust have occurred and resulted in higher levels of performance (El Sawy 1985; Jarvenpaa, Knoll and Leidner 1998). Moreover rational values, similar to developmental values, would be more susceptible to those arguments that emphasize the efficiency and objective side of telecommuting, particularly in the adoption stage (Cooper and Zmud 1990). Therefore:

> ***H4:*** **The stronger the rational values of the organization, the greater the level of adoption, diffusion, and success of telecommuting.**

An innovation may fit within an existing culture or it may be countercultural. Telecommuting may be countercultural in organizations exhibiting hierarchical values that may exist, in part, to control personnel. Both rational and hierarchical values focus on control, but rational values emphasize outcomes and goals, whereas hierarchical values emphasize procedures and rules. Clearly, focusing on outcomes and goals is more congruent with telecommuting, and managers in organizations with such values should more easily adapt to the idea that employees will no longer be monitored on a day-to-day basis.

Researchers (e.g., El Sawy 1985; Sitkin and Roth 1993) suggest that organizations frequently adopt formal rules when trust is lacking, but such remedies are ineffective for building trust because they do not address differences in values. Handy (1995)

suggests that, in order to obtain the efficiencies and other benefits of virtual arrangements, organizations must be based on trust rather than the control mechanisms. Because of the hierarchical control, large organizations are not conducive to trust and it is better to devise smaller, fairly constant groupings of employees in such organizations (Handy 1995). Therefore:

> **H5:** **The stronger the hierarchical values of the organization, the lesser the level of adoption, diffusion and success of telecommuting.**

4. METHODOLOGY

4.1 Sample

IS personnel, with their IT-related knowledge and relative independence in their tasks, are believed to be a group well-suited to telecommuting. Therefore, surveys were sent to 1,200 IS managers randomly-selected from an address list of Applied Computer Research. Approximately 900 surveys reached the IS manager, as estimated by a reminder, follow-up survey with address correction requested. The survey resulted in 125 usable responses, for a response rate of approximately 14%.

It was believed that these IS managers would be in the best position both to observe both telecommuting's practical and value compatibility with their organization and the level of telecommuting by IS personnel. In addition, the respondents represented companies at a variety of levels: local level (20%), national level (40%) and international level (40%). A mix of mainframe and PC users is also represented with approximately 18% of the respondents mainframe-oriented, 15% PC-oriented, and 67% both mainframe and PC-oriented.

To determine if a representative sample was achieved, two tests for non-response bias were conducted. First, a follow-up survey was sent asking non-respondents the reason they did not respond. The major reasons given for not responding were (1) too many surveys: 36%, (2) not enough time: 23%, (3) length of survey: 20%. Second, industry classifications of the respondents were compared to the industry classification of the mailing list as a whole, and no significant departures were found. Therefore, we do not believe there is a non-response bias even though the response rate is less than desired.

Of the respondents, 69 reported some degree of telecommuting and 30 reported some knowledge of telecommuting results. The surveys were analyzed using correlation analysis, followed by multivariate regression in order to test the level of variance in telecommuting explained by the independent variables.

4.2 Measures

4.2.1 Practical Compatibility

The literature on practical compatibility suggests that IT architecture, infrastructure, and IT staff with appropriate levels of technical and business knowledge best describe compatibility in the IS arena (cf. Niederman, Brancheau, and Wetherbe 1991; Soh and Markus 1995). Therefore, the respondents were asked to rate telecommuting's "fit with hardware and software currently in use," "ability to control or secure telecommuting," and "ability of MIS personnel to use or implement" on a scale of 1 = very poor to 5 = very good. While the three items loaded on one factor in a factor analysis, it was apparent that the "ability to control or secure telecommuting" was negatively impacting the Cronbach alpha. Therefore the "ability to control or secure tele-commuting" was separated from the practical compatibility variable and treated separately through the rest of the analysis. The resulting Cronbach alpha for the remaining two items is 0.83.

4.2.2 Value Compatibility

Measures for value orientation were taken from Yeung, Brockbank and Ulrich's competing values instrument. Respondents were asked to rate, on a scale of 1 = very strongly disagree to 7 = very strongly agree, the extent to which each statement described their

IS department. Cronbach reliabilities for the four value types ranged from 0.66 to 0.68. Examples of the items for each values type follow:

- Group: "My MIS department is a very *personal* place. It is like an extended family. People seem to share a lot of themselves" (three items).

- Developmental: "My MIS department is a very *dynamic and entrepreneurial* place. People are willing to stick their necks out and take risks" (three items).

- Rational: "My MIS department is a very *production oriented* place. People are concerned with getting the job done" (three items).

- Hierarchical: "My MIS department is a very *formal and structured* place. People pay attention to procedures to get things done" (two items).

4.2.3   Telecommuting Adoption, Diffusion, and Success

The measure for the adoption of telecommuting was a four-point scale including: 1 = considered at one time and rejected, 2 = currently being considered for use, but not in use, 3 = currently being used on a trial basis, and 4 = implemented. Those who marked an item reading "not familiar with the practice or never considered it" were eliminated from further analysis since they would not have considered the practical compatibility associated with telecommuting.

Diffusion was a six-point scale ranging from -1 = tried and rejected, 0 = considered for use, but not in use yet, 1 = initial or sporadic use, 2 = a few people use regularly; slightly implemented, 3 = many people use regularly; partially implemented, and 4 = all people use regularly; fully implemented. Telecommuting success was measured on a four-point scale ranging from poor to excellent results. The measurement of telecommuting success depended on the respondent having already adopted telecommuting.

5.   RESULTS

Correlation results (Table 1) clearly show a relationship between the ability to secure telecommuting and adoption and diffusion of telecommuting. Group values are related to telecommuting diffusion and success.

Of those responding, 70% of mainframe managers, 47% of PC managers, and 69% of managers of both mainframes and PCs felt their organization had a poor ability to secure or control telecommuting. This result is opposite that found by Loch , Carr and Warkentin (1992) where mainframe managers felt their security procedures were well suited to external access.

Stepwise regression analysis (Table 2) was used to examine the explanatory power of the variables found to be significant in the correlation analysis. Variables significant in adoption included the ability to secure telecommuting and developmental values, with 24% of the variation explained. Group values, the ability to secure telecommuting, and developmental values were significant variables in diffusion, with 49% of the variation explained. Practical compatibility (without security), group culture and rational values explained 52% of the variation in telecommuting results.

5.1 Limitations of the Study

The study was cross-sectional and retrospective, and so causation is not confirmed. However, an attempt was made to study three states of telecommuting, adoption, diffusion, and success, which had the effect of studying organizations in various states of telecommuting implementation in a pseudo-longitudinal form.

Table 1. Spearman Correlation Coefficients

	1	2	3	4	5	6	7	8
1. Ability to secure								
2. Practical compatibility	0.28*							
3. Developmental values	-0.12	0.23$^+$						
4. Group values	0.12	0.11	0.19$^+$					
5. Rational values	0.08	0.11	0.42***	0.37***				
6. Hierarchical values	0.20	-0.21	0.03	-0.05	0.03			
7. Adoption	0.39**	0.07	0.20	0.20	0.20	-0.10		
8. Diffusion	0.44**	0.16	0.25	0.57***	0.30$^+$	0.09	0.87***	
9. Success	0.27	0.21	0.00	0.50**	-0.01	-0.11	0.36*	0.65***

$^+$p < .10,   *p < .05,   **p < .01,   ***p < .001

Table 2. Stepwise Regressions

Dependent/Independent Variable	F Value	P Value*	Partial R-Squared	Model R-Squared	Model F-Value	Pr > F
Telecommuting Adoption				0.24	7.49	0.0015
Ability to secure	11.47	0.001	0.19			
Developmental values	3.04	0.09	0.05			
Telecommuting Diffusion				0.49	10.79	0.0001
Group values	14.47	0.001	0.29			
Ability to secure	9.88	0.004	0.16			
Developmental values	2.84	0.10	0.04			
Telecommuting Success				0.52	8.69	0.0004
Practical compatibility (without ability to secure)	9.84	0.004	0.28			
Group values	8.47	0.007	0.18			
Rational values	3.14	0.09	0.06			

*P value to enter was left at SAS's default value of p = 0.15

6. CONCLUSION AND IMPLICATIONS

This study is an attempt to see whether an organization's practical compatibility and value compatibility with telecommuting influence the dependent variables of adoption, diffusion or success of telecommuting. Of note is that the findings suggest that the types of compatibility and their dimensions influence the dependent variables differently.

The ability to secure telecommuting arrangements (a dimension of practical compatibility) strongly affects the adoption and diffusion of telecommuting. The strength of these correlations suggest that managers are looking at the practical side of telecommuting and are more likely to adopt it if they believe their organization can ensure security. Despite previous research that mainframe managers are more confident of their existing security systems, a higher proportion of mainframe managers in this study believed their systems were poor in ability to secure telecommuting. This finding may be the result of a greater awareness of security issues since prior studies were conducted or it may be that telecommuting is an application that does not fit the traditional nature of mainframe security. Although mainframe vs. PC security is not a focus of the study, further investigation is needed to understand this unexpected result.   In addition, further investigations into the organization's ability to secure the IT, as one form of practical compatibility, take on added importance in IS research as other similar virtual arrangements occur.

While security concerns pose a barrier to the initial adoption of telecommuting, value compatibility takes on increasing importance as telecommuting is diffused. Group values, in particular, become increasingly important and may indicate that, as employees work remotely with less contact time, group processes and keeping communication going take on added importance. These results are consistent with Reinsch (1997), who found that organizational neglect of the telecommuter-manager relationship may become more apparent as telecommuting becomes more widespread and as the increasing numbers of telecommuters lose social support and coaching from coworkers and managers. Managers of telecommuters must be flexible enough to adapt to managing from a distance, which generally involves a significant change from managing in the traditional method (Belanger and Collins 1998; Nilles 1997). The implication is that managers must provide encouragement and ways for employees to continue the communications after the initial adoption. Also, managers who wish to realize the best possible results from telecommuting should ensure that the human resource practices and group values are in place.

The significant role of group values may also help explain how to overcome middle manager resistance, a primary barrier to adoption of alternative work arrangements or telecommuting (e.g., Kavan and Saunders 1998; Ruppel and Harrington 1995). If group values are already a strong part or are becoming a part of the corporate culture, management resistance may be reduced, even if it involves significant change/adaptation on the part of the managers. Those organizations that value people, flexibility, open participation, and human resource development have values more compatible with telecommuting arrangements, and these values likely lead to less management resistance and greater diffusion and success of telecommuting arrangements.

There is also some support, albeit weak, for developmental values as compatible with adoption and diffusion and rational values as compatible with telecommuting diffusion and success. Developmental values, which emphasize flexibility and change, would likely also help middle managers adapt to the change embedded in telecommuting. Rational values would play a role in the diffusion and success, presumably because organizations that manage by setting goals, rather than by monitoring work effort, would be better able to integrate telecommuters into their existing management style. Management's perceived loss of control, reported to be an obstacle to telecommuting (i.e., Handy 1997), may be less of an obstacle in such organizations with rational values. Further research, however, is needed to verify the existence of the weak effects found for these two organizational value sets.

The relationship between telecommuting success and practical compatibility, with its dimensions of ability of IS personnel to use or implement telecommuting and telecommuting's fit with the hardware and software currently in use, suggest that training and IT infrastructure may be important to telecommuting's success. While this form of practical compatibility does not appear to pose a barrier to telecommuting adoption or diffusion, it may be important to achieving the maximum return from telecommuting. This is consistent with Nilles' (1997) suggestion that training and existing information technology play an important role in achieving success. Moreover, a greater investment in technology may facilitate communication and activities in line with group values, which were also found to be a facilitator of telecommuting diffusion and success in this study.

The study has implications for those wishing to champion telecommuting. In general, the fit between the organization's values and practices must be examined to determine the path of least resistance and aid in implementation success. Those wishing to champion telecommuting in their organizations need to take practical steps, such as making sure the telecommuting arrangement can be secured. Group values should be advocated in order to aid in telecommuting's diffusion and success and an investment in the people, hardware and software to support the use of the technology should be adequate.

In sum, this study shows that IS studies of IT innovations could benefit greatly from distinguishing between practical and value compatibility and between adoption, diffusion and success of the IT innovation. While the ability to secure telecommuting appears to influence adoption and diffusion, value compatibility, especially related to the human resource practices of the organization, increasingly aids diffusion and success. Whether the different role of these two forms of compatibility influence other ITs in a similar manner should provide a fruitful area for future research.

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