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Integration mechanisms and R&D project performance ☆

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Abstract

Information processing theory suggests the need for different types of integration mechanisms in R&D project management depending on levels of uncertainty and equivocality. This paper examines the use of these mechanisms and their links to project performance in a sample of 121 R&D projects in a large research laboratory. Overall, it is found that formal leadership, planning and process specification, and to a lesser extent information technology use are related to project performance while the positive effects of horizontal structures are apparently balanced out by their costs. The integration mechanisms studied act on performance partly through their effect on horizontal communications. Modest support was found for the contingency hypotheses derived from information processing theory. It appears that managers adjusted their use of horizontal structures, planning and process specification, and informal leadership to project uncertainty but not to project equivocality. The positive effects of horizontal communications on performance were found to be greatest under high project equivocality as would be predicted by information processing arguments. Moreover, with the exception of formal leadership, the use of integration mechanisms did not enhance performance in contexts of low uncertainty and low equivocality.

Keywords: Information processing theory; R&D project management; Integration mechanisms; Innovation management

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1. Introduction

In an innovative process, distinct sets of specialized skills rarely found within one individual are often necessary to accomplish the complex tasks required for the development, manufacturing and marketing of a product (Allen, 1986; Roberts, 1988; Von Hippel, 1990). At the same time, communication, collaboration and integration between specialists and functions are required to maximize the synergy between the various interdependent parts of a project (Brownlie, 1987; Moenaert and Souder, 1990; Ettlie and Reza, 1992; Hitt et al., 1993). As Dougherty (1992) shows, integration tends to be hampered by the development of distinct ''thought worlds'' associated with individual specialization. This tension between the need for differentiation and for integration lies at the heart of the study of organizations and seems particularly salient to the problem of innovation (Thompson, 1967; Lawrence and Lorsch, 1969; Daft and Lengel, 1986).

To solve this problem, a number of different approaches to integration and coordination among the diverse specialists involved in R&D project development have been proposed. These mechanisms can include formal or informal project leadership, formal planning procedures, horizontal structural or cultural mechanisms, and the use of communication technologies (Moenaert and Souder, 1990; Hitt et al., 1993; Adler, 1995).

Integration mechanisms are not costless however, (Hitt et al., 1993; Emmanuelides, 1993). For example, regular project meetings and status reports absorb time and energy that might be better spent in execution. Moreover, the effectiveness of the various mechanisms is likely to vary depending on specific project needs. In particular, larger and more complex projects seem likely to warrant more elaborate mechanisms. Similarly, radical innovations may require different types of organizational arrangements from more incremental projects. In this paper, we use information processing theory (Daft and Lengel, 1986) to derive hypotheses concerning the prevalence and efficacy of five types of integration mechanisms under different project conditions. These are tested on a sample of projects from a large R&D laboratory (labeled Centerlab).

2. Theoretical base: information processing requirements and integration mechanisms

2.1. Uncertainty, equivocality and information processing needs

Daft and Lengel (1986) propose that two distinct task dimensions determine organizational information processing needs in any given situation: uncertainty and equivocality. Uncertainty refers to the absence of answers to well-defined questions: for example, a lack of knowledge about future events or the consequences of specific actions. Equivocality refers to a deeper level of ambiguity and confusion concerning the nature of the questions asked, the goals pursued and the problems to be solved (Daft and Lengel, 1986). While the collection of hard factual data can help resolve uncertainty, it may be of relatively little help under equivocality when the nature of the task itself is unclear.