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Information Systems Development Project Success: The Use of Incentives and Rewards for Developers

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Abstract

The failure rate of information systems (IS) development projects remains alarmingly high. Many factors have been identified as its cause. One such cause is a lack of incentives or rewards for developers. A survey instrument was developed using content analysis of structured interviews of twelve IS project managers. Responses to a Web-based survey came from 409 members of a professional organization of IS project managers. The instrument was statistically tested for internal reliability and convergent and discriminant validity. Regression analysis tested the relationship of incentives and rewards to project success. This study contributes to the understanding of information systems project management by showing that an incentives and rewards construct is bi-dimensional. One dimension, professionalism, strongly predicted project success in terms of client satisfaction, perceived quality, and implementation process, whereas the other, perquisites, predicted it weakly and only in terms of implementation process. These findings might help IS project managers offer more appropriate incentives and rewards.

Introduction

The failure rate of information systems (IS) development projects remains alarmingly high (Ewusi-Mensah 1997). This problem has endured for over three decades, and does not seem to be abating (Faraj and Geter 1998). As a result, many IS professionals have accepted failure as inevitable.

A study by The Standish Group found that only 16% of all IS projects came in on time and within budget (Cafasso 1994). In larger companies, only 9% of projects were completed on time and within budget (Johnson 1995). These statistics suggest a need to investigate possible solutions to the problem. A potential explanation for project failure is that project managers do not offer incentives and rewards to developers (Rasch and Tosi 1992). Broadly speaking, the central research question for the study is thus, "How are incentives and rewards related to project success?"

Project Success

Software development has proved troublesome over the past three decades (Niederman, Brancheau et al. 1991). Even today it remains as one of the top concerns of IS executives (Brancheau, Janz et al. 1996). By assessing incentives and rewards as predictors of IS development project success, this study attempts to provide an understanding of the causes of failure in such projects.

Three distinct aspects of project success have been identified (Pinto and Slevin 1988; Pinto and Mantel 1990). They are: 1) the implementation process itself (staying on schedule and within budget); 2) perceived quality of the project; and 3) client satisfaction.

Incentives and Rewards

The current study focused on understanding which incentives and rewards are most effective. It thus sought to understand the incentives and rewards for developers that were positively related to project success.

Researchers have identified two separate and distinct types of incentives and rewards, some that are involved in producing job satisfaction and others that lead to job dissatisfaction (Herzberg 1987). Intrinsic rewards are those that exist in the job itself, such as achievement, variety, challenge, autonomy, and personal growth (Herzberg 1987; O'Driscoll and Randall 1999). These rewards lead to satisfaction.

Extrinsic rewards are external to the job and comprise elements such as pay and fringe benefits, promotions, recognition, status, and the social climate (Herzberg 1987; O'Driscoll and Randall 1999). The absence of these rewards lead to unhappiness on the job (Herzberg 1987).

The relationship between rewards and successful outcomes has been tested extensively. For example, in lab experiments, using students as subjects, results showed that rewards are positively related to successful outcomes (Tosi, Katz et al. 1997). Based on such research from disciplines other than IS, the following hypothesis is proposed:

H: The use of incentives and rewards will be positively related to project success.

Methodology

An instrument, the Project Implementation Profile (PIP), measures various aspects of project success (Slevin and Pinto 1986; Pinto and Slevin 1988; Pinto and Mantel 1990). Its twelve-item scale has been empirically tested, shown to be reliable, and comprised of three sub-dimensions: 1) the implementation process itself; 2) perceived quality of the project; and 3) client satisfaction (Pinto and Mantel 1990). Subjects are asked to respond on a 1 (strongly disagree) to 5 (strongly agree) scale to indicate the extent they agreed that a recent project had achieved each measure of success.

In the absence of an instrument for measuring rewards, one was developed following the steps suggested by Churchill (1979) and Bearden, Netemeyer, and Teel (1989). Twelve structured interviews were conducted by phone or face to face (Shenhar 1998; Fowler and Walsh 1999). The subjects were asked to discuss how incentives were used for motivation and how developers were rewarded. The incentives and rewards mentioned were: Technical training; Flexible work schedule; Sense of contribution to organization; Public praise; Favorable annual performance appraisals; Private office space; Time off; Pride; Financial bonus; Newer technology (i.e., PC or laptop); Opportunity to work at home; Project completion celebration; Choice of future assignments; Job promotion; and Job security. These were incorporated into the survey instrument. Subjects were asked to respond to each on a 1 to 5 scale to indicate the extent IS developers in their organization received each for successfully completing large IS projects.

The current research surveyed project managers responsible for IS development projects. The data were collected via a Web-based survey. An e-mail note was sent to members of the Project Management Institute Information Systems Specific Interest Group. The members were asked to respond to the survey in terms of the most recent major project with which they were familiar. A reminder note was sent to members after ten days. Seven thousand seven hundred eighty-five surveys were sent. Four hundred nine surveys were returned, for a 5% response rate.

Data Analysis

Late respondents were used as surrogates for non-respondents (Armstrong and Overton 1977). Early and late ones were compared on 31 items to test for systematic differences. Only one test was significant ($p<.05$), suggesting the absence of response bias.

Project Success

Twelve items measured project success. They appear in Table 1. Confirmatory factor analysis (CFA) was performed on Pinto and Mantel's (1990) dimensions of client satisfaction, perceived quality, and implementation process.

CFA can assess how well the data fit a proposed model (Hatcher 1994). Each detail item is proposed to load on one and only one factor. Goodness of fit indices show just how well the model and the data match one another.

A test for data normality was first performed. None of the items were univariate normal. Thus, no claim for multivariate normality exists. As a result, the EQS software package, with its ROBUST option, was used for the CFA.

EQS software produces three CFA goodness of fit measures. They are the Bentler-Bonett non-normed fit index (BB NNFI), the comparative fit index (CFI), and the robust comparative fit index (RCFI). A value of 0.9 or greater for all three fit indices shows that the measurement model fits the data. A measure of overall goodness of fit is the ratio of Satorra-Bentler Scaled (SBS) Chi-squared to degrees of freedom (df). The SBS Chi-squared/df ratio should be less than 3.0.

The measurement model for project success was tested using EQS. The dropping of four items was necessary to improve the model's fit, and meet the criteria. Each was then dropped on a subsequent CFA due to cross loading.

PS08, PS05, PS06, and PS09 were dropped. Afterward, the ratio of SBS Chi-squared/df was lower than 3.0 and the BB NNFI, the CFI, and the RCFI all exceeded 0.9. Therefore no further modifications were necessary.

Table 1. Project Success Detail Items

Variable	Item	Avg	s d
The project is used by its intended users	PS04	4.38	0.85
The project that has been developed works	PS03	4.30	0.92
Important clients, directly affected by this project, will make use of it	PS07	4.25	0.91
This project will have a positive impact on those who make use of it	PS11	4.15	0.90
The results of this project represent a definite improvement over the way clients used to perform these activities	PS12	4.12	0.98
This project has directly benefited the intended users either through increasing efficiency or employee effectiveness	PS05	4.09	1.00
Given the problem, this project seems to be the best choice among alternatives, i.e., it was the best choice among a set of alternatives	PS06	4.05	0.96
Use of this project has directly lead to more efficient decision making or performance for the clients	PS10	3.75	1.01
We are confident that non-technical start-up problems will be minimal, because the project will be readily accepted by its intended users	PS09	3.53	1.06
I was satisfied with the process by which this project was completed	PS08	3.44	1.17
The project came in within its original schedule	PS01	3.29	1.41
The project came in within its original budget	PS02	3.18	1.42

Incentives and Rewards

Fifteen detail items measured incentives and rewards. They appear in Table 2. Exploratory factor analysis (EFA) applied the maximum likelihood extraction method with a Varimax rotation. The number of factors extracted was determined using a minimum eigenvalue of 1.0. A review of the scree plot supported the decision to use that minimum.

EFA identified two dimensions. Five items were dropped, one each through serial EFA runs, because they did not load on either factor. They were CT06, CT02, CT05, CT03, and CT10. The remaining items each loaded on exactly one of the two factors.

The EFA results appear in Table 3. The factors are identified as professionalism and perquisites. Interestingly, they correspond respectively to Herzberg's intrinsic and extrinsic dimensions.

Further analysis through CFA using the EQS software package with its ROBUST option was conducted to assess the validity of the dimensions identified above (Chau 1997). CFA provides additional statistical tests of validity (Chin and Todd 1995). It can also be used to further refine the dimensions of the constructs (Bentler 1989; Chau 1996).

The measurement model of perquisites and professionalism was tested to assess its fit with the data. Four modifications were needed to improve the fit between the model and the data. That is, covariances between four pairs of error terms were estimated.

Although the SBS Chi-squared/df ratio was just slightly above the cutoff recommended by Carmines and McIver (1981), each fit index exceeded 0.9 indicating a reasonable fit between the model and the data. No further modifications were made.

Validity Analysis

T-tests for the standardized loadings of the indicator variables measuring the same factor can be used to assess convergent validity (Hatcher 1994). In this research, all such loadings for the indicator variables measuring both constructs had t-values significantly different from zero ($p<.001$), supporting convergent validity.

Table 2. Rewards Detail Items

Variable	Item	Avg	s d
Pride	CT09	4.02	0.96
Favorable annual performance appraisals	CT02	3.83	1.03
Sense of contribution to organization	CT13	3.80	0.97
Project completion celebration	CT11	3.57	1.29
Public praise	CT12	3.52	1.22
Job security	CT06	3.43	1.19
Technical training	CT14	3.40	1.19
Flexible work schedule	CT04	3.22	1.60
Job promotion	CT05	3.17	1.08
Newer technology (i.e., PC or laptop)	CT07	2.90	1.29
Financial bonus	CT03	2.74	1.31
Time off	CT15	2.53	1.25
Choice of future assignment	CT01	2.47	1.19
Opportunity to work at home	CT08	2.43	1.31
Private office space	CT10	1.97	1.14

From the CFAs in this research, a composite reliability analogous to Cronbach's alpha can be computed for each factor (Hatcher 1994). The minimally accepted level for composite reliability is generally 0.6 to 0.7 (Hatcher 1994). Both composite reliability values were above 0.6.

Discriminant validity exists when factors display low correlations with each other. Three statistical tests -- variance-extracted test, confidence interval test, and chi-squared difference test -- may be used to show support for discriminant validity. All three supported a claim of discriminant validity.

All variance inflation factors were less than 2, indicating that multicollinearity was not a problem in the data. A review of the residual plots indicated that heteroscadasticity was not a problem either.

Findings

The top project success items, as shown in Table 1, suggest project managers believe that their projects often deliver systems that work and that the intended users actually use the systems. These results could imply that project teams do a good job creating high quality systems that address the users' needs.

However, the lowest project success items related to project implementation. They suggest that budgets and deadlines are often not met. Thus, project teams perhaps do a better job of providing systems that work than of delivering them within budget.

The highest rated reward item, as shown in Table 2, was pride. It was the only item with a mean above 4.0. This aspect of professionalism apparently is the most used incentive for developers to do good work. The four lowest rated rewards suggest that perquisites may be used less extensively to motivate.

The multivariate regression in Table 4 shows the relationship between the dimensions of incentives and rewards and the dimensions of project success. The Pillais test was significant ($p<.001$), permitting the interpretation of the three individual univariate regressions.

Table 3. Rewards Rotated Factor Loadings

Variable	Item	(F1) Professionalism	(F2) Perquisites
Public praise	CT12	**.81**	.16
Sense of contribution to organization	CT13	**.75**	.21
Project completion celebration	CT11	**.69**	.16
Pride	CT09	**.54**	.14
Newer technology (i.e., PC or laptop)	CT07	.09	**.68**
Opportunity to work at home	CT08	.11	**.65**
Flexible work schedule	CT04	.06	**.61**
Technical training	CT14	.37	**.58**
Time off	CT15	.26	**.53**
Choice of future assignment	CT01	.24	**.50**
Eigenvalue		3.88	1.66
Percent of Variance Explained		38.83%	16.58%
Cronbach's alpha		.80	.79

Higher levels of professionalism were associated with higher levels of all three project success constructs ($p<.01$ for implementation process and $p<.001$ for client satisfaction and perceived quality). The use of perquisites was significantly related to improvements in the implementation process, but not so strongly ($p<.05$). Perquisites did not seem to influence client satisfaction or the perceived quality of the system at all.

These findings provide partial support for the hypothesis in this research. They are thus generally consistent with the expectation that incentives and rewards may prove useful in encouraging developers to find ways to meet the project success measures.

However, the difference between professionalism and perquisites is interesting. The finding that professionalism may be much more influential than perquisites could offer project managers significant assistance in motivating their project workers.

Table 4.- Multivariate Regression

	Client Satisfaction	Perceived Quality	Implementation Process
Perquisites	.01	.04	.15*
Professionalism	.27***	.30***	.17**
R square	.07	.10	.06
F	13.52	18.82	12.56
P	<.001	<.001	<.001

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

Implications

Information systems project managers can thus benefit from this research. The findings suggest that IS managers may wish increase their emphasis on professionalism in the motivation of their subordinates. Project managers should study the items in Table 2 and assess how well they use each in that process.

The study also has implications for IS researchers investigating success in IS development projects. It raises questions as to why professionalism is a more powerful predictor of project success than are perquisites, and as to why client satisfaction and perceived quality are more strongly predicted than implementation process.

Future researchers could replicate this study with a different sample of IS project managers. Such a study could help assess the validity of the instrument developed here. A new study may find similar results, thus reenforcing these findings.

Conclusion

This research attempted to answer the question, "How are incentives and rewards related to project success?" It contributed to the understanding of IS project management by showing that incentives and rewards are bi-dimensional, by identifying the dimensions, and by providing an instrument for their measurement. This research also contributed by providing validation for an existing instrument to measure project success. Finally, it contributed by showing that specific incentives and rewards lead to specific elements of project success.

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