Perceptual Congruence and Systems Development Cost Estimation

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Information systems cost estimating is an important concern for information resource management. Information systems cost estimators and non-estimators (those IS professionals not responsible for cost estimating) have different roles, responsibilities, and objectives. They might consequently be expected to have different perceptions of the estimating process. Previous research has shown that perceptual congruence—the degree to which individuals view matters similarly—is associated with favorable organizational consequences. A study of information systems cost estimators and non-estimators at 112 organizations compared and contrasted their perceptions of the cost estimating process and its success. Estimators and non-estimators did not differ substantially in their views of the uses of the estimate, the basis for estimating, the influences on the estimate, and management practices for estimating. They did differ in their perceptions of the importance of the estimate, their satisfaction with the estimating process, their estimating accuracy, and the causes of inaccurate estimates. The similarities and differences provide implications for researchers and information resource managers.

Accurate software development cost estimating is very important. Underestimated costs may convince management to develop new systems that later overrun their budgets and fail to achieve their expected payoff. Many worthwhile projects waste the resources invested in them by being canceled because of cost overruns due to poor estimates (Vacca, 1991). In fact, projects that merely begin to overrun may be canceled before completion. Overruns can thus reduce information resource management’s credibility and discourage future user cooperation.

Overestimated costs may convince management not to develop potentially beneficial systems. Management generally declines to approve a project with unrealistically high estimates and thus loses its potential benefits (Emery, 1971; King and Schrems, 1978). Hence, both underestimates and overestimates can have a significant, deleterious impact (Tate and Verner, 1990) and cause lost strategic opportunities (Benjamin, Rockart, Scott Morton, and Wyman, 1984).

The impact of inaccurate estimating on business and industry has been enough to cause a discussion of it to reach the popular press. The Wall Street Journal (Pope, 1993) reported a Dallas–based consulting firm’s estimate that 70% of its clients had major cost overruns on recent downsizing projects. The article added that a doubling of estimated costs was not unusual. Businessweek (1988) discussed several information systems development calamities. As an example, an insurance system initially estimated at $8 million was reestimated at $100 million during development. The Businessweek article also reported a consulting firm’s survey in which 35% of its largest clients admitted major cost overruns. Although one may question the accuracy of reports in the popular press, the problem of inaccurate estimates has clearly produced widespread attention.
Researchers have identified many potential explanations for this inaccuracy (Brooks, 1978). They have further suggested that conflict between the participants in information systems development may exacerbate this situation (Lederer, Mirani, Neo, Pollard, Prasad, and Ramamurthy, 1990). For example, those responsible for producing estimates and those responsible for carrying them out may have different objectives and perceptions of the estimating process. The study sought to better understand the perceptions of these two parties. Doing so might suggest actions for improving the accuracy of cost estimates and the management of information resources.

**Background**

**Overview of Estimating Research**

Prior research on information systems development cost estimating has largely concentrated on the study of estimating techniques. Some of this research has identified elements believed to affect information systems development and necessary to consider while cost estimating (Benbasat and Vessey, 1980; Boehm, 1984; Boehm and Papaccio, 1986; Mohanty, 1981; Subramanian and Breslawski, 1993). These diverse elements include system size and complexity, personnel capabilities and experience, hardware constraints, the use of modern software tools and practices, users’ understanding of information systems technology, the volatility of their requirements, the site, and many others.

Most techniques are based on one or more such elements (Conte, Dunsmore and Shen, 1986). The estimator quantifies each based on historical data about past development projects or on intuition and experience (Aron, 1976; Mohanty, 1981). Different methods may define the same factors in different ways. For example, many methods operationalize system size in terms of the projected number of lines of executable code in the proposed system (Boehm, 1984; Conte et al., 1986; Freiman and Park, 1979; Herd, Postal, Russell, and Stuart, 1977; Jensen, 1983; Nelson, 1966; Putnam, 1978; Walston and Felix, 1977; Wolverton, 1974) whereas other methods use the number of functions, modules, or program features in the system (Albrecht, 1979; Demarco, 1984; Donelson, 1976; Halstead, 1977; Jones, 1986; McCabe, 1976).

The algorithmic methods use these quantified elements to produce an estimate of the proposed system’s cost. These methods vary widely in mathematical sophistication. Some use simple arithmetic formulas based on such summary statistics as mean and standard deviations (Donelson, 1976) while others employ regression models (Walston and Felix, 1977) and differential equations (Putnam, 1978).

**Types of Cost Estimating Research**

A wide variety of types of research has appeared on cost estimating. Some researchers have used experiments to predict the cost of projects using different algorithmic techniques (Banker and Kemerer, 1989; Kusters, van Genuchten, and Heemstra, 1990; Kemerer, 1987; Kitchenham and Taylor, 1985; Miyazaki and Mori, 1985). One study evaluated the accuracy of four algorithmic methods by predicting the durations of already completed projects (Kemerer, 1987). However, it found considerable inaccuracy with error rates averaging from 85% to 77%.

In a related study, experts estimated these same projects without using formal algorithmic techniques and generally performed better than the models in the original study although mean error rates ranged from 32% to 1107% (Vicinanza, Mukhopadhyay and Prietula, 1991). A third study (using different projects) found error rates averaging 166% (Miyazaki and Mori, 1985). A fourth study (again with different projects) found similarly high error rates (Martin, 1988).

However, the projects were complete and the subjects in the studies had full knowledge of their scope at the time of estimating (knowledge generally available only in laboratory settings). Kemerer (1987) has speculated that the techniques would be even more inaccurate if the scopes were initially unknown. In any case, besides illustrating cost estimating research, these experiments confirm the inaccuracy of the estimating process.

In addition to experimental research, simulation research has considered the relationship between project management decisions on cost estimating and project completion costs (Abdel–Hamid and Madnick, 1987). In other research, the developers of methods have described their own technique and reported their own assessment of its accuracy (Donelson, 1976; Jensen, 1983; Putnam, 1978; Walston and Felix, 1977; Wolverton, 1974). In still other examples of action-oriented research, authors have used their own personal experiences to write prescriptive articles (Boehm, 1981; Demarco, 1982).

A final type of research is a case study. One such study described the cost estimating practices at a Fortune 200 organization’s largest division (Lederer et al., 1990). It distinguished the roles of systems professionals responsible for producing estimates from those responsible for implementing the systems within those estimates. It identified possible organizational pressures on the cost estimating process resulting from conflicting objectives held by those participants. For example, estimators may be very susceptible to management pressure to provide relatively low estimates so predicted costs meet budgetary constraints and projects obtain approval. On the other hand, non–estimators may prefer estimates padded sufficiently that they will not be exceeded.

**Perceptual Congruence and Cost Estimating**

Such different responsibilities, roles, and objectives can
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