Heuristics and Biases in Information Systems Project Management

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Abstract: Formal project management is vital for effectively applying organizational resources to competing demands within and across projects. However, using project management is predicated upon valid and accurate project specifications. Introducing biases into the formulation of specifications can lead to compromised or failed projects. In many cases, biases arise from project personnel applying heuristics. Project personnel can offset bias impact by recognizing and understanding these heuristics and their potential effects. This study surveys project personnel, attempting to identify heuristics and their use in IS projects.

Keywords: Heuristics, Biases, Inappropriate Comparisons, Use of Intuition, Gambler's Fallacy, Closeout, Hindsight Bias, Information Systems Development

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The function of the modern project manager is to balance the competing demands of scope, time, cost, quality, and stakeholder needs and expectations (PMI, 1996). This function is extremely important with information systems development projects. Information systems projects can often spiral out of control, becoming runaway systems that far exceed their original budget and scheduled due date (Zhang et al., 2003). Many escalated projects are eventually abandoned or significantly redirected without delivering intended business value (Zhang et al., 2003).

Project managers make numerous decisions throughout the system development process that impact project outcome. Project success often depends on the validity and accuracy of project decisions. Studies show that project management factors are usually more critical than behavioral factors in the success of an IT project (Zhang et al., 2003). The project decision-making process is extremely difficult, having a dynamic project environment that constrains time and resources with incomplete information. Difficulties start at the beginning of most projects. Studies (Snow and Keil, 2002) show that most software projects experience trouble during the early stages of development. Project managers may encounter problems such as uncommitted or under-involved users or clients, little control over external resources, and minimal organizational support regarding resources (personnel, knowledge, facilities, and financial) (Jiang et al., 2001). Project managers who quickly master new environmental circumstances can succeed; however, projects often fail if they do not adapt quickly (Jiang et al., 2001).

Because of this, when planning and overseeing project tasks, project managers often respond by applying heuristics or "rules of thumb" (Agarwal et al., 1992; Bukszar and Connolly, 1998; Hogarth and Einhorn, 1990; Schwenk, 1984; Tversky and Kahneman, 1974). As with many complex decision-making environments, heuristics can provide valuable assistance when addressing difficult project decisions. The irony lies in

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the recent research studies finding project managers to be ineffective decision-makers (McCray et al., 2002; Purvis and McCray, 1998).

What impact do heuristics make? Project managers do not always realize that they use heuristics in decision-making. Using heuristics can bias the decision-making process. Using a "rule of thumb" can present problems in a dynamic environment such as within information technology projects (McCray et al., 2002). Failing to take advantage of new development methods, software, or hardware can create risk factors that are very difficult for an organization to overcome.

A tenet of this article is that by recognizing and addressing heuristics and biases, many organizations can improve their project management process. The goal of this article is to empirically view potential heuristics and biases in actual project management processes. This study will assess the use of project management heuristics by project managers, providing their assessment of the impact on their systems development projects.

Project Management Processes and the Current Study

In *A Guide to the Project Management Body of Knowledge* (*PMBOK® Guide*) (PMI, 1996), generally accepted and proven project management processes are identified. These processes include: initiation, planning, execution, control, and closeout. These processes may be a part or subpart of any project. For instance, all of these project management processes may appear during any phase of the system development life cycle (SDLC). They can vary with any SDLC phase or from project to project. In the same context, heuristics and biases may vary within the task frame of any particular project. These biases may reveal themselves within the context of the project processes over time. For this study, the authors address three separate project management processes, including: (1) planning and initiation, (2) execution and control, and (3) closeout.

This study focuses on unseen heuristics and their impact on the project management process. These heuristics and biases have been documented in literature, including psychology and business. Tversky and Kahneman (1974) outlined a multitude of heuristics that affect the decision-making process. This study attempts to validate the existence of these heuristics by surveying information technology professionals working on multitudes of projects. The study focuses on the cost and time duration components of project management. We expect to find heuristics active among ongoing projects.

Research Questions

Heuristics and Biases During Initiation and Planning. During the initiation and planning processes, the organization commits to undertake a project phase, developing a scheme to successfully complete the phase. Initiation and planning are of the utmost importance to the successful completion of project phases. Decisions made during initiation and planning impact the organization more than at any other time during the project management process (McCray et al., 2002). Several studies (Jiang, Klein, and Discenza, 2002; Jiang, Chen, and Klein, 2002) have found that altering the project management environment during pre-project activities can improve effectiveness of project teams and managers, ultimately increasing the probability of project success. These decisions include resource allocation and risk assessment. This will profoundly affect subsequent project management processes.

Heuristics and biases used during these processes will probably not impact a project until the later stages. Some decisions that may impact the overall project include the over- or under-estimation of project or phase cost, the over- or under-estimation of project or phase duration, or the over- or under-estimation of overall project or phase work requirements (such as labor hours required). Decisions relating to individual project tasks within a phase may also be susceptible to heuristics (McCray et al., 2002). In many cases, the project manager does not scrutinize the decisions associated with specific tasks as closely as with the entire project, resulting in an accumulated bias effect.

R1: What planning procedures do project managers use to develop estimates (costs and duration) for projects? Do they validate these measures?

R2: Do project managers accurately estimate project tasks (costs and duration)?

R3: Do project managers make the appropriate comparisons of tasks from previous project experiences in developing future project plans?

Inappropriate Comparisons. Project managers commonly reflect upon previous experiences with projects or tasks similar to the current project or task. Unfortunately, research shows that decision-makers do not consistently include the correct elements of prior experiences (Tversky and Kahneman, 1974). Project managers seldom use quantitative evidence indicating the failure rate of similar projects or tasks (McCray et al., 2002). What was the cost of prior projects? Was expertise for the project available in-house? Was the previous project completed on schedule? What part of the project went wrong? The tendency is to reach a level of comfort with a decision based upon "soft" experiences without considering hard evidence on the likelihood of project success (McCray et al., 2002). In comparison, managers tend to base decisions upon a few—and in many cases only one or two—prior experiences. Without sufficient prior experience, reliable predictions are suspect at best. Another problem is the tendency to rely upon qualitative interpretations of other "experts" in developing projections of project or task viability (Tversky and Kahneman, 1974). Project managers often become overly optimistic in their perceptions of the system development project, giving executives status reports that differ from reality (Snow and Keil, 2002). Project team members and corporate executives may become optimistic if a respected team member forecasts a positive completion date. This could easily cause misallocation, under-allocation, or waste vital resources.

R4: Do project managers depend on data that may often create a misinterpretation for project estimates (cost and duration)?

Misinterpretation of Data. Forecasting resource requirements such as raw materials, personnel, and capital is an integral part of the initiation and planning for any project phase. Project managers often formulate estimates providing best, worst, and most likely scenarios for many project requirements (cost and duration). Usually, project managers or organizations use prior projects as a

basis for these estimates (McCray et al., 2002). The dilemma is in the variation of projects. This is especially true with many software development projects. This creates a situation likely to make a project manager misinterpret data (Tversky and Kahneman, 1974). The end result of this heuristic is a lack of confidence in the ability to successfully forecast project outcomes.

R5: Do project managers use their intuition to develop project estimates based on past experience?

Preference for Intuition. Mathematical models are often used to build initial project estimates. Many organizations would prefer to see more rigorous techniques used to make projections; however, applying any quantitative model is probably preferable to using none at all. Many project managers rely upon intuition to generate their best guesstimate for a project task cost and duration. Project managers may have years of experience and a strong ability to anticipate outcomes, but this is often a hit-and-miss strategy (McCray et al., 2002). History and research demonstrates our preference for relying upon subjective predictions made without the benefit of mathematical models.

Research also proves that in most cases subjective judgment is inferior to even the most simplistic statistical models (Einhorn and Hogarth, 1987). Experiments show that integrating common tools for systems analysis and standard tools for project management can improve the system development process and its management (Gelbard et al., 2002). The challenge is determining when and how to encourage foregoing instinct and apply rigorous objective techniques for decision-making. Distrusting statistical evidence is natural. Project managers often adjust estimates upward even when presented with statistical analysis projecting low total project cost. This is an example of the natural resistance to rely upon statistical evidence (Hogarth and Einhorn, 1990). Another human tendency elevates negative predictions instead of positive predictions (Norem and Cantor, 1986). The result is relying on intuition over objective approaches, compounding the issue by elevating negative predictions.

Heuristics and Biases During Execution and Control

Execution and control activities actuate the planning and initiation project phases. Resources must be allocated and performance measures established and monitored to assure successful progression toward project completion (PMI, 1996). Corrective actions should be taken when necessary to ensure project success (PMI, 1996). Again, heuristics and biases are often present during execution and control activities of a project or project task. Ironically, many of the heuristics associated with initiation and planning activities may be present during execution and control. The end result of these heuristics is quite different. These heuristics can result in an unchecked spiraling commitment to ill-fated projects, a continued misallocation or inappropriate reallocation of vital resources to unviable projects, or an irrational justification of task outcomes inconsistent with earlier projections.

R6: Do project managers make mid-course corrections to project estimate costs and durations?

Gambler's Fallacy. Projects rarely unfold without problems. Regardless of the detail and time spent on project plans, projects frequently tend to deviate from expectations. The key for project managers is taking corrective action in a timely fashion to avoid escalated resource requirements downstream. The dilemma is that project managers often delay or forego taking corrective action as a result of this heuristic (McCray et al., 2002). The gambler's fallacy refers to the mistaken belief that the project is due a positive event following a series of negative or undesirable events (Tversky and Kahneman, 1974). This represents flawed reasoning on the part of the project manager. Without a direct causal relationship between a series of project activities and outcomes, there is no reason to expect project results will change.

R7: Are project managers overly optimistic about project estimates and outcomes?

Overconfidence. With all projects, a generally accepted belief is that the earlier a problem is identified and resolved, the less impact the problem will make on the project. It seems that project managers would reevaluate during the early signs of difficulty. However, when project managers are familiar with the existing project plan, they often believe the project can be directed to a successful conclusion via the current course (McCray et al., 2002). Research suggests this result is not often achieved (Langer, 1975). Project managers should understand the objectives of the project and potential barriers to success, continuously conducting effective planning and monitoring performance on an ongoing basis (Jiang et al., 2001). The problem with this approach lies in failing to address issues that may lead to future problems for the project.

Heuristics and Biases During Closeout. During the closeout of a project phase, project tasks and activities are brought to formal conclusion. This may complete a project phase or the entire project. The actual impact of heuristics will be minimal on the completed project. However, one heuristic may be problematic for future projects.

R8: Are project managers rewarded or penalized based upon the result/outcome of a project?

Hindsight Bias. Hindsight bias is one's confidence in explaining prior events. Hindsight bias is a phenomenon in which the outcome of a project becomes entirely predictable (Bukszar and Connolly, 1998). Potential consequences are considerable. Project personnel may be chastised for poor management abilities, decision-making processes may be changed, and the project management process for future projects may be significantly altered. Any of these changes can create problems for future projects. Obviously, hindsight projections on project outcomes are more accurate. However, being overzealous may lead organizations to forego future projects and create an expectation of failure on other projects. Organizations need a balanced approach when looking at both project successes and failures when dealing with project members and managers.

Research Methodology

A survey instrument was created using information from heuristics outlined by previous studies (McCray et al., 2002; Tversky and Kahneman, 1974). The survey had 51 questions.

Section I (4 items) asked demographic questions. Section II (4 items) gathered the respondent's perception of the predictability of projects costs. Section III (4 items) focused on the perception of the predictability of project duration. Sections II and III used a 5-point Likert scale—from 1 = strongly agree to 5 = strongly disagree. Section IV (17 items) focused on heuristics involving project costs, while section V (17 items) focused on the heuristics of project duration. A 5-point Likert scale was used with 1 = always and 5 = never. The goal was determining whether project management personnel actually perform these tasks. The final five items on the survey in Section VI were developed to learn about the respondent's perceptions of why projects fail. These items used a 5-point Likert scale, again with 1 = always and 5 = never. The items used in the survey are presented in Exhibit 1.

Surveys were collected from 118 project managers and team members directly and actively involved in IT projects and core project management processes described in the literature within planning and initiation, execution and control, and closeout. Respondents represented 12 companies with significant IS staff and development teams. Each company came from the Fortune 500. Great effort was taken to ensure only knowledgeable individuals were used in the sample.

A series of one-sample t-tests were performed on each item to determine whether stakeholders agreed with the item or performed certain tasks during projects. The test identifies whether the project personnel rated items greater than or less than 3 toward (strongly agree or strongly disagree or always and never) depending on the scale used for the item. The results of the one-sample t-tests are presented in Exhibit 2.

Results

The survey results produced interesting findings regarding the planning procedures for IS projects. These statistical results are presented in Exhibit 2 and summary findings in Exhibit 3. The results indicate that high level plans (item #4 in sections IV and V) are not created for costs (3.16) or duration (3.17). Project members indicate that they do formulate individual task estimates (item #3 in sections IV and V) for project duration (2.46), while they do not always make such estimates for project costs (2.78). Finally, the analysis produced significant results for justifying project estimates (item #5 in sections IV and V) for project costs (2.62) and duration (2.55). These results are surprising because of limited high-level planning taking place for projects. Another surprise is the failure of respondents to always formulate individual tasks cost estimates. This may indicate the difficulty of projecting estimates in a dynamic environment. The results for justifying project estimates are not surprising.

The results for project estimates produced interesting results as well. Respondents indicated that they rarely underestimate the resources needed for projects (item #6 in sections IV and V) as expressed in costs (3.25) and duration (3.20). Respondents claim their estimates that are miscalculated are off by a small margin (item #6 in sections IV and V) for costs (2.70) and duration (2.68). Perhaps the most surprising result came from item #14 (section IV and V) with regard to building a comfort zone with estimates. Results were not significant for project duration (2.91); however, respondents tend to build a buffer with cost estimates (2.66). This result indicates that project managers worry more about project cost overruns than being behind schedule. A heuristic of creating a buffer can create cost overruns for projects.

Project members strongly agreed that former project experiences (item #3 in sections II and III) were useful for predicting project costs (1.89) and duration (2.09). They stated that they rely on their previous project experiences (item #2 in sections IV and V) in constructing cost (2.16) and duration (2.01) estimates for project tasks. This is quite effective if projects do not have a great deal of variability. However, constantly applying this heuristic can be a problem. The other component is making sure that project managers use correct comparisons among like projects. Without question, project members fall victim to this heuristic.

Project team members indicated that they are provided initial targets (item #12 in sections IV and V) for project estimates for both project costs (2.75) and duration (2.37). They also indicate that they are not provided realistic initial targets (item #13 in sections IV and V) for project costs (3.33) and duration (3.24). This reveals concern about the accuracy of estimates provided to the project team. Project team members were indifferent about the predictability of project costs (2.83; 2.86) and durations (2.82; 2.89) for individual project tasks (item #2 in sections II and III; item 11 in sections IV and V). Regarding costs (2.72), results indicate that project team members believe these estimates difficult to predict (item #4 in sections II and III). These results play into the heuristic problem of misinterpreting data for project estimates. These results show project team members distrust provided information. Without clear, trusted data to make project estimates, it is no surprise that project teams often misinterpret previous project data.

The results did not indicate that project team members rely only on their intuition to develop project estimates (item #8 in sections IV and V). Project team members responded with indifference to using their instincts to make project estimates for cost (3.12) and duration (2.89). The irony is that project team members did not totally deny using intuition for critical decision-making. Project team members also did not indicate using formal models to construct estimates (item #16 in sections IV and V) for project costs (2.76) or durations (2.84). This result leads one to question where estimates come from and what methods are being used. The responses to getting estimates for project costs (2.32) and duration (2.18) from others (item #1 in sections IV and V) indicate that project teams overwhelmingly depend on external data to make such estimates. Using such methods makes project teams susceptible to the heuristic of misinterpreting data.

One heuristic that did not appear in the results is the gambler's fallacy. Project team members indicated that project managers would make mid-course corrections (item #17 in sections IV and V) to project estimate costs (2.56) and durations (2.42). This indicates that most project managers do not assume that something is due to go right for their projects when all indicators point to problems with the initial project estimates. Additionally, project managers indicated optimism about keeping project costs (2.61) within budget (item #1 in section 2) and project task durations (2.64) on schedule (item #1 in section 3). These results were tempered by the responses when asked about pessimism concerning costs (2.94) and durations (3.14) once the project had been initiated (item #7 in sections

Exhibit 1. Project Heuristic Survey Items

Section II: Project costs—Part A

1. Generally, I am optimistic that individual tasks within projects with which I am involved will be completed within budget.
2. The costs associated with project tasks generally are predictable.
3. Former project experiences are useful in predicting future project costs.
4. The costs associated with project tasks increasingly are difficult to predict accurately.

Section III: Project duration—Part A

1. Generally, I am optimistic that individual tasks within projects with which I am involved will be completed on schedule.
2. The time requirements associated with project tasks generally are predictable.
3. Former project experiences are useful in predicting future project durations.
4. The durations associated with project tasks increasingly are difficult to predict accurately.

Section IV: Project costs—Part B

1. I rely upon explicit estimates from other members within the information systems area to determine cost estimates for a project.
2. When formulating project plans, I rely upon my earlier project experiences in constructing cost estimates for project tasks.
3. When formulating project plans, I explicitly formulate cost estimates for individual project tasks.
4. I formulate multiple high-level project plans for a given project before settling on a single estimate of project costs.
5. I am asked to justify my estimates of project costs.
6. I under-estimate the financial resources required to complete projects.
7. When a project is first initiated, I am pessimistic about its completion within budget.
8. I rely upon instinct when projecting projects costs.
9. I am rewarded when my predictions of project costs prove accurate.
10. I am penalized when my predictions of project costs prove inaccurate.
11. Task expenditures are predictable.
12. As a project manager, I am provided with initial targets for overall project cost.
13. As a project manager, I am provided with realistic initial targets for overall project cost.
14. I adjust upward estimates of project costs to build in a "comfort zone" in case the project goes over budget.
15. When one of my cost estimates for a project task proves incorrect, it is usually only a small over- or under-estimation.
16. I use a formal model or framework to construct cost estimates for projects.
17. I make "mid-course" corrections to estimates of project costs.

Section V: Project duration—Part B

1. I rely upon explicit estimates from other members within the information systems area to determine time estimates for a project.
2. When formulating project plans, I rely upon my earlier project experiences in constructing time estimates for project tasks.
3. When formulating project plans, I explicitly formulate time estimates for individual project tasks.
4. I formulate multiple high-level project plans for a given project before settling on a single estimate of project duration.
5. I am asked to justify my estimates of project duration.
6. I under-estimate the time required to complete projects.
7. When a project is first initiated, I am pessimistic about its completion on schedule.
8. I rely upon instinct when estimating project duration.
9. I am rewarded when my predictions of project duration prove accurate.
10. I am penalized when my predictions of project duration prove inaccurate.
11. Task durations are predictable.
12. As a project manager, I am provided with initial targets for overall project duration.
13. As a project manager, I am provided with realistic initial targets for overall project duration.
14. I adjust downward estimates of project duration to build in a "comfort zone" in case the project goes beyond its expected completion date.
15. When one of my time estimates for a project task proves incorrect, it is usually only a small over- or under-estimation.
16. I use a formal model or framework to construct time estimates for projects.
17. I make "mid-course" corrections to estimates of project duration.

Exhibit 2. One-sample Statistics

Project Costs and Duration

Section	Item	Mean	SD	t	p(t)
II Project costs-A	1	2.61	0.868	-3.857	.000[A]
	2	2.83	0.778	-1.930	.057
	3	1.89	0.815	-11.760	.000[A]
	4	2.72	0.938	-2.585	.012[A]
III Project duration-A	1	2.64	0.875	-3.540	.001[A]
	2	2.82	0.844	-1.903	.061
	3	2.09	0.851	-9.297	.000[A]
	4	2.87	0.949	-1.217	.228
IV Project costs-B	1	2.32	0.796	-7.305	.000[AI]
	2	2.16	0.794	-9.074	.000[AI]
	3	2.78	0.955	-1.948	.055
	4	3.16	1.098	1.270	.208
	5	2.62	1.069	-3.045	.003[AI]
	6	3.25	0.806	2.651	.010[N]
	7	2.94	0.715	-0.664	.509
	8	3.12	0.979	1.069	.289
	9	3.44	0.957	3.913	.000[N]
	10	3.23	1.087	1.831	.071
	11	2.86	0.652	-1.794	.077
	12	2.75	1.038	-2.030	.046[AI]
	13	3.33	0.872	3.243	.002[N]
	14	2.66	1.044	-2.803	.006[AI]
	15	2.70	0.758	-3.397	.001[AI]
	16	2.76	1.107	-1.810	.075
	17	2.56	0.928	-4.037	.000[AI]
V Project duration-B	1	2.18	0.778	-9.139	.000[AI]
	2	2.01	0.702	-12.251	.000[AI]
	3	2.46	0.930	-5.056	.000[AI]
	4	3.17	1.038	1.437	.155
	5	2.55	0.958	-4.072	.000[AI]
	6	3.20	0.712	2.416	.018[N]
	7	3.14	0.778	1.622	.109
	8	2.89	0.873	-1.051	.297
	9	3.28	0.932	2.584	.012[N]
	10	3.14	0.989	1.275	.206
	11	2.89	0.727	-1.270	.208
	12	2.37	0.892	-6.172	.000[AI]
	13	3.24	0.781	2.644	.010[N]
	14	2.91	0.941	-0.854	.396
	15	2.68	0.657	-4.187	.000[AI]
	16	2.84	1.220	-1.136	.260
	17	2.42	0.771	-6.550	.000[AI]

Note: A= Agree D=Disagree Al= Always N=Never for items that are significant at .05.

Exhibit 3. Summary Results and Research Questions

Research Question	Summary Results
1. Project planning	Project managers make few high level plans for costs or duration.
	Project managers do formulate individual task estimates but not for project costs.
2. Accuracy of project task estimates	Project managers rarely underestimate resources needed for costs or duration.
	An estimate comfort zone was not created for duration, however, results did indicate the building of a buffer for cost estimates.
	There was an obvious concern for cost overruns.
3. Use of previous experience	Project managers agreed that previous project experience was useful in making cost and duration estimates.
	Many project managers stated that they relied heavily on previous experience.
	Heavy reliance on previous experience could be a heuristic problem in a dynamic environment.
4. Data dependence	Initial targets for costs and duration are provided by the organization.
	Many initial targets and estimates are not realistic.
	Project managers have a concern regarding the accuracy of estimates given the project team.
5. Intuition	No one agreed or denied the use of intuition to create project estimates for costs or duration.
	Neither use of models or formal methods were mentioned when developing project estimates.
	Estimates come from external sources to the project teams.
6. Mid-course corrections	Project managers did indicate the making of mid-course corrections to estimates of the project.
	These results counter the gambler's fallacy.
7. Overly optimistic concerning estimates and outcomes	There is optimism among project managers about keeping projects within budget and time constraints.
	Some pessimism exists among project managers about schedules and costs.
	Overconfidence does not seem to be in play.
8. Rewards or penalties	Project managers did indicate being rewarded or penalized by the results of projects with regard to schedule or costs.

IV and V). These results do not indicate over-confidence by the project team that projects will be within budget and on schedule. This probably means the overconfidence heuristic is not impacting projects.

Results of the survey do not indicate that the hindsight heuristic is in play during project closure. Project managers tended not to be rewarded (item #9 in sections IV and V) for accurate cost (3.44) or duration (3.28) estimates, nor were they penalized (item #10 in sections IV and V) for inaccurate cost (3.23) or duration (3.14) estimates. The responses indicate that companies know about problems with IT projects and do not place sole blame or praise upon any particular manager due to project results. As noted in the literature, hindsight estimates are accurate, but must be taken in context. Survey responses indicate managers create a comfort zone estimate for costs. It makes one wonder why they believe costs are so important without performance rewards or penalties.

Mitigating the Effects of Heuristics: Recommendations for Project Managers

Being aware and understanding heuristics and appreciating their potential impact is necessary but insufficient to prevent

their effects in project management settings. A proactive stance manifest in management policy and procedures holds promise in mitigating the influence of heuristics and biases:

Tactic 1: Institute a formal project kick-off event and ask pertinent questions. What did we do right on our last project? What did we do wrong? What can we learn from these experiences? These kick-off sessions have a proven track record for generating very useful conversations that can inform upcoming projects. Beware of the aforementioned heuristics. Has the experience occurred frequently, or on one or a few occasions? If the latter, then generalizations drawn from the experience should be made with much care.

Tactic 2: Require decision processes to rely upon objective data. For example, the project manager may have the attitude that he or she simply doesn't like to be first with a new approach. While this may be sage insight, it is better to back it up with relevant evidence. This mitigates the impact of subjective influences that cannot be substantiated by fact.

Tactic 3: Clearly specify methods to objectively determine or calculate planning and oversight. For example, specify the accepted method for calculating expected labor hours for a project phase. Require deviations be explained, holding people accountable. Also, specify the manner in which these objective data are used in planning and oversight processes.

Tactic 4: As a component of planning, construct a balance sheet of positive and negative aspects of the project or activity under consideration. This can be—and has been—done effectively with simple flip charts during a kick-off event. Creating such a document offers an opportunity to surface multiple perspectives through brainstorming, as well as leading to a more balanced consideration of the project or activity at hand. For example, the sales force may not have access to timely market information for two weeks as a result of project activities, but once completed, they will have significantly improved functionality. The ratio of positive to negative aspects of a project, activity, or technique will impact the attitude toward it.

Tactic 5: Articulate a project management process to project team members. The process should indicate and justify roles, responsibilities, and how to address unforeseen events. This is an increasingly important tactic as work groups become global in composition; cultural differences relative to work habits can lead to group dysfunction. Specifying not only what work is to be accomplished, but also how those outcomes are to be achieved can mitigate the effects of individual differences.

Tactic 6: Require formulating more than one feasible alternative approach to the project or project phase. For example, require explicit and objective consideration of in-house production versus purchase from a third-party vendor. Always strive to identify at least two alternative approaches. If this is not possible, make certain there is a clear explanation for why there is only one way to approach the work. This avoids settling on the first option that springs to mind, a known problem in project work.

Tactic 7: Assure the existence and effectiveness of a project oversight body, such as a steering committee. It should be comprised of representatives from organizational areas impacted by the project. Such a governing body guards against potentially problematic biases of individuals.

Tactic 8: Establish mechanisms for positive feedback to employees. When evaluating project team members, use a collection of data and experiences with those employees, rather than focusing on a single or recent events. The true portrait of contributions made by an individual is apparent only over time. This tactic may be more relevant for punishment than for rewards. Do not severely punish a project team member who is generally a good worker. This demotivates a good employee. Long-term project success depends on retaining good people.

Study results indicate that many of the noted confounding heuristics exist in contemporary IS project environments. Evidence from the survey data indicates that every heuristic problem mentioned can be found in the planning and initiation phases of projects. Organizations would do well to proactively establish policies and procedures targeted at limiting the negative influence of heuristics and biases.

Limitations of the Study and Implications for Future Research

Strong project management has long been at the core of successful information technology investments in organizational settings. Projects often spiral out of control, leaving bewildered and frustrated information systems professionals and clients/users wondering what went wrong. The present study may illuminate the evidence amassed to suggest that heuristics and their associated--and often damaging—biases exist. When viewed with prior research, they may exist unbeknownst to key project players.

The present study gathered data from 118 project managers and team members directly involved in IT projects. What remains unknown is the extent to which their organizations have instituted formal policies and procedures to mitigate heuristics and biases, and the extent to which these actions have proven efficacious. How mature is the IS organization within a given firm? How intentionally are management actions taken to avoid cognitive limitations in project planning and execution activities? These questions were not addressed in this study, but they represent an important area of future inquiry.

This study essentially confirms suspicions from other research (McCray et al., 2002). An important follow-on study will carefully examine the rich contexts within which these heuristics and biases play out over the life of multiple projects. Only via the case study approach can the phenomena introduced by heuristics and biases be more fully understood. The present research intends to provide a springboard from which to launch further inquiries.

Conclusion

Heuristics can be useful tools to address complex decision situations. They can provide simple approaches for resource and time allocation for many projects. The dilemma lies in knowing when unrecognized heuristics and associated biases may negatively impact the effective management and execution of a project. Detecting the presence of these heuristics is often difficult, yet their impact can be profound. Organizations can mitigate the impact of negative heuristics by pursuing selected

management tactics, as previously outlined. The management techniques suggested will have little impact on external factors (Cash et al., 1988; Davis and Olson, 1985), but the potential for internal project processes to be improved warrants careful internal evaluation.

Ideally, identifying and correcting negative heuristics and associated biases will free funding and other resources, allowing firms to pursue organizational projects that might not otherwise be attempted. Organizations may abandon projects that consume resources better applied elsewhere. Regardless of the corrective action taken, an awareness of the potential negative impact of heuristics and biases is an important tool for the arsenal of IS project managers, representing a rich and relevant area of further inquiry by scholars.

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