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Abstract
This paper presents the results of a 2009 survey of professional IT auditors that explored their perceptions about root psychological and sociological causes of Information Systems (IS) project failure based on a punctuated equilibrium theoretical framework. As predicted by punctuated equilibrium theory, the results of the survey indicate that radical as opposed to incremental organizational changes are more effective in turning around "runaway" projects. The results indicate IS development project performance is worse in government than in the private sector. These results provide support for the continued use of punctuated equilibrium models for further research in IS development project failure.

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Introduction
The rate of information systems (IS) development project failure in the 1980s and 1990s was routinely documented to be above 50%, the larger the development; the more likely it was unsuccessful (SIMPL & NZIER, 2000). A 1994 study of IS development projects in the British public sector estimated that 20% of expenditures were wasted, and a further 30% to 40% did not produce perceivable benefits (Wilcocks, 1994). Also in 1994, the U.S. General Accounting Office reported that spending of more than US$200 billion in the previous twelve years had led to few meaningful returns. A 1995 study of over 8,000 IS projects by Johnson revealed that only 16% were completed on time and within budget (Johnson, 1995). The U.S. Internal Revenue Service, with an annual computer budget of US$8 billion, managed "a string of project failures that have cost taxpayers $50 billion a year [mainly defined as revenue forgone] - roughly as much as the yearly net profit of the entire computer industry" (James, 1997). Collins and Bicknell (1997) estimated that public sector failures in the United Kingdom cost £5 billion. The Wessex Health Authority's Regional Information Systems Plan was cancelled after more than
£43 million had already been spent, with little achieved (Collins et al., 1997). The New Zealand Police abandoned an IS development in 1999, at a cost of more than NZ$100 million, after years of development provided little more than an e-mail system and a number of terminals run by a 1970s-era mainframe. A study by SIMPL & NZIER (2000) found that the success rate was only 55% for projects under US$750,000; however, for those with budgets over US$10 million, no projects were successful. A 2001 U.S. Standish Group survey of IS projects found success rates were as follows: 59% in the retail sector, 32% in the financial sector, 27% in manufacturing, and 18% in government. Overall, the average success rate was 26%. In all, 46% of the projects had problems, including being over budget, behind schedule, or delivered incomplete. Another 28% failed altogether or were cancelled, and cost overruns averaged nearly 200% (SIMPL & NZIER, 2000).

The beginning of the 21st century has shown little improvement in IS development project performance. In 2002, the United Kingdom’s National Health Service initiated the largest-ever public sector project at an estimated cost of £11 billion. This led to the introduction of new information systems in almost every hospital, but it was still considered a failure (Rainer & Turban, 2009). A benefit payment scheme involving the British Post Office, the Department of Social Security, and the computer company ICL was abandoned after three years and a cost of £300 million (The Economist, 2002). An already obsolete air-traffic support system opened at Swanson in the United Kingdom, in 2002, six years late and £180 million over budget (The Economist, 2002). The Canadian Firearms Program increased from initial estimates of C$113 million to more than C$1 billion, an overrun of almost 900% (Auditor, 2002). Georgiadou (2003) found five out of six corporate projects are considered unsuccessful, with one-third cancelled. Of the two-thirds that were not cancelled, price and completion times were almost
twice what had originally been planned. Dalcher and Genus (2003) reported US$150 billion was wasted per annum on information and communications technology failures in the public and private sectors in the United States and US$140 billion in the European Union. A 2004 Standish Group report estimated a success rate of 29%, with 53% of the projects having problems, and a failure rate of 18%. The Royal Academy of Engineering and the British Computer Society (2004) found that 84% of public sector projects resulted in failure. Vast sums of money, mostly provided by aid agencies, have been spent on health and other information systems in South Africa, on donor-funded IS projects in China, and on World Bank funded projects in Africa. Overwhelmingly, these projects have resulted in varying degrees of failure (Heeks, 2002, 2004). The Standish Group's 2009 report showed only 32% of all projects succeeded, while 44% were problematic and 24% failed. In the United States the best known IS project failures are the FBI Trilogy Project (Knorr, 2005; US GAO, 2006), the California Motor Vehicles Driver Licensing System (Bozman, 1994), and the Denver airport baggage handling system (Montealegre & Keil, 2000).

In summary, the consensus is that 20% to 30% of all IS development projects are perceived as overwhelming failures, while 30% to 60% are partial failures (Collins et al., 1997; Corner & Hinton, 2002; Georgiadou, 2003; Heeks, 2002; Iacovou, 1999; James, 1997). IS projects that run wildly over time and budget have been labeled "runaways" (Glass, 1998; Mann, 2003). Runaway projects have been said to take on a life of their own without adding business value (Zmud, 1980; DeMarco, 1982; Abdel-Hamid & Madnick, 1991; Johnson, 1995; Mahring & Keil, 2008). One of the main reported causes of “runaway” projects has been said to be management over-commitment to the project (Keil, 1995). The management behavior that underlies runaway projects resembles what IS researchers have called the process of
"escalation of commitment to a failing course of action" (Brockner, 1992; Keil, 1995; Schmidt & Calantone, 2002). The reverse of this process has been defined as IS project de-escalation (Keil & Robey, 1999; Montealegre & Keil, 2000; Royer, 2003; Heng et al., 2003). The literature suggests four general types of determinant factors of project commitment: project, psychological, social, and organizational. (For a good review see Newman & Sabherwal, 1996). The tendency for managers to over-commit to an obviously failing project has lent credence to the strategy that it is sometimes better to radically change the entire organization rather than incrementally improve the immediate project team (Pan et al., 2006a, 2006b). This line of research stems from punctuated equilibrium models that have their roots in biology (Eldredge & Gould, 1972) and are increasingly being proposed in the organizational sciences (e.g. Tushman & Anderson, 1986; Mokyr, 1990; Gersick, 1991).

Most of the research on IS project failure was conducted prior to the age of IT governance practices put in place after the 2002 Sarbanes Oxley Act. IT governance implies a management system in which top management has a bigger influence on IS development project decision-making. The exploratory research presented here responds to the need for an improved understanding of IS project performance in the post-Sarbanes Oxley environment. The primary purpose of this study was to determine the extent to which, given recent popularity of IT governance practices, runaway projects continue to be common and to help determine promising new areas for future research in preventative measures. Another purpose of the study was to determine if, as predicted by punctuated equilibrium theory, radical organizational changes are more effective in withdrawing commitment to runaway projects than are incremental measures.
SOCIAL AND PSYCHOLOGICAL CAUSES OF “RUNAWAY” PROJECTS

Management literature identifies four general types of determinantal factors of project commitment: project, psychological, social, and organizational (Newman & Sabherwal, 1996; Keil & Robey, 1999; Pan et al., 2006; Hirschheim, Klein, & Newman, 1991). Project factors include the costs and benefits as perceived by management. Projects are considered prone to over-commitment when they involve a large potential payoff, when they require a long-term investment before substantial gain, and when setbacks are perceived as temporary surmountable problems (Keil, 1995; Keil, Man & Rai 2000).

Psychological factors cause managers to believe the project will eventually be successful (Brockner, 1992). Contributing causes include the manager's previous experience, the degree to which the manager feels personally responsible for the outcome (Newman & Sabherwal, 1996), and other cognitive biases (Tversky & Kahneman, 1981). As a result of these causes, managers may engage in a kind of "self-justification" behavior committing additional resources to a project instead of ending it and admitting that their earlier decisions were flawed (Whyte, 1986; Staw & Ross 1987; Ross & Staw, 1993). This line of research, known as self-justification theory (SJT), is grounded in Festinger's (1957) theory of cognitive dissonance. Prospect theory focuses on the cognitive biases that influence human decision-making under uncertainty and is a derivative of this theory is the so-called "sunk cost" effect in which decision makers exhibit a tendency to "throw good money after bad" (Garland & Conlon, 1998). This research suggests that sunk costs may influence decision makers to adopt a negative frame, promoting risk-seeking (IS project escalation) behavior. Approach-avoidance theory suggests there is a natural tendency for management to over-commit to IS projects because of the “completion effect,” which suggests the motivation to achieve a goal increases as an individual gets closer to that goal (Garland &
Conlon, 1998; Pan et al., 2006). The completion effect is particularly relevant to software projects, which frequently exhibit the so-called "90% complete" syndrome (DeMarco, 1982; Garland & Conlon, 1998).

Social factors also promote IS project over-commitment (Newman and Sabherwal, 1996; Pan et al., 2006). Social factors include competitive rivalry with other social groups, the need for external justification, and norms for consistency (Brockner et al., 1979; Hirschhem, Klein, & Newman, 1991). Projects are prone to over-commitment when competitive rivalry exists between the decision-making group and another social group, when external stakeholders believe the project will be successful, or when norms of behavior favor persistence (Ross & Staw, 1993). One social determinant of commitment is "the desire not to lose face or credibility with others" (Staw & Ross 1987). The concept of "face saving" is grounded in self-justification theory (Whyte, 1986; Staw & Ross, 1987; Ross & Staw, 1993) and is discussed in the IS project de-escalation literature (Montealegre & Keil, 2000).

Organizational factors in project over-commitment include the structural and political factors that form the "ecosystem" of a project. Information systems researchers (e.g., Keil, Mann & Rai, 2000) have referred to several other organizational factors that may affect commitment to an IS project: top management's knowledge of information technology (Vitale et al., 1986), information intensity of the organization's value chain (Johnston & Carrico, 1988), and the maturity of the IS function (Sabherwal & King, 1992). Other organizational factors identified in the IS project escalation and de-escalation literature include top management support for the project, administrative inertia in the organization, and the extent of project institutionalized or the extent to which it is perceived as strategic (Johnston & Carrico, 1988).
More recent work on IT project de-escalation suggests projects may be resistant to de-escalation because of organizational "inertia" that causes long periods of organizational "equilibrium" periods that are difficult to disrupt because of the constancy of the "deep structure" of the organization (Gersick, 1991; Pan et al., 2006; Orlikowski, 1993). As a result, organizations may be unable to change substantially unless forced by a radical organization change or other crisis (Tushman & Romanelli, 1985; Sastry, 1997). In a number of industries, it has been observed that long periods of unsuccessful "incremental" organizational change tends to be interrupted by short periods of radical change called "revolutionary periods" (Abernathy & Utterback, 1978; Utterback & Suarez, 1993). This pattern termed "punctuated equilibrium," was originally identified in the biological sciences (Eldredge & Gould, 1972) and was subsequently adopted in the management literature (e.g., Tushman & Anderson, 1986; Mokyr, 1990).

According to punctuated equilibrium theory, organizations tend towards "equilibrium" because of the permanence of the organization's "deep structure." "The deep structure of an organization consists of its "alliances, associations and co-operations with interlocking interests" (Anderson & Tushman, 1990). This analysis complements Tushman and Romanelli's (1985) identification of "performance pressures . . . whether anticipated or actual" as the fundamental agents of organizational reorientation. Tushman, Newman, & Romanelli (1986) described the scenario of an organization falling into serious trouble before responding by replacing its top management as typical. They found "externally recruited executives are more than three times more likely to initiate frame-breaking change than existing executive teams . . . Failures caused by inappropriate deep structures are destined to elude the (misdirected) efforts of current system members to correct them. Unless such failures kill the system, they command increasing attention and raise the likelihood that newcomers will either be attracted or recruited to help solve the problems."
The newcomer has the opportunity to see the system in an entirely different context than incumbent members, and he or she may begin problem solving on a new path" (Tushman, Newman, & Romanelli, 1986).

The preceding review demonstrates the extreme complexity of the study of information system (IS) project performance. Existing research demonstrates the presence of many important factors that affect the performance of an IS development project. This raises the question of the most important areas for further IS practice research: Should the focus be on the subtleties of the various indirect psychological and social factors mentioned above? Or, is it more practical to concentrate on the practice of project management itself? The answers to these questions are the impetus for this study.

**Research Method**

In order to address these research questions concerning IS development projects a simple questionnaire was developed to survey IS audit and control professionals. The design of the survey was based on Dillman's (1978) "total design method." Auditors were selected for the study because they are likely to be more objective than other IS project stakeholders, such as managers directly responsible for problematic projects. The sample was designed to select professional auditors who would be most likely to be involved in information systems development. The pool of individuals represented approximately one thousand (1000) Information Systems Audit and Control Association (ISACA) members in the Houston, Texas area. The survey was designed to gather data concerning the perceived frequency of problematic IS development projects, the perceived major sources of problems, and the recommended magnitude of corrective actions. A survey is usually the most cost-effective way of collecting data on a large number of IS projects (Mann, 1996). To get a reasonable response rate, the
survey was designed to be completed in less than ten minutes. To ensure the survey questions
demanded minimal cognitive effort, questions consisted mostly of paired category choices.

Participants were emailed a link to the survey that was posted on the international ISACA
web site. Respondents were asked to consider projects with which they were familiar that fit the
definitions of “problematic,” “runaway,” and “failed” on the survey form. The survey had five
sections: introduction, demographics, project performance, corrective actions, and closing.
Please see Appendix A for the actual survey questions. The survey was refined through two
iterations of pre-testing.

The demographics of the sample are shown in Tables 1, 2, 3 and Table 12 below. Almost
half the respondents reported having more than fifteen years experience, while over 40%
reported having more than five years experience. Almost 80% reported having the Certified
Information Systems Auditor (CISA) certificate; and, about half reported they had been involved
with either a problematic or runaway project (Table 13).

Variables, such as auditor experience, could have impacted the results. However, a
similar survey of IT auditors showed these variables did not affect overall results (Keil et al.,
2000). Thus, to keep the survey brief, we chose not to control for these factors. Furthermore, as
was the case in Keil et al. (2000), our method did not allow us to measure non-response bias. To
increase the reliability of the survey instrument, three different measures of project performance
were operationalized: (1) “failed” projects, (2) “problematic” projects and (3) “runaway”
projects. The actual measurement items are shown in Appendix B.
RESULTS AND DISCUSSION

Overall project performance

The results for overall project performance are shown in Table 4. As one can see, significantly more of the respondents reported the overall rate for both problematic and failed projects are above 50%. These high frequencies are corroborated by the fact that 40% of the respondents reported having been involved with a “runaway,” and 60% reported involvement with a “problematic” project (See Table 12). The findings regarding “runaways” reported here appear to contrast sharply with the views of some practitioners, who contend that software project runaways are rare events (Glass, 1997).

Sources of project problems

As can be seen in Tables 6 and 7, the most important sources of problems for both problematic and runaway projects were perceived to be formal attributes of the project team such as size, skills, etc., rather than informal social or psychological attributes of project stakeholders.

Government versus private sector performance

Table 8 shows significantly more respondents believed that all three project types - failed, problematic, and runaway - are more likely to occur in government than industry. We submit this result is consistent with that predicted by punctuated equilibrium theory (our assumption’s basic argument is presented as an informal theorem in Table 7).

The role of “collective belief” in management over-commitment

Another important determinant of management commitment to an IS project is termed the "collective belief" in the eventual success of the project (Royer, 2002). The results suggest that government managers seem less confident in their abilities than do private sector executives (See Table 8, question 2.2) and government is more likely to produce runaways and failures than is
the private sector (Table 9, question 3.11). However, the results run counter to that reported in Royer (2002). There it was found that "collective belief" in the eventual success of the project was a primary determinant of management over-commitment.

**Corrective actions, incremental or radical?**

Survey section three (corrective actions) is designed in part to measure whether, as predicted by punctuated equilibrium theory, respondents thought it more effective to apply radical (aka "revolutionary") measures to turn around “runaway” projects than to apply more moderate (aka "incremental") ones (Gersick, 1991).

Our results are consistent with the punctuated equilibrium argument presented as an informal theorem in Table 9: for “runaway” projects, question 3.8 (See Table 11) respondents believed it more beneficial to choose the more radical action of replacing project management rather than the more incremental action, to simply educate them. However, for “problematic” projects, the respondents reported the opposite conclusion: that an incremental change (i.e., education) is more beneficial than a more radical change, such as replacing staff (See Tables 11 and 12). Overall though, the results strongly support the conclusion that project factors are more important than organizational factors in determining project failure or success.

**Corrective actions, top management or middle management?**

In all cases, respondents believed it more beneficial to take corrective action at the project management level than at the top level of management (See Tables 11 and 12). These results suggest the most important causes and remedies for poor project performance have to do more with project management practices than with the structure of the surrounding organization. And this does not support the notion that IT governance initiatives introduced by many large organizations early in the 21st century have improved performance of IS development projects.
Risk aversion in runaway projects

Another purpose of the study is to help managers decide on an appropriate level of risk aversion in “runaway” projects. On survey question 3.12 (See Table 4) respondents reported an insignificant difference between those that believe managers prematurely kill runaway projects less than 20% of the time, and those that believe managers prematurely kill runaway projects more than 20% of the time. Thus, we speculate that overall respondents probably tend to believe that projects are prematurely killed about 20% of the time. How managers feel about this likelihood is important to the organization’s bottom line. For example, suppose management has decided that if there is any evidence that a project is escalating, then it should be terminated. If so, the organization may often kill good projects prematurely, experiencing loss and committing what Keil and his colleagues (Keil et al., 2000) called a “Type I” error. On the other hand, allowing too many cases of escalation to be continued on the grounds the project may be incorrectly classified (a Type II error) causes loss by wasting valuable resources. The results obtained suggest that managers tend to be too risk-averse to runaway projects. Consequently, we believe managers should include this new information in determining an appropriate balance between Type 1 and Type 2 errors.

Summary and Conclusion

Implications for practice

In summary, we believe this study’s primary contribution to the practice of IS project management is the evidence it provides concerning the prevalence of project over-commitment in both government and private industry in the 21st century. The results suggest most large IS projects will exceed their original budgets and timelines by more than 50%, and much more often in government than in private industry. Second, the study provides evidence that
“runaway” projects occur frequently, especially in government. Furthermore, the study supports other research that suggests “runaway” projects should be treated fundamentally differently from simple problematic projects, in that more radical organizational changes are needed to reduce management commitment. In addition, the results imply managers should consider being more aggressive in promptly shutting down projects that show signs of over-commitment before they needlessly waste valuable resources. The results suggest managers prematurely kill escalating projects only about 20% of the time. Finally, the results support the idea that nothing is more important in promoting successful IS development project outcomes than best project management practices.

The survey respondents consistently rated project management factors more important than top management factors in determining project success. Our particular results underscore the importance of good monitoring of projects. And as Keil et al. (2000) suggest: “To minimize the problems associated with project escalation, managers would do well to implement early warning systems aimed at detecting escalation as early as possible. One way to minimize budget and schedule escalation is to define the de-escalation trigger points at the outset of the project. In this way, when the cost and schedule begin to approach the predefined trigger points, managers can take steps to de-escalate the project and contain the damage. Another related tactic is defining termination conditions at the outset of the project” (Keil et al., 2000).

There is a wealth of information on these best practices published by Carnegie Mellon’s Software Engineering Institute (http://www.sei.cmu.edu/) and the University of Texas’ software quality institute (http://lifelong. engr.utexas.edu/sqi/index.cfm) (See also Wright & Capps, 2008). To sum up, our study’s data does not support a conclusion that IT governance measures implemented by many large organizations in the early 21st century have measurably improved IS
development project performance. The results support the Standish 2009 report which indicated that such projects are experiencing even worse performance than they did in the 20th century.

Implications for future research

One of the most interesting research questions this exploratory study raises is related to why IS development projects "runaway" or fail significantly more often in government than in private industry. The results indicate that all three project types - failed, problematic, and runaway - are much more likely to occur in government than industry. Is this because the deep structure of government organizations is more resistant to change than that of the private sector? Such a result would be consistent with that predicted by punctuated equilibrium theory (See Table 7). Other unanswered questions related to punctuated equilibrium theory are whether or not government projects are more often "over-committed" than those in private industry; and, what are the conditions under which incremental organizational changes are preferable to radical changes? Our results suggest that under certain conditions an incremental change, education, is more beneficial than a more radical change, replacing staff (See Tables 9 and 10). However, for "runaway" projects, question 3.8 (See Table 11), this pattern was reversed: the respondents believed it more beneficial to replace project management staff rather than to simply educate them.

Because project failure is a politically sensitive subject, and thus difficult to study empirically, many more longitudinal in-depth case studies are greatly needed with an aim of generating an explanatory theory of project escalation and de-escalation cycles (Wright & Capps, 2010; Pan et al., 2006a, 2006b). Many believe that further insights can and will come from punctuated equilibrium theory (Eldredge & Gould, 1972; Tushman & Anderson, 1986; Mokyr, 1990; Gersick, 1991) as well as from other organizational theories (Sutton, 1987; Eisenhardt,
1989; Ancona, 1990; Isabella, 1990; Pettigrew, 1990; Elsbach & Sutton, 1992; Shenhar, 1998; Cule & Robey, 2004). What's more we believe there is a need for the IS audit and academic community to join hands in conducting further pragmatic academic research on IS projects.

Global surveys of IS auditors concerning the frequency, circumstances and characteristics of similar projects would also be helpful. Unfortunately, the Information Systems Audit and Control Association in recent years has reduced its support for this kind of survey research, although some academics intend to lobby for increased support. There are several advantages relying on IS auditors for this type of research. As reported by Keil et al. (2000) these include: “… IS auditors do not have directly vested interests in project outcomes because their careers are unlikely to be made or broken by a project's success or failure; IS auditors can be expected to report more objectively than managers and other project participants; IS auditors have access to objective data on project performance; and IS auditors have experience with multiple projects and formal standards for judging projects” (Keil et al., 2000).

The outsourcing literature (See Tiwana & Bush, 2007) also promises to be of help in the study of IS development project performance. The relationship between control practices and the project commitment escalation process is an additional promising area for future research (See Kirsch, 1997; Mahring, 2002; Kirsch, 2004; Tiwana & Bush, 2007). Another area for research would be to go beyond the results of Mahring (2002) and Kirsch (2004) to explore further whether the constitution and effectiveness of Information Technology Governance is inversely related to management over-commitment to projects. Specifically, it would be of interest to determine if the organization's ability to adapt control practices to the dynamic nature of complex projects reduces the likelihood of escalation periods. The relationship between over-
commitment and the requirements determination process is also a promising one for future research (See Kirsch & Haney, 2006).

Limitations of the study

Because the research was limited to proxy measurements consisting of the beliefs of self-reported information systems (IS) auditors, the conclusions drawn herein must be interpreted with caution. Admittedly, this method raises the possibility of a possible bias or an error in the data set. It is conceivable that auditors are more likely to be assigned to troubled projects and that their estimates of the frequency of project problems may be biased upward. Conversely, it is also conceivable that IS auditors tend to be employed by organizations more aware of the need for good project management. Based on the latter reasoning, it is possible that IS auditors’ estimates of project problems may be biased downward. Further, this study’s data may have been more reliable if it had been gathered from individual projects rather than from multiple subjects. But such an approach was not deemed appropriate or necessary for an initial exploratory study. Because the study relied on self-reported information concerning past events, the results are also limited by possible recall bias. This is justifiable as the same research method has been used in similar research (i.e., Keil et al., 2000) because there are not any effective methods for avoiding subject recall bias. Despite these limitations of the methodology’s approach, we believe this study contains important contributions to research and practice of information systems development.
REFERENCES


