TOP MANAGEMENT'S ROLE IN IMPLEMENTING TECHNOLOGICAL CHANGE: A STUDY OF COMPUTER INTEGRATED MANUFACTURING

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ABSTRACT

Information technology and advanced manufacturing technology, used together in Computer Integrated Manufacturing (CIM), provide manufacturers with a formidable weapon in the battle for competitive advantage. Top management plays a pivotal role in the successful implementation of technological change such as CIM. In this paper, we propose and test a model explaining top management's role in implementing technological change. According to our model, successful implementation of technological change depends on whether or not communications and goals espoused by top management are accompanied by concrete actions that are consistent with stated goals. The proper role of top management includes: (1) committing needed resources, (2) removing obstacles, and (3) involving functional managers in planning and implementation to gain their commitment. A path analysis supports the hypothesized model.

INTRODUCTION

Computer Integrated Manufacturing (CIM) is the application of information and manufacturing technology, plans and resources to improve the efficiency and effectiveness of a manufacturing enterprise through horizontal (data sharing among manufacturing systems), functional (data sharing among functions), and external (data sharing among different organizations) integration [13]. Although technological changes such as CIM offer substantial benefits, actual gains often fall short of potential and promised gains [1,6,15,24]. Melnyk and Narasimhan call this the "CIM mystery"-- CIM should work, but in many cases it doesn't [15, p. 12]. It should work because technology is improving and costs are decreasing. Moreover, though technology presented a formidable barrier in the past, technological solutions have been developed to solve technological problems with a high degree of success [14, 15].

The implementation of CIM is a substantial technological change requiring (1) a sound strategy to ensure that proposed changes match environmental demands and (2) congruent changes in organizational subsystems to ensure that technology fits formal organization, informal organization, and people [8, 27]. Needed changes may involve work rules, task roles, requisite skills, work contents, formal and informal covenants of the workplace, system standards and measures, management styles and cultures, and organizational patterns [27]. If collateral changes lag, or they are inconsistent with the technological change being implemented, the full benefits of technological change may not be realized [14, 15, 18].

In recent years the CIM literature has deemphasized technical issues and has exhibited a distinct trend towards greater concern for the systemic changes needed to successfully implement technological change. For example, Snyder and Cox [23] conducted case studies of individual firms known to have successful CIM implementations and identified three major problem areas: management, technology, and human resources. Snyder and Cox [23] highlighted the importance of cultural change and warned that inadequate attention to human resources could doom CIM to failure. Goldhar, Jelinek, and Schlie [6] reported similar conclusions but also emphasized the importance of strategic barriers to CIM success. Likewise, Tranfield et al. [24] discovered that major obstacles to CIM success tended to be organizational, cultural, and human in nature, rather than technological. Successful CIM users attributed their success to "a parallel process of organizational change to match technological changes" [24, p. 213], leading Tranfield et al. [24] to conclude that integrated technologies require highly integrated social systems and flexible, decentralized organizations.

In view of the importance, scope, and systemic nature of these changes, top management's role in the successful planning and implementation of technological changes such as CIM is critical [17, 8]. The importance of top management's contribution to the success of technological change is documented in the literature on innovation [3], information technology (IT) [5, 22, 9], manufacturing technology (MT) [18, 11], and CIM [12, 14, 15, 25]. By contrast, the nature of top management's role in technological change is less clear. Progress is apparent in some areas (See Jarvenpaa and Ives, [9]); however, as Daft concludes, "the precise role of organization leaders in the innovation process is not clear" [3, p. 193]. Suboptimal performance may be a consequence of this lack of understanding.

In sum, CIM can be expected to produce only moderate success if technological change is not accompanied by fundamental changes in parallel organizational subsystems. Organizational change of this magnitude demands the attention of top management, but the nature of top management's role is unclear. In the next section, we propose a model that examines the role of top management in technological change. The model focuses on what top management must do to contribute to the success of technological change such as CIM.

DEVELOPMENT OF RESEARCH MODEL

The effective implementation of technological change such as CIM is increasingly critical to the success of organizations and is inextricably linked with the actions and effectiveness of top management [8, 17, 27]. But what actions should top management undertake to increase the likelihood that technological changes such as CIM are effectively implemented?

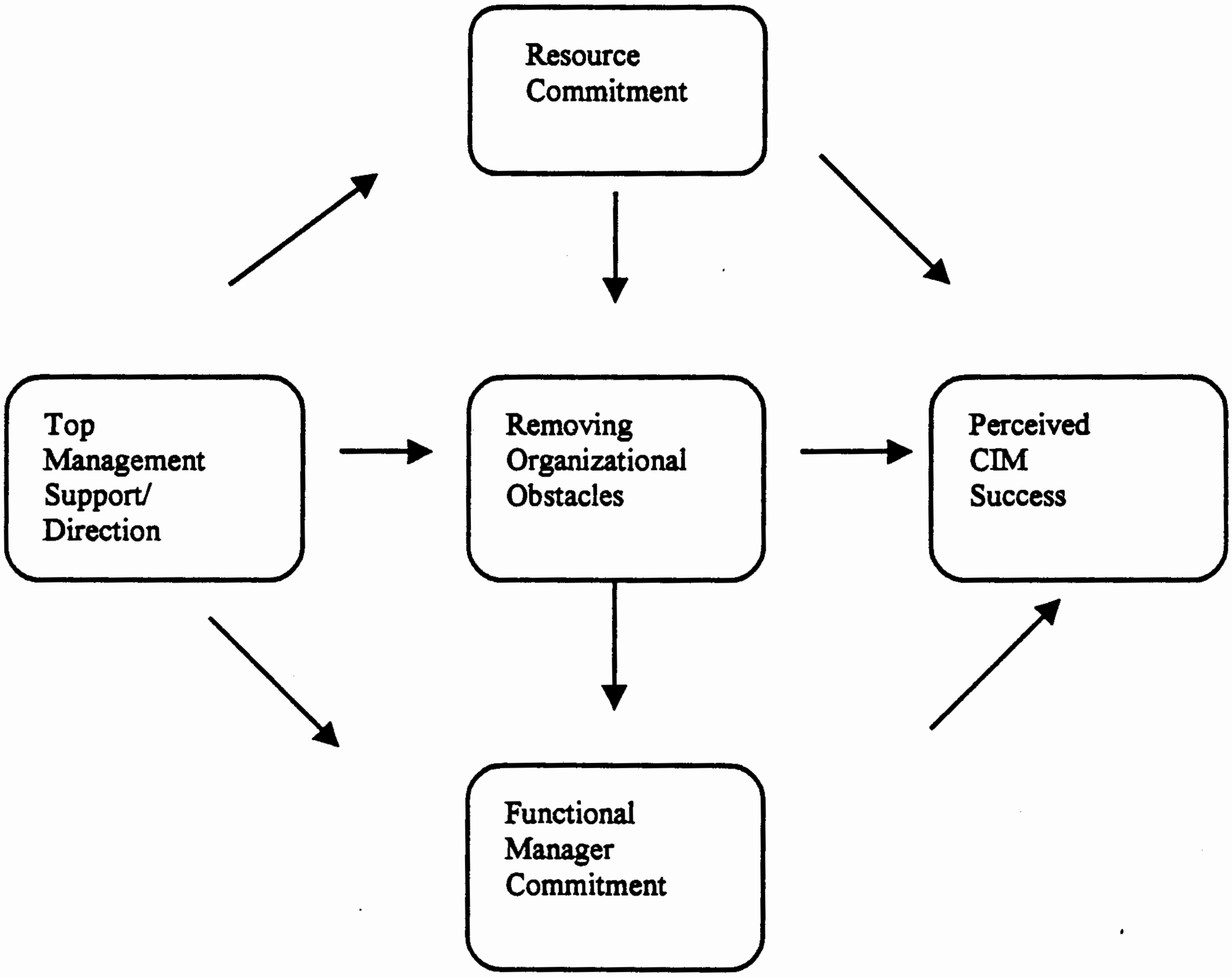
Perrow's [21] distinction between official and operative goals offers a promising approach for exploring the question. Official goals are the stated goals of top management that top management announces to various internal and external constituencies. For example, a CEO might announce that CIM is being implemented in order to improve the firm's competitive position and that the CIM effort is critical to the firm's success. By contrast, operative goals are those "sought through the actual operating policies of the organization; they tell us what the organization is actually trying to do, regardless of what the official goals say are the aims" [21, p.855]. Operative goals concern "those future states toward which a majority of the organization's means and the major organizational commitments of the participants are directed, and which, in cases of conflict with goals that are *stated* but command few resources, have clear priority" [4, p.7]. In contrast to its pronouncements, top management may take few actions to actually support the implementation of CIM.

Figure 1 contains a proposed model of top management's role in technological change. Top management expresses the official goals of the organization by stating objectives and by publicly leading and directing the effort to obtain those objectives. But organizational participants discern a difference between words and actions [8] and withhold commitment unless operative goals are viewed as consistent with official goals. A central component of our model is the absence of any direct path between top management support and direction and successful technological change. The link between top management support and direction and CIM success materializes only if operative goals are consistent with official goals. We hypothesize that top management support and direction directly affects three variables which mediate the relationship between top management support and direction and successful technological change. These variables are (1) resource commitment, (2) the removal of organizational obstacles to technological change, and (3) functional manager commitment.

Among top management's most visible actions are those which involve resource commitment. Resource commitment is considered one of top management's most critical roles; it is what top managers do [16]. The particular allocation of resources and the justification of that allocation are significant for a myriad of reasons. Resources should be allocated to areas where they will be effectively and efficiently employed. Resource allocation should also be consistent with the expectations that emerge from the goals and leadership of top management, for managerial expectations and objectives are likely to be viewed as unrealistic if insufficient resources are allocated. Until actual resources consistent with official goals expressed and supported by top management are allocated, many organizational participants may be skeptical about top management support and direction.

Top management communications about resource commitments are carefully monitored by organizational participants and the actual allocation of resources serves as a highly visible communication of top management's priorities. Because of the uncertainty and fear that accompanies change, top management must structure communications to assure organizational participants that needed resources are allocated fairly and promptly, and in a

FIGURE 1
Top Management's Role in CIM Implementation



manner consistent with official goals. In sum, top management communication is inextricably linked with resource allocation.

When top management defines and clearly supports technological change, resources are more likely to be committed. To the extent that resources are needed to secure the physical and human resources required to implement change, there is a direct link between resource commitment and successful implementation. The act of committing resources sends a clear signal to organizational participants regarding top management's operative goals. As resources are committed to new technology, organizational participants are more likely to perceive that something is being done to address managerial and organizational obstacles that could impede technological change. These perceptions lead to greater functional manager commitment to the success of technological change. In sum, resource commitment affects the success of technological change both directly and indirectly through its impact on participant perceptions regarding obstacles.

Top management also directly affects the successful implementation of technological change by removing obstacles, perceived or real, that might otherwise thwart the effort. Obstacles must be removed and, perhaps more importantly, organizational participants must perceive top management as effectively doing its part by removing organizational barriers to change. One such obstacle is the perception that top management is providing inadequate leadership, support, and planning. This can be partly offset by providing a clear vision for the change. The literature on organizational change and development [7, 26] suggests that it is important to have an executive sponsor for large change efforts. The specific charge for such a sponsor includes running interference for the project. In addition to dealing with specific obstacles, the appointment of an executive sponsor communicates the importance of the project to organizational participants. A second obstacle is the failure of top management to adequately address structural and cultural changes needed to ensure the successful implementation of technological change. Several authors have noted that the chances for successful change are improved when there is a "fit" between formal and informal organizational configuration and technological change [8, 17, 27].

Finally, to ensure CIM success, top management must take specific steps to ensure the involvement of functional managers to gain their commitment. Because of their experience and position in the organization, functional managers provide valuable information about the business and about how proposed technological changes mesh with business plans and corporate strategy. The involvement of functional managers is especially important in an era when many middle managers face uncertain futures because of constant restructuring in a dynamic business environment. Middle managers are expected to implement systems such as CIM that produce effects no middle manager eagerly anticipates. In an era of automation, reengineering, and downsizing, middle managers face job elimination, threats to hard-earned managerial expertise and established power relationships, and reduced allocations of organizational resources and rewards [2, 10]. In this context, with the managers most responsible for implementing technological change standing to lose if it is successfully implemented, it is perhaps not surprising to find that the outcome of technological change such as CIM has ranged from modest success to dismal failure. To counteract middle management concerns, top management must establish a vision which clearly establishes the role of middle management and take specific steps to involve functional managers in the planning and implementation of technological change. These concrete actions help gain their commitment.

METHODS

Overview

In this study, we examine the role of top management in the planning and implementation of a particular technology, CIM. In the first stage of the study, we interviewed CIM practitioners to determine what they viewed as important factors and obstacles to CIM. We used the factors and obstacles identified by the interviewees to construct a survey. The survey was mailed to a second group of practitioners who rated the importance of each of the factors and obstacles. Finally, factor analysis was used to assess the quality of the survey as a means of measuring the constructs proposed in our model of top management's role in implementing CIM.

Questionnaire Construction

We developed the questionnaire for this study through an extensive literature review and interviews with 27 CIM practitioners. Interviewees assisting in questionnaire construction were employees of firms using CIM, vendor representatives (suppliers of CIM hardware, software, or both), or consultants. A total of 19 interviewees were employed at user firms. The six CIM user firms selected to participate in the study had considerable experience (four and one-half to seven years) with CIM and represented the Aerospace, Computer, Tire, Automotive, Electronic Controls, and Plastics industries. At least one manager, one engineer, and one person representing IS (Information Systems) from each user firm was interviewed. Vendor interviewees included a CEO, a Vice-President of Marketing, a product manager (also in charge of strategic planning for manufacturing products), and the manager of a customer support group. Consultant interviewees included a college professor who provided specialized consulting on CIM system design; the director of a manufacturing research center who provided consultation on CIM strategy and manufacturing strategy; the director of a state industrial development center offering a wide range of CIM consultation and training; and the chief consultant of a consulting group for one of the largest industry providers of CIM consulting services.

We used a structured interview to explore a wide range of issues related to CIM. For the development of the survey used in this study, the relevant questions were:

1. "What factors do you regard as most important to the success of CIM planning?"

2. "What are the major obstacles encountered with CIM?"

No limit was set on the number of factors or obstacles interviewees could identify, nor were they asked to list them in any specific order.

We included items on the survey that were: (1) both identified in the literature and supported by interviewee comments or (2) identified only by interviewees--we felt they might be emerging concerns. In an ongoing dialogue, interviewees assisted the authors as they tried to eliminate redundancy in the list of items. The net result of this process was a list of 35 factors considered important to CIM planning and 21 obstacles to CIM success. These factors and obstacles became the items included in the survey conducted for this study.

Data collection procedure and sample characteristics

A private database of U.S. manufacturers was used to identify managers and professionals involved in the introduction of CIM in the plants where they worked and who were involved in equipment acquisition decisions. The database was purchased from a company that specializes in CIM research. A query was performed to extract from the database a list of plants known to be planning, implementing, or using CIM.

In an introductory letter sent out with the survey to each of the 421 managers and professionals at targeted sites, respondents were assured that their responses would be confidential. A number was placed on each survey corresponding to a company number (primary key) in our data table (file). Data was entered into that table for each returned survey. This helped ensure that a respondent could not inadvertently respond to both mailouts without alerting the researchers. Of the 421 mailed surveys, 28 were returned because the individual no longer worked at the plant. After six weeks, 35 surveys were returned. A second mailout was conducted and 66 additional surveys were returned, bringing the total to 101 and a response rate of 26%.

The Survey

Survey respondents were asked to rate the importance of 21 obstacles to CIM success on a scale ranging from 1 (not an obstacle at all) to 6 (an obstacle to a very great extent). Respondents were also asked to rate the importance of 35 planning factors on a scale ranging from 1 (not important at all) to 6 (important to a very great extent). Finally, respondents were asked to indicate how successful their CIM planning had been to date on a 1 (very unsuccessful) to 6 (very successful) scale. We used six point scales to avoid neutral responses.

The database included the following information: company sales, plant sales, number of employees who worked in the company, and number of employees who worked at the plant. Respondents provided demographic information not included in the database. Respondents reported the number of years they had been with the company, briefly described their area of specialization, and indicated how long the CIM effort had been underway at their plant (<1 year, 1, 2, 3, .. 25 years).

Instrument Assessment

Using the model described in Figure 1, the authors independently reviewed the 56 questionnaire items and listed items each perceived as potential measures of the four explanatory variables (top management support/ direction, resource commitment, organizational obstacles, and functional manager commitment). The authors discussed their respective categorizations and arrived at a consensus, reducing the number of items to be factor-analyzed to 21.

The responses to the 21 items were factor-analyzed with a principal component analysis and a varimax rotation. Because the theoretical model consisted of four variables, we forced a four factor solution. Both the eigenvalues and a scree test support the four factor solution (see Table 1). We used two rules to decide which items to retain. First, we only retained items which loaded above .40 on at least one of the factors. Second, to reduce cross-loading, an item was not retained unless the highest loading for an item exceeded the next highest loading by at least .10. The factor loadings of retained survey items for these four factors are reported in Table 1.

Resource commitment

Six items were used to assess resource commitment. These items reflect various resources that are allocated, the extent to which expectations are realistic, and the role of communication in the resource allocation process. The items were: unrealistic expectations, key people are usually overcommitted, inadequate funding, inadequate communications, management averse to risk of investing in new technology, and the lack of people with technical expertise. Respondents were asked to indicate the extent to which each item is an obstacle to CIM success on a six-point scale: (1) not an obstacle at all, (2) a very small obstacle, (3) a small obstacle, (4) an obstacle to some extent, (5) an obstacle to a great extent, and (6) an obstacle to a very great extent. Using the criteria listed above, all six items loaded on the same factor and none of the six cross-loaded on any other factor. In addition, Cronbach's alpha was .73, indicating a level of reliability sufficient for exploratory analyses [19]. The average response for the six items is used for subsequent analyses.

Functional manager commitment

Four items were used to assess functional manager commitment. These items reflect the involvement and commitment of functional managers and the knowledge that functional managers provide. The items were: functional manager involvement, functional manager support and commitment, understanding how CIM fits into business plans and corporate strategy, and understanding the business. Respondents were asked to indicate the extent to which each factor contributes to the success of CIM planning on a six-point scale: (1) does not contribute, (2) contributes very little, (3) contributes little, (4) contributes to some extent, (5) contributes to a great extent, and (6) contributes to a very great extent. Using the criteria listed above, all four items loaded on the same factor and none of the four cross-loaded on any other factor. Cronbach's alpha is .75. The average response for the four items is used for subsequent analyses.

Overcoming organizational obstacles

Six items were used to assess the importance of overcoming organizational obstacles. These items reflect obstacles related to top management's (in)effectiveness in leading and supporting the CIM effort and in incorporating organizational changes in conjunction with the CIM effort. Many of these items are consistent with Huber and Glick's [8] conceptualization of top managers as both facilitators and inhibitors of technological change. The items were: inadequate leadership, lack of top management support and commitment, corporate/executive sponsor, corporate culture not right for CIM, inadequate organizational structure, and inadequate planning. Except for the corporate/executive sponsor item, items were framed as obstacles and respondents were asked to indicate the extent to which each item is an obstacle on the same six-point scale used for the "resource commitments" factor. The corporate/executive sponsor item was framed as a CIM planning factor and was assessed on the same six-point scale as the "functional manager commitment" factor. Using the criteria listed above, two items, inadequate planning and inadequate organizational structure, cross-loaded on other factors and were dropped from subsequent analyses. For the remaining 4 items, Cronbach's alpha is .75. The average response for the four items is used for subsequent analyses.

Top management support and direction

Five items were used to assess top management support and direction. These items reflect the need to both clearly define desired outcomes and to lead and support the effort to achieve those outcomes. Many of these items are consistent with Huber and Glick's [8] conceptualization of top managers as creators of technological change. The items were: clearly defining the scope of plans, clearly defined objectives, setting reasonable goals, competent and effective leadership, and top management support and commitment. The items were framed as CIM planning factors and were assessed on the same six-point scale as the "functional manager commitment" factor. Using the criteria listed above, "setting reasonable goals" cross-loaded on other factors and was dropped from subsequent analyses. For the remaining 4 items, Cronbach's alpha is .75. The average response for the four items is used for subsequent analyses.

RESULTS AND DISCUSSION

Descriptive Statistics

As shown in Table 2, most of the intercorrelations between the four explanatory factors were significant, with correlation coefficients ranging from 0.16 to 0.57. Respondents who perceived one factor as important were likely to view other factors important as well. Only the organizational obstacles factor is significantly correlated with perceived CIM success ($r = -.20$). Thus, in terms of the contribution of various factors to the success of

TABLE 1

Results of Factor Analysis[1]

Survey Item	Mean	s.d.	Resource commitment	Functional manager commitment	Removing organizational obstacles	Top management support and direction
Unrealistic expectations[2]	4.45	1.23	.63	.11	.05	.32
Key people are usually overcommitted[2]	4.30	1.32	.63	.09	-.06	.05
Inadequate funding[2]	4.78	1.06	.55	.18	.26	-.01
Inadequate communications[2]	4.71	0.98	.53	.09	.17	.25
Management averse to risk of investing in new technology[2]	4.59	1.16	.52	-.03	.22	-.04
Lack of people with technical expertise[2]	4.61	0.95	.45	-.14	.02	.05
Functional manager involvement	4.52	1.11	.11	.77	.18	.12
Functional manager support and commitment	5.12	0.78	.14	.68	.09	.16
Understanding how CIM fits into business plans and corporate strategy	4.84	0.94	-.13	.68	.12	.14
Understanding the business	4.95	0.99	-.02	.53	.09	.15
Inadequate leadership[2]	5.18	0.83	.16	.15	.76	.22
Lack of top management support and commitment[2]	5.18	0.95	.05	.14	.68	.30
Corporate/executive sponsor	4.88	1.11	.12	.25	.50	.36
Corporate culture not right for CIM	4.60	1.07	.18	.15	.47	-.03
Inadequate planning[2]	4.93	1.01	.53	-.15	.53	.26
Inadequate organizational structure[2]	4.35	1.14	.39	.35	.31	.02
Clearly defining the scope of plans	5.16	0.83	.31	.01	.12	.69
Clearly defined objectives	5.48	0.69	.05	.21	.13	.67
Competent, effective leadership	5.23	0.91	.01	.30	.36	.59
Top management support and commitment	5.36	0.90	-.03	.32	.36	.50
Setting reasonable goals	4.97	0.85	.33	.38	.04	.48
Eigenvalue			5.70	2.04	1.20	0.97
Cronbach's alpha			0.73	0.75	0.75	0.75

[1] Only items with factor loadings greater than .40 were retained and reported in this table. In addition, even if an item loaded .40 or greater on one of the factors, the item was not retained unless the highest loading for the item exceeded the next highest loading by at least .10.

[2] These items were framed as obstacles to CIM planning. The remaining items were framed as factors important to CIM planning.

technological change, our study suggests that attention be directed to participant perceptions regarding the extent to which top management effectively addresses organizational obstacles which frequently impede such efforts. The negative correlation suggests that the failure to recognize organizational obstacles decreases the likelihood of CIM success.

We conducted a series of t-tests to check for differences between the mean responses for the two mailings. Twenty-one of the 22 tests indicated that there were no significant differences between mailings for the items used in this study. The t-tests did reveal that respondents to the second mailout perceived CIM planning to have been less successful than did respondents to the initial mailout (M1 = 4.41, M2 = 3.87, p-value = .03). Perhaps respondents in organizations where CIM planning was perceived to be less successful were hesitant to respond to the first request for information. In the end, the net effect of the second mailing for this study, in addition to the obvious increase in sample size, was to reduce restriction of range problems for the perceived CIM success variable. The standard deviation for the perceived CIM success variable (s.d. = 1.18) and other survey items provides further evidence that restriction of range was not a problem in this study.

Test of Hypotheses

The path analysis required us to analyze four regression equations. All variables in the analysis were standardized; hence the beta coefficients are path coefficients which indicate the direct effect of each antecedent variable on the relevant dependent variable. The beta coefficients, along with overall tests of each equation in the hypothesized model, are presented in Table 3. In sum, the regression results are statistically significant and support the proposed model. For ease of understanding, the beta coefficients are also recorded on the path diagram in Figure 1.

We evaluated the overall fit of our model by comparing the observed correlations between model variables and the correlations reproduced from the path coefficients for paths included in the model [20]. The goodness of fit, Q, for the hypothesized model was .9975 (.80 < p-value < .90), indicating that our model was consistent with the correlation matrix.

In addition to the direct effects represented in a straightforward manner by the path coefficients, the path coefficients can also be used to assess the indirect effects suggested by the proposed model. This is accomplished by multiplying the path coefficients on all relevant paths [20]. For example, the indirect effect of top management support on organizational obstacles is obtained by multiplying the path coefficient from resource commitment to organizational obstacles (.172) by the path coefficient from top management support and direction to resource commitment (.307). Table 4 summarizes the direct, indirect, and noncausal (spurious) effects. In general, the direct effects were larger than the indirect effects. Two of the decompositions, both correlations involving the removal of organizational obstacles, contain a substantial spurious component. Future work might attempt to develop a theory that incorporates additional variables that explain these relationships.

Limitations and Future Research

Four limitations constrain interpretation of this study and suggest future directions for research. First, our use of self-reported, cross-sectional data limit interpretation of the study results. Path analysis cannot prove causation but can only support the contention that a set of hypothesized paths is among those sets of paths which are capable of reproducing observed correlations among variables. Future studies should consider additional factors, include questions which attempt to directly assess how and why the relationships reported here exist, and be collected longitudinally where possible. Second, a multidimensional measure of success is needed. Participant perceptions of the extent to which CIM implementation has produced benefits reported in the literature is a possible approach. Third, the nature of the questions posed in this study constrains interpretation. We asked respondents to rate the importance of each CIM planning factor/obstacle, but we did not ask respondents to indicate the extent to which each factor/obstacle was actually present as CIM was implemented. We did this because the initial objective of our study was to identify factors (planning factors and obstacles) that influence CIM success. Finally, though the model and data of this paper are amenable to structural equation modelling, we did not use it because (1) our sample size was not large enough, and (2) we view the current study as an exploratory effort which aims to develop a model which can be tested in the future using structural equation modelling. In addition to these limitations, before our model can be generalized to the management of technological change, future research should examine the extent to which our model is applicable to technological changes other than CIM.

Conclusions

This study extends knowledge concerning the effects of top management support and direction on the success of technological change, such as CIM. We

TABLE 2

Means, Standard Deviations, and Zero-order Correlations

Variables	Means	s.d.	1	2	3	4
1. Perceived Success	4.06	1.18				
2. Functional Manager Commitment	4.86	0.73	-.17			
3. Removing Organizational Obstacles	4.96	0.75	-.20*	.38***		
4. Resource Commitment	4.57	0.73	.05	.16	.33***	
5. Top Management Support/ Direction	5.30	0.63	-.15	.44***	.57***	.31**

* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 3

Results of Regression Analyses for Hypothesized Paths

Variables	Beta [a]	t	R^2	F	df
Perceived Success			.06	2.02	3,91
Functional Manager Commitment	-.118	-1.07			
Removing Organizational Obstacles	-.190	-1.66*			
Resource Commitment	.117	1.11			
Functional Manager Commitment			.22	13.27***	2,95
Removing Organizational Obstacles	.196	1.76~			
Top Management Support/Direction	.330	2.98**			
Removing Organizational Obstacles			.35	25.64***	2,95
Resource Commitment	.174	2.02*			
Top Management Support/Direction	.512	5.94***			
Resource Commitment			.09	9.89***	1,97
Top Management Support/Direction	.307	3.15**			

~ $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 4
Decomposition of Correlations

Variables	r	Causal Effects			Noncausal
		Direct	Indirect	Total	
Perceived CIM success					
Functional manager commitment	-.172	-.118	.000	-.118	-.061
Removing organizational obstacles	-.198	-.190	-.023	-.213	.019
Resource commitment	.053	.117	-.010	.107	-.046
Functional manager commitment					
Removing organizational obstacles	.381	.196	.000	.196	.187
Top management support and direction	.439	.330	.110	.440	.000
Removing organizational obstacles					
Resource commitment	.329	.174	.000	.174	.157
Top management support and direction	.568	.512	.053	.565	.000
Resource commitment					
Top management support and direction	.307	.307	.000	.307	.000

empirically addressed the nature of top management's role in the planning and implementation of CIM. According to our model, top management's effect on CIM success is a function of the effect of top management support and direction on three intervening variables: resource commitment, the removal of organizational obstacles, and functional manager commitment. Our findings are consistent with the notion that CIM success can only be achieved if effective CIM implementation is not just an official goal, but also an operative goal for top management. It is simply not enough for top management to develop a clear vision statement and talk about the importance of change. Concrete actions are required. Resources must be visibly committed. Organizational obstacles must be removed. Functional managers must be involved in the CIM planning process to gain their commitment to success.

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