

**Substitutes for leadership revisited:
An assessment of the computer system as a substitute for
leadership**

Catriona Wallace

Australian Graduate School of Management

University of New South Wales

SYDNEY NSW 2052

Geoff Eagleson

Australian Graduate School of Management

University of New South Wales

SYDNEY NSW 2052

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Australian Graduate School of Management

University of New South Wales

SYDNEY NSW 2052

AUSTRALIA

Email: geoffe@agsm.edu.au

Tel: 61 2 9931 9275

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Abstract: The search for substitutes for leadership has been spectacularly unsuccessful yet the most obvious potential substitute, the computer system, has not been systematically studied. A computer system can provide some of the initiating structure and feedback functions of leadership in an obvious manner, but whether a computer system, used this way, actually substitutes for hierarchical leadership is not clear.

An analysis was made of the perceptions that front-line agents in call centers have about the role of the computer system in their supervision. Contrary to expectations, there was no evidence that the activities of the computer system were seen to substitute for hierarchical leadership. Rather, the activities of the computer system were perceived to supplement personal leadership. The implications of this finding for research and managerial practice are discussed.

Keywords: Call centers; Computer systems; Consideration, Initiating structure; Managerial feedback; Substitutes for leadership.

Introduction

The central tenet of the Substitutes for Leadership theory is intuitively appealing: in some circumstances hierarchical leadership is irrelevant as it can be replaced by characteristics of the organizational context such as the individuals involved, the task, the group or the organization itself. A substitute for leadership reduces, if not removes completely, the effect of hierarchical leadership by moderating that effect in a negative way.

The genesis of the Substitutes for Leadership theory was a concern with the lack of practically significant results in the earlier leadership literature. But the fact is that few genuine substitutes for leadership have been identified. Despite many potential substitutes for leadership having been studied there is little evidence of their moderating influence over the different aspects of leadership behavior (Podsakoff, MacKenzie & Bommer, 1996). Summarizing the results of a review of the literature searching for moderators in the Path-Goal and Substitutes for Leadership theories, Podsakoff and his co-authors (1995) concluded:

“... we find the lack of support for the moderating effects predicted by the path-goal and substitutes for leadership models both shocking and disappointing. It is hard to believe that so much research, by so many researchers, over such a long period of time, could have produced such meager results.” (p. 465).

While many potential substitutes have been proposed and investigated, the most obvious modern candidate for a substitute, the computer system, has been largely

ignored in the leadership literature. Yet a computer system has the advantage that its operation is well specified and the way it can be used to structure tasks, schedule workflow and provide feedback is clear. If substitutes for leadership exist, the computer system will surely be one of them (Howell, Bowen, Dorfman, Kerr & Podsakoff, 1990; Lawler, 1988).

The research reported here set out to determine whether a computer system is used to provide routine structuring and feedback functions substitutes for hierarchical leadership. The development of the Substitutes for Leadership theory is first reviewed. The potential for using a computer system to provide some of the leadership tasks is then noted and the likely effect of doing so on subordinate affect and performance is discussed. On the basis of this discussion some explicit hypotheses are generated and tested. Finally, the relevance of the results for both theory and practice is noted.

Substitutes for leadership theory

In their seminal paper (1978; p.337), Kerr and Jermier set out to provide “a conceptualization (of leadership) adequate to explain both the occasional successes and frequent failures of the various theories and models of leadership” that were then available. At that time, leadership theory had developed beyond the behavioral model to take contingencies (Fiedler, 1964; 1967) and motivation (House, 1971; House & Mitchell, 1974) into account. But despite many attempts to confirm the importance of hierarchical leadership to the criteria of subordinate affect and performance, the results obtained were neither substantive nor consistent. In many situations it

appeared that leadership behaviors were irrelevant, leading to claims that “the concept of leadership itself has outlived its usefulness” (Miner, 1975, p.200).

When leadership of a group is seen in terms of functions rather than individuals (Benne & Sheats, 1948), there is a possibility that these functions can be provided by means other than the personal influence of an individual. The Substitutes for Leadership theory (Kerr & Jermier, 1978) explicitly identifies a number of ways in which this can happen. Like the Path-Goal theory of leadership that predated it (House, 1971), Substitutes for Leadership is based upon the expectancy model of motivation and recognizes that both goals and paths to goals may be well specified independently of the leader.

A “substitute for leadership”, as defined in Kerr and Jermier’s (1978) paper, is any aspect of organizational context that renders “relationship and/or task-oriented leadership not only impossible but unnecessary” (p.395), contributing itself to the explanation of the variance of the criterion variable. A substitute can be a characteristic of the subordinates, the task, the group or the organization itself. Thus a set of clear Standard Operating Procedures for a routine task can provide enough clarity about what needs to be done that no room is left for a hierarchical leader to “maintain definite standards of performance”. For this particular aspect of leadership, a hierarchical leader is irrelevant except to ensure that subordinates know and adhere to the Standard Operating Procedures. In the same way, the provision of negative feedback through a computer system can remove the need for an immediate supervisor to monitor performance closely and to “let a subordinate know when they perform poorly”.

What differentiates the Substitutes for Leadership theory from earlier theories of leadership is the assumption that hierarchical leadership may have no role whatsoever in certain situations. The existence of a substitute for leadership will render hierarchical leadership irrelevant (Kerr & Jermier, 1978). The earlier contingency theories of leadership all assumed that leadership, even if redundant, is always relevant. However, when a substitute for leadership is present, the theory claims that hierarchical leadership becomes impossible and unnecessary for influencing subordinate satisfaction (Kerr, 1973; Schriesheim & Kerr, 1977). As a result, when substitutes exist it is predicted that leadership will be unable to explain practically (as opposed to statistically) significant amounts of criterion variance and hence that it should not even be measured, let alone studied (Kerr & Jermier, 1978).

The Substitutes for Leadership theory has influenced both leadership research and managerial practice. It is mentioned in most textbooks on leadership and has been reviewed as a leadership classic in the *Leadership Quarterly* (Hunt, 1997). It has focused attention on a particular set of organizational factors that are important to understanding the leadership process and it is credited with breaking the romantic notion that personal leadership is always a determinant of organizational outcomes (Meindl, 1993).

The possibility of substituting for leadership has influenced management practice by providing an alternative to leader replacement or training for improving organizational outcomes (Howell et al., 1990). That its insights have been heeded is demonstrated by the replacement of large numbers of middle managers with individual, task or organizational substitutes (Howell, 1997).

Despite its simplicity and intuitive appeal, the Substitutes for Leadership theory is not universally admired. It has been criticized on three main grounds: the constructs used in the theory to describe and measure substitutes have poor psychometric properties (Childers, Dubinsky & Gencturk, 1986; Pitner, 1986; Williams, Podsakoff, Todor, Huber, Howell & Dorfman, 1988); the assessment of substitution effects has been made at too high a level with relatively vague constructs such as organizational climate and perceived ability being assessed against complex, multi-dimensional descriptions of leader behaviors (Yukl, 1994); and causal mechanisms, explaining exactly how a construct substitutes, have neither been described (Yukl, 1994) nor researched (Podsakoff et al., 1996).

Besides these shortcomings in the theory, the analysis used in the Substitutes for Leadership research has also been criticized (Villa, Howell, Dorfman & Daniel, 2003). In many of the studies all of the original thirteen substitutes are included and all possible interactions assessed. The few significant results obtained are then complex to summarize and the multiple comparison problem has not been adequately addressed. This concern is especially salient when it is noted that there is little consistency in those moderators that are identified in different studies (Podsakoff, MacKenzie & Fetter, 1993).

Despite the intention in the early development of the theory to use 'substitute' as a generic term, encompassing moderation, mediation and main effects (Dionne, Yammarino & Atwater, 2002), most of the subsequent research in the theory has been focused on identifying moderators of leadership behaviors. This search for moderators has not been successful (Podsakoff, MacKensie, Ahearne & Bommer, 1995; Podsakoff et al., 1996). Recently Dionne, et al., (2002) have argued that in

some cases it makes more sense to look for mediators, rather than moderators.

However, their study found no evidence of mediator effects and little evidence of moderator effects. What little evidence there was of moderation disappeared when common source bias was removed.

Interestingly there is one potential substitute that could be expected to be a substitute in the strongest sense of the word and yet whose relationship to leadership seems not yet to have been studied, namely the computer system.

The Computer System as a Substitute for Leadership

The increasing availability and functionality of computers has transformed the way work is done and has allowed the possibility that the computing system can now play an important role in the management of an organization. A computer system is a perfect example of a true substitute for leadership: a way of providing many of the routine management functions by replacing the corresponding activities of the hierarchical leader (Bass, 1990). Thus a computer system can be used to schedule workflow, to set and maintain standard operating procedures, to generate targets, to detect errors, to monitor performance and to provide both positive and negative feedback (Howell et al., 1990; Lawler, 1988).

From a theoretical point of view, the computer system, of all the potential substitutes for leadership identified, is perhaps the only one for which most of the criticisms noted above do not hold. The computer system can be used to provide many of the Initiating Structure functions as well as the feedback functions captured in reward and

punishment activities. In these cases, the causal mechanisms whereby a computer system provides a leadership function are explicit and, in fact, codified. Thus the scales constructed to measure the intensity of a computer system's use can be the same as, or a component of, the corresponding scale used to measure leadership behaviors. As a consequence the computer system activities and leadership behaviors can be compared item-by-item, if so desired.

Despite the potential of the computer system to substitute for hierarchical leadership, it seems that it has not been studied in the context of leadership. Yet an understanding of this role for a computing system is interesting from a research point of view and important from a managerial point of view. Bass (1990) notes that one of the leadership issues for the twenty-first century is to understand how the use of computers to monitor and give feedback influences the perceptions of subordinates.

A study of the use of the computer system as a substitute for leadership requires research sites that satisfy two requirements: first, the computer systems at the site must be capable of providing some of the leadership functions and, second, the nature of the tasks being performed should encourage the replacement of the hierarchical leader by the computer system. One organization that satisfies these requirements is a call center providing routine transactions where the sophistication of the technology employed allows supervisory tasks that can be well defined and standardized to be automated.

Call centers are used to accomplish a multitude of tasks: completing routine transactions, generating sales and providing customized advice and solutions (Batt,

2000). The most straightforward use of a call center is as an interface between customers and the company's systems, completing standard transactions whose distinguishing characteristics are that they are well-defined and relatively simple tasks that can be delivered through encounters (Gutek, 1995). The transaction services provided by a call center are managed with an emphasis on efficiency and hence the computer system is likely to be used as a leader substitute in these cases. At the other extreme, a call center can be used to provide solutions to and advice on quite complex and technical problems. Here the focus is on the customer both in terms of access, personalized attention and quality of advice and the same employee is likely to deal with a particular customer to ensure a long-term relationship exists. These services can be expected to attract a high margin and so are managed for effectiveness rather than efficiency (Lepak & Snell, 1999). In this context the computer system is more likely to be used as a resource for the frontline than as a management tool.

Support for the existence of substitutes for leadership has been disappointingly weak. Yet the most obvious candidate for a substitute, the computer system, seems not to have been studied from a leadership point of view. It is clear how a computer system can substitute for a hierarchical leader and we have argued that this is likely to take place when transaction services are provided in a call center. A study of the leadership of those call center employees largely involved in transaction tasks was designed, therefore, to assess the usage of the computer system as a substitute for leadership for these workers.

Leadership of transaction services

There are three dominant leadership functions that influence subordinate affect and performance: structuring the task, providing feedback and managing the socio-emotional needs of the group (Bass, 1990). Consistent with earlier reviews (Andriessen & Drenth, 1984), Bass (1990) found task-oriented functions to be associated with group performance and relations-oriented functions to be associated with subordinate satisfaction. However, Bass also noted that relations-oriented functions are positively associated with group performance. This may be because task-oriented behavior without personal attention to group members can affect performance by reducing motivation (Fleishman & Harris, 1962).

Feedback, both positive and negative, can be expected to influence group and individual outcomes (House & Mitchell, 1974). Both types of feedback can be provided in contingent or non-contingent ways. Podsakoff, Todor and Skov (1982) showed that while contingent reward behavior by a supervisor positively influenced both affect and performance; non-contingent punishment had a negative effect on satisfaction.

As a consequence of the pressure to reduce costs of transaction services, one would expect that the computing system would be used whenever possible to structure tasks and provide feedback to those whose work is routine. In this context a computer system allows information and feedback to be provided directly to workers resulting in less need for human supervision (Howell, 1997) and thus truly substitutes for hierarchical leadership.

Hypothesis 1: Front-line call staff, the majority of whose work is judged by them to be routine, will perceive the computer system as a strong substitute for hierarchical

structuring of the task and provision of positive and negative feedback. That is, perceptions about the use of the computer system to provide leadership functions will have a significant main effect on subordinate affect and performance and will moderate negatively the effect of the corresponding hierarchical leadership behaviors.

In order to capture the efficiencies available when the computer system is used to provide more of the standardized managerial functions, it is predicted that the human managers will provide less. Of course a leader can still insist on trying to lead in the presence of a substitute. But, in this case, they would either be replicating what the substitute has already done, which would be inefficient, or they would be contradicting the substitute, which would give rise to conflict and confusion. In either case, as has been noted by House and Mitchell (1974), when a leader and a substitute provide the same function, this will be seen by subordinates as excessive control and can be expected to lead to decreased satisfaction.

Hypothesis 2: Front-line call staff, the majority of whose work is judged by them to be routine, will perceive computer system activities to be negatively associated with those leadership behaviors that provide the same specific leadership functions.

Using the computer system to provide leadership functions can influence the front-line in either a positive or negative way, depending on how the managerial resources that are released are utilized. The excess management resources can be redeployed in one of two ways: to achieve efficiencies in management or to provide more leadership to the front line.

If the excess resources are used to improve management efficiency by allowing the manager to attend to higher-level issues of scheduling and coordination, this is unlikely to be controversial. But if they are used to increase the amount of control, including negative feedback, this can be perceived to result in the creation of “sweatshops of the mind” with deleterious consequences (Fernie & Metcalf, 1998). While productivity might improve (Komaki, 1986), the perceived overemphasis on monitoring the quantity (as opposed to the quality) of work can lead to employee well-being, job satisfaction and organizational commitment decreasing (Aiello, 1993; Deery, 2002; Holman, 2002).

However, a dependence on the computer to provide some of the traditional supervisory functions need not be deleterious from a subordinate’s point of view. As well as replacing some leader behaviors with a standard, predictable process, using the computer system to replace the leader can contribute in a positive way to the development of a work climate that itself can enhance subordinate affect. Managers no longer have to monitor the workforce and so can spend more time developing closer relations with their subordinates, leading to the development of harmonious social relations (Woodward, 1980).

A surrogate for the time spent by a leader in developing closer relations with subordinates is the degree of relations-oriented supervision provided. When the computer system is used to provide some leadership functions and when there is no effort on the part of team leaders to increase relations-oriented behaviors, it is expected that in-role performance will increase but that extra-role performance, organizational satisfaction and commitment would all decrease. On the other hand,

when team leaders are seen to display frequent relations-oriented behaviors, one would expect both affect and performance to increase. It must be noted, though, that the amount of relations-oriented behavior shown by a team leader will depend on the individual leader as well as on organizational norms.

Put another way, the effect of using the computer system to provide leadership functions can be expected to be moderated by the relations-oriented behavior of the hierarchical leader, at least for extra-role performance, organizational satisfaction and commitment. Because of the constant, close supervision provided by a computer system, in-role performance would be expected to increase, no matter how the hierarchical leader behaves.

Hypothesis 3a: For front-line call center staff, the majority of whose work is judged by them to be routine, the perception of frequent use of the computer system to provide task structuring and feedback will result in high levels of in-role performance.

3b: For front-line call center staff, the majority of whose work is judged by them to be routine, the relations-oriented behavior of the hierarchical leader will positively moderate the effect of providing some of the leadership functions by the computer on subordinate affect and extra-role performance.

Methods

The sample

A total of 68 call center managers in Australia and New Zealand agreed to participate in the study. They were sent a questionnaire to give to some of their front-line staff to assess perceptions of supervisory and computer activities and affect. They were sent a second questionnaire for the supervisors of those completing the survey asking for an assessment of performance of the individuals they managed. Results were obtained from 44 call centers, providing usable responses from 357 front-line staff who considered that the majority of their work was routine. It is worth noting that there may be a self-selection bias among the call centers and also among the respondents.

Measures

Four dependent variables were measured: Organizational Satisfaction, Organizational Commitment; In-role and Extra-role Performance. Eleven independent variables were assessed: Initiating Structure, Contingent and Non-contingent Reward and Punishment activities for both the hierarchical leader and the computer as well as the Relations-oriented behavior of the team leader. Wherever possible, extant scales were used for both predictors and criteria in order to facilitate comparison with earlier work and interpretation of the results (Comstock & Scott, 1977; Nunally & Bernstein, 1994).

The scales used for subordinate affect were the Minnesota Satisfaction Questionnaire (Weiss, Dawis, England & Lofquist, 1967) and the Organizational Commitment

Questionnaire (Porter & Smith, 1970). The Minnesota Satisfaction Questionnaire measures a combination of intrinsic and extrinsic satisfaction perceptions. While these two aspects can be factored into subscales there is some criticism of the allocation of items (Cook, Hepworth, Wall & Warr, 1993). In this study the full scale was used, providing a measure of overall job satisfaction. The reliability of this scale is consistently reported to be greater than 0.87 (Cook et al., 1993).

The Organization Commitment Questionnaire measures “the strength of the individual’s identification with and involvement in a particular organization” (Cook et al., 1993, p.84). It has high reported reliability (a median Cronbach alpha of 0.90), and, though different to job satisfaction, is generally highly correlated with scores on the Minnesota Satisfaction Questionnaire (ibid).

Subordinate performance was separated into two aspects: in–role performance and extra–role performance as assessed by an individual’s team leader. In–role performance was measured using a questionnaire developed by Podsakoff and others (1982). This scale measures the effectiveness of an individual at doing the job as formally specified and is reported to have an internal liability of 0.90 or greater (Farh, Podsakoff & Cheng, 1987). Extra–role performance was measured using the Organizational Citizenship Behaviors Reduced Scale (Organ, 1988). This scale rates a subordinate’s corporate citizenship by assessing how willing they are to help others and to do things not formally required by the job.

To measure hierarchical leadership behavior, the LBDQ Form XII (Stogdill, 1963) scales for Initiating Structure and Consideration were used, together with pre-existing measures of reward and punishment behaviors, either contingent or non-contingent

(Podsakoff et al., 1982; Podsakoff, Todor, Grover & Huber, 1984). The feedback scales used in this study were developed in order to assess the influence of feedback behaviors on subordinate affect and performance and have reported internal reliabilities ranging from 0.80 to 0.93 (Podsakoff et al., 1982). Both theoretical arguments and experimental results lead one to expect that Contingent Reward and Non-contingent Punishment will have the greatest effect on subordinate perceptions (Podsakoff et al., 1982; Podsakoff & Todor, 1985).

Given the preference to use pre-existing scales, their structure was confirmed on the data collected for the present study by factor analysing the items using principal components and varimax rotation. It is reasonable to use the pre-existing scales if the factors derived from the current sample have essentially the same items with comparable loadings and communalities as the published scale (Hair, 1995; McIntosh, 1990). The factor structure was confirmed for all of the above scales on the present data set.

The scales used to measure the contribution of the computer system to the leadership of the front-line staff were based on the hierarchical leadership scales. If it was at all possible, items in the leadership scales were rephrased so as to reflect the activities of the computer system; if this was not possible, the item was not used. Thus, for example, the item from the Initiating Structure scale,

“how frequently does your team leader schedule the work to be done?”

can be used, *mutato mutandis*, to apply to the computer system by asking,

“how frequently does the computer system schedule the work to be done?”.

On the other hand, the item from the same scale,

“how frequently does your team leader try out his or her ideas on the team?”

does not seem appropriate to ask of a computer system and so was omitted.

In this way, scales were developed for the leadership contributions of the computer system. There was no scale corresponding to Consideration, as none of the items could be rephrased to relate to the computer system’s activities. Three of the five scales for measuring the task structuring and feedback activities of the computer, had fewer items for the computer than for the leader. Initiating Structure had seven items rather than ten; Contingent Reward had nine rather than ten; Non-contingent Reward had three rather than four.

The responses to the items assessing the non-contingent feedback activities of the computer system were highly skewed. All of these items had 63% or more responses in the category “Never”. It was decided that it was best to remove all the non-contingent scales from the analysis. The remaining items used to assess the contribution of the computer system to leadership were factor analysed, using principal components with varimax rotation. Three distinct factors with eigenvalues greater than one were found with the items allocated as expected.

The scales used to measure the extent to which the computer system is used to manage subordinates were all subscales of extant instruments. Apart from allowing a direct comparison between the leader and computer scales, this approach provides assurance that the new scales have content and construct validity. Their face validity was assured through a pilot study, leading to minor rewording of some of the items.

Data description

Descriptive statistics for the remaining seven independent and four dependent variables were calculated and are presented in Table 1a below. The means and standard deviations of the leadership behavior variables were all within the ranges reported in the literature.

(Insert Table 1a about here)

A preliminary analysis showed that there were a number of outliers in these distributions. At each stage of the analysis, subjects with missing values or outliers in their responses were removed, resulting in different sample sizes for different analyses. The smallest sample size that was used was 226. It should be noted that a recalculation of the descriptive statistics when outliers are removed gave essentially the same results as in Table 1a.

The correlations between the 11 variables were calculated and are shown in Table 1b. The Cronbach alpha coefficients are displayed in italics on the diagonal.

(Insert Table 1b about here)

Note that for these data the correlations between an individual's perceptions of their organizational commitment and satisfaction and their supervisor's ratings of their in-role and extra-role performance are close to zero. This is not unusual. A review of 12 studies of the correlation between an individual's job satisfaction and a rating of their job performance found correlations ranged from -0.31 to 0.23 (Vroom, 1964). In 4 of the 12 studies, the correlation was less than 0.1 in absolute value.

Analysis

It is clear from the summary statistics reported in Table 1a that there is evidence that the front-line staff perceive that the computer system provides many of the task and feedback functions of leadership.

Given that the computer system is perceived to be providing some of the functions of leadership, is it actually substituting for the traditional hierarchical leadership?

Because the scales measuring the influence of the computer systems are, on the whole, subscales of those for the hierarchical leader, a direct comparison can be made as recommended by Dionne et al. (2002) and Villa, et al. (2003). We can observe the influence of leader Initiating Structure behavior on organizational commitment, for example, and then assess whether Initiating Structure provided by the computer system substitutes for it.

To make the assessment we followed the protocol set out by Howell and Dorfman (1981). For each leadership variable it was first determined whether it was potentially substitutable. To be potentially substitutable, the variable has to have a significant main effect on the criterion either in the full sample or in the sub-sample for which the corresponding substitute scale is low. Whether a leader variable was substitutable or not, the four criterion variables were regressed on the specific leader scale, the corresponding computer scale and an interaction term. In all of the comparisons, only similar leader and computer scales were considered. Thus, for example, the leader Contingent Reward scale was compared only with the computer Contingent Reward scale. The one exception was the leader Consideration scale which, having no direct analogue among the computer scales, was compared with the computer Contingent Reward scale. For ease of interpretability and to ensure that the

interaction term is less correlated with the main effects, all variables were centered about their respective means (Aiken & West, 1991).

The computer is declared a “substitute” if, in the full regression model, the computer variable has a significant main effect of the same sign as the leader variable and the interaction term is also significant but with the opposite sign to the main effects.

Some of the patterns of results that could be obtained, together with their associated classification, are given in Table 2.

The assessment of the perceived association between the activities of the computer system and the corresponding leader behaviors was made on the basis of the empirical correlations in Table 1b.

To test Hypothesis 3a, In-role performance was regressed on the three computer variables, first singly and then in a group. Hypothesis 3b was assessed by testing the interaction of the leader Consideration scale with the computer variables for the criteria of Extra-role Performance and subordinate Commitment and Satisfaction

(Insert Table 2 about here)

Results

The results of this analysis for all of the four leader scales retained in the analysis are given in Table 3. In that table the pattern of significant results is shown. The detailed results are available from the authors on request. When interpreting the results in Table 3, one has to remember that they have been derived from a regression analysis that used correlated independent variables. The regression equations calculated may

be an adequate description of the data, but there is no guarantee that the significance of the individual independent variables would be repeated in the analysis of different data sets.

(Insert Table 3 about here)

Summarising the results in Table 3, we see that there is no evidence of the computer system substituting for leader behavior even when it could have been expected to do so. In five cases the leader behavior was not potentially substitutable and there was no significant effect from the computer variables. In two other cases the leader behavior was not substitutable but there was a (marginal) main effect due to the computer. In six cases there was a significant leader effect but no corresponding effect from the computer. In two of the three cases where the computer effect was significant, it supplemented rather than substituted for the corresponding leader behavior. All except one of the interaction terms were not significant. For the one exception, Initiating Structure affecting Satisfaction, the interaction was the same sign as the two main effects and so was labelled a “Strong Supplement”. Hypothesis 1 was not supported.

As there are significant correlations between all the leader scales, a second analysis was performed using the other leadership variables as controls. The results of this second analysis were qualitatively the same as when the leadership and computer system were compared directly.

It is clear from the results in Table 3 that using the computer to provide task structuring functions is the dominant way a computer system contributes to leadership. There is some evidence that using the computer to deliver criticism will

only exacerbate a negative reaction to the leader's contingent punishment behavior. The other notable aspect of the results is the frequency with which leader behaviors have an effect, especially on commitment and satisfaction. It appears, as noted by Dionne et al., (2002), that classical leadership behaviors continue to be important.

Hypothesis 2 was tested by assessing the relevant correlations from Table 1b.

Contrary to expectations, the only significant correlation between the leader and the corresponding computer scales was for Initiating Structure. That correlation is positive, not negative. There was no evidence to support Hypothesis 2.

To assess Hypothesis 3a, the three computer variables were used to predict In-role Performance, first singly and then as a group. The results are shown in Table 4.

(Insert Table 4 about here)

The computer providing Contingent Reward has a marginally significant main effect, but with a negative coefficient as was the case in the previous analysis (Table 3) when leader behavior variables were also included as predictors. The Computer Initiating Structure was a statistically significant predictor of In-role Performance but was not significant in the previous analysis (Table 3), presumably because of the inclusion of the (correlated) Leader Initiating Structure as a predictor. Computer Contingent Punishment and all three variables together were statistically significant predictors of In-role Performance but, once again, in a negative way. The computer variables do have an effect on In-role Performance, but not in the direction hypothesized.

Hypothesis 3a is not supported.

Finally, Hypothesis 3b was assessed by testing the interaction of the leader Consideration scale with the computer scales for the criteria of Extra-role Performance and subordinate Commitment and Satisfaction. There were no significant interactions. There was no evidence to support Hypothesis 3b.

Discussion

The possibility that a computer system can act as a substitute for hierarchical leadership has already been explicitly noted by Lawler (1988). However, its effect as a substitute does not seem to have been studied in detail. This is despite the fact that a direct assessment of the way the computer system substitutes can be made and its interaction with interpersonal influence processes can be studied.

The study reported here set out to establish that computer systems are used to substitute for leadership, at least in a environment conducive to their use. It was argued that such an environment would be a call center, where routine transactions are performed. While there was clear evidence that the front-line staff in such centers perceived that the computer system is used to provide a range of leadership functions, to our surprise there was no evidence that this was seen in any way as substituting for the hierarchical leader.

If management were consciously taking account of the leadership role of the computer system, one would expect to see high levels of computer activity associated with either low levels of task structuring behaviors or high levels of relations-oriented behaviors, or both. This was not the case. Rather than the computer system making the hierarchical leader redundant, there was a significant, positive, howbeit small, correlation between the frequencies of their Initiating Structure activities. It appears

that sometimes those on the front-line perceive both the computer system and the hierarchical leader are providing the same task structuring functions at the same time. This could be because there was some degree of overlap and hence redundancy in the activities of the leader and the computer system or it could be that, when responding to individual items, the subordinates could be interpreting them differently for the two sources.

If there is redundancy in the activities of the supervisor and the computer system, one would expect that using the computer system to manage would have a deleterious effect on subordinate affect. This was not the case. The computer system, after controlling for the human leadership behaviors, either had no significant influence on affect or, where it did, it supplemented the effect of the team leader. Where the use of the computer system and, for that matter, the behavior of the team leader had a negative effect was on in-role and extra-role performance.

In a review of the development of the theory, Jermier (Jermier & Kerr, 1997) makes the point that when a substitute replaces a leader there will be a main effect attributable to it. This is what distinguishes the theory from the previous contingency theories of leadership. When the emphasis is placed on identifying moderators of the relationship between leader behaviors and criteria, the unique contribution of the theory is lost. Jermier states of the substitutes: "... it is the main effects that deserve our attention" (p.98).

By now there is ample evidence that many aspects of organizational context have significant main effects and explain substantial amounts of criterion variance but there is little evidence of them acting as moderators (Kerr & Jermier, 1978; Podsakoff et al.,

1993; Podsakoff, et al., 1995; Podsakoff et al., 1996) or even mediators (Dionne, et al., 2002). Rather than acting as moderators or mediators, the organizational context may provide supplements as the computer system seems to do, coexisting and sharing leadership functions as appropriate (Howell & Dorfman, 1981).

The idea that leadership may be supplemented is not new, though much of the literature relating to this possibility considers only human supplements. It has been argued that to be an effective leader an individual has to provide high levels of both task and relations leadership (Bass, 1990). However, there are many ways in which leadership can be enacted: by an heroic individual (Misumi, 1985), by a leadership team (Waldersee & Eagleson, 2001) or by the conglomeration of all the potential influences available, be they people, systems or work climate (Yukl, 1999a, 1999b).

Implications for research

In a review of the research subsequent to the publication of Kerr and Jermier's original article (1978), Podsakoff and MacKenzie (1997) note that "most of the effects of the substitute variables appear to be main effects rather than interactions" (p. 122). They call for future research to focus on understanding the main effects of potential substitutes, but there is no evidence that this call has been heeded. Based on the results of this study, the focus of future research on substitutes for leadership should be on the whole gestalt of leadership, especially on ways of supplementing hierarchical leadership.

The data in this study have the drawback that they have been collected through questionnaires. Though every attempt was made to gather independent information about an individual's performance, there still remains a concern with common method

variance. Also, the study was designed (for practical reasons) to be cross-sectional. Further research is needed, using a longitudinal design, so that causality, rather than mere association, can be determined.

Another concern with the study is that the data were collected from only one type of organization: call centers where routine transaction services are provided. Whether the results obtained here would be replicated in other types of organization with sophisticated technology and routine tasks is an open question that requires further research.

It can also be expected that the computer leadership variables used here will be correlated with at least some of the classical potential substitutes such as how routine the task is, feedback provided by the task, organizational formalization and inflexibility. Further work is needed to understand how the computer system interacts with other aspects of the organization's context and how, together, they influence subordinate affect and performance.

Finally, while the way in which a computer system can substitute for hierarchical leadership is clear, it is nevertheless the case that the analysis has been based on simple, one-dimensional scales to measure multi-dimensional constructs. This need not have been the case. The items used to assess the provision of leadership functions by the computer system are precisely the same as those used to assess hierarchical leadership behavior. As a consequence, any perceived overlap between the efforts of the hierarchical leader and the computer system can be identified and then assessed on an item-by-item basis. This analysis has been left for another paper.

Given that using a computer system to provide leadership functions seems to supplement rather than substitute for leadership, the search for substitutes should be modified. It will be more productive to study the complete leadership gestalt in an organization and to understand how the different ways of influencing outcomes complement or interfere with each other. It is only by doing this that we shall serve well those practising managers who seek to apply our results.

Implications for management

The implications for management of this research are twofold: first the results reported here challenge some widely held assumptions, and secondly they provide a framework for managers to think about and understand the different ways in which leadership can be delivered.

The assumption underlying the Substitutes for Leadership theory, that there are situations in which hierarchical leadership is irrelevant and unnecessary, must be questioned. The fact of the matter is that, despite many researchers searching for substitutes in a myriad of studies, few have been found. This is not to say that substitutes, if they exist, should be ignored. Of course, not. Every manager is anxious to use all the tools at his/her disposal to improve performance and affect and so should use an appropriate substitute if one is available. But no-one should imagine that substitutes are common and easy to use.

What is more likely to be true is that supplements to leadership are common. The existence of supplements is no less important than the existence of substitutes. Supplements can be used to enhance a manager's effectiveness. By using their own

behavior judiciously and complementing it with leadership supplements, managers can obtain better outcomes.

Leadership, like most of management, is not about mutual exclusivity, doing either this or that, but is about mutual reinforcement. Knowing the potential for aspects of the context to complement leadership, the manager can deliberately act to ensure that supplements exist and are effective. Among other things, the leader can affect the attraction, selection and retention of the right staff, the creation of work climate (Burke & Lutwin, 1992), organization culture (Ogbonna & Harris, 2000), and the design of the structure, administration and control systems of the organization. They can also determine how the computer system will be used to control and motivate subordinates.

Another assumption challenged by the results reported here is the belief that non-personal control, especially when delivered through an invasive computer system, is deleterious to employee affect and hence performance. It may well be that there are situations where this would be the case: professionals are much less likely to accept formalized control systems. But in the current study of call centers, there was evidence to the contrary. The use of the computer system to structure and schedule tasks was associated with higher satisfaction levels. It was only when the computer system was used to provide both positive and negative feedback that it was negatively associated with performance.

Realizing that there are many ways of supplementing their leadership efforts provides management with a framework for thinking about and understanding the different ways in which leadership can be delivered. Attention has to be focused on

understanding and providing the leadership required, not on searching for ways to delegate responsibility for it to inanimate aspects of the organization. It is clear from the research reported here that management should not be thinking about supplements and substitutes as a way of decreasing their involvement and thus increasing administrative efficiency. Rather management should be working closely with the supplements and substitutes they have identified and created, using any spare resources generated to shift their leadership activities away from the routine to the more value-adding.

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Table 1a: Descriptive statistics of the scales measured

Scale	Theoretical Range	Observed Range	Mean	Standard Deviation
Leader Initiating structure	10 – 50	24 – 50	40.2	5.64
Leader Consideration	10 – 50	16 – 50	40.0	6.75
Leader Contingent Reward	10 – 50	10 – 50	36.8	8.61
Leader Contingent Punishment	5 – 25	5 – 25	15.8	4.15
Computer Initiating structure	7 – 35	7 – 35	21.4	7.08
Computer Contingent Reward	9 – 45	9 – 41	17.4	7.09
Computer Contingent Punishment	5 – 25	5 – 24	9.9	5.14
Commitment	21 – 105	21 – 105	72.5	15.46
Satisfaction	20 – 100	39 – 100	74.0	11.31
In-role Performance	4 – 28	4 – 28	21.4	5.27
Extra-role Performance	16 - 112	34 – 99	72.7	11.29

Table 1b. The correlations between the variables

	Leader Initiating Structure	Leader Consideration	Leader Contingent Reward	Leader Contingent Punishment	Computer Initiating Structure	Computer Contingent Reward	Computer Contingent Punishment	Commitment	Satisfaction	In-role	Extra-role
Leader Initiating Structure	0.85 [†]										
Leader Consideration	0.50***	0.90									
Leader Contingent Reward	0.47***	0.68***	0.92								
Leader Contingent Punishment	0.32***	0.08	0.16*	0.77							
Computer Initiating Structure	0.15*	0.05	0.06	0.01	0.83						
Computer Contingent Reward	0.01	0.04	0.05	-0.04	0.28***	0.81					
Computer Contingent Punishment	0.05	0.01	-0.01	-0.01	0.36***	0.68***	0.86				
Commitment	0.21**	0.28***	0.31***	0.07	0.15*	0.03	0.03	0.88			
Satisfaction	0.36***	0.47***	0.47***	0.17*	0.14*	0.05	0.08	0.65***	0.91		
In-role	-0.14	0.00	0.04	-0.11	-0.17**	-0.03	-0.10	0.03	0.01	0.91	
Extra-role	-0.17*	-0.01	0.01	-0.13	-0.22***	-0.03	-0.08	-0.02	0.01	0.73***	0.90

*indicates $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$; $n=226$

[†]Cronbach alphas appear on the diagonal

Table 2. Patterns of substitution

Hierarchical leader main effect significant	Potential substitute main effect significant	Interaction between the leader and substitute significant	Description
✓	✓	✓ Opposite sign	Substitute ¹
✗	✓	✓ Opposite sign	Strong Substitute ²
✗	✓	✗	Very Strong Substitute ²
✓	✓ Same sign	✗	Supplement ³ (Weak Substitute ¹)
✓	✓ Same sign	✓ Same sign	Strong Supplement

¹ Howell & Dorfman, (1981)

² Howell, Dorfman & Kerr (1986)

³ Howard & Joyce (1982)

Table 3. A comparison of the contributions of leader and computer to the four criteria (the direction of the effect is indicated in brackets)

	Leader and Computer Initiating Structure	Leader Consideration and Computer Contingent Reward	Leader and Computer Contingent Reward	Leader and Computer Contingent Punishment
Commitment	Leader main effect only	Leader main effect only	Leader main effect only	Not substitutable. No significant effects
Satisfaction	Strong supplement	Leader main effect only	Leader main effect only	Not substitutable. No significant effects
In-role Performance	Not substitutable. No significant effects	Not substitutable. Marginal* computer main effect (negative)	Not substitutable. Marginal* computer main effect (negative)	Supplement (negative)
Extra-role Performance	Computer main effect only (negative)	Not substitutable. No significant effects	Not substitutable. No significant effects	Leader main effect only (negative)

* 'Marginal' here means a p-value between 0.05 and 0.10.

Table 4. Tests of the contribution of the computer variables to In-role Performance

Variable	Sign of regression coefficient	F-statistic (Degrees of freedom)	p-value
Computer Initiating Structure	Negative	4.48 (1,290)	0.04
Computer Contingent Reward	Negative	3.14 (1,280)	0.08
Computer Contingent Punishment	Negative	8.08 (1,277)	0.00
All three variables	Negative Positive Negative	3.59 (3,273)	0.01