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# Designing and facilitating collaboration in R&D: A case study☆

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ABSTRACT

This case study aims to highlight the strategic decisions and managerial practices in the formation and operation of a co-located research unit within a national laboratory. The empirical evidence is based on interviews with members of the research unit as well as responses from a research environment survey. The findings of the case study suggest specific strategies that are conducive not only for the co-location of research units but also for research management in general. Principal among these are the need to balance increases in diversity and complexity with mechanisms of integration and the use of specific management practices and leadership qualities that support these activities.



## 1. Introduction

Although the impact of co-location in research and technology or product development (R&D) is typically assumed to be positive, there are scant few empirical studies that provide an in-depth exploration of this practice (Kahn and McDonough, 1997). While a number of studies exist that focus on the related issue of collaborative networks (for example see Danilovic and Winroth, 2005; Johansen et al., 2005; von Corswant and Tunälv, 2002), often overlooked are the organizational mechanisms that allow for integrating the diversity of cross-functional teams, both within and across organizations (Holland et al., 2000; Susman and Majchrzak, 2003). Further, there is very little in the literature that explores the initial organizational decisions that formed the co-location effort as well as the management practices that sustain the ongoing unit. Finally, a great deal of the studies that do exist

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focus primarily on new product development or the integration of design or marketing with manufacturing, rather than the co-location of a research unit with another part of the R&D continuum.

The motivation to co-locate is typically driven by the assumption that cross-functional communication and teams lead to increased or accelerated innovation. In the organizational literature, the role of a complex division of labor, like that found in cross-functional teams, has been identified as a critical factor in facilitating organizational innovation. As Hage (1999) demonstrated in a comprehensive review of the organizational innovation literature, a complex division of labor is a key determinant for facilitating innovation, as it encompasses the organizational learning, problem-solving, and creativity capacities of an organization. But the practice of co-location highlights a central issue in the management of R&D of how to strike a balance between increasing the complexity of labor to increase innovation, while at the same time ensuring adequate integration (Nooteboom, 1999, 2000). As Leenders et al. (2003) discuss, integrated and active interactions among researchers plays a key role in promoting the cross-fertilization of ideas and creativity necessary for innovation. While the need for integration is recognized as critical in the management of R&D (Allen, 1977; Leenders et al., 2003; West, 2004), the successful attainment of integration represents a challenge for managers (Nihtila, 1999; Sicotte and Langley, 2000; Holland et al., 2000). And while the use of co-location is becoming more common, the limited evidence of the results of these attempts at cross-functional integration is often mixed (Kahn and McDonough, 1997).

Further, it should go without saying that a co-location effort, or any research effort, cannot be successful without strong leadership, particularly in the initial management decisions. As Von Zedwitz (2003) discusses, the formation of new research units entails a series of decisions that impact the development of these units over time, including the selection of an appropriate manager. And leadership practices and styles, in general, have been demonstrated to have a significant impact on R&D performance (Oh et al., 1991; McDonough and Barczak, 1991; Green, 1995; Sicotte and Langley, 2000; Stoker et al., 2001; Cordero et al., 2004). Yet, we would argue that there are few studies that provide practical insights on successful leadership styles or practices in the R&D literature.

The objective of this paper is to discuss the issues of balancing diversity and integration and leadership in R&D through an examination of a case study of the formation and co-location of a dedicated basic research unit within a manufacturing department (S&T MD) in a large national laboratory (hereafter NATLAB) in the United States. The research unit was formed to focus on the manufacturing department's single product, a component which requires extreme precision, exotic materials and highly advanced processes in its manufacture. It was anticipated that the integration of basic research in the production facility would result in fewer technical surprises on the production line and quicker resolution of problems that do arise. Our case study encompasses not only the current activities of the S&T MD, but also the initial decisions and actions that led to the formation of the unit. In this manner, the case study provides a relatively more comprehensive investigation of a novel application of the use of co-location.

But the case study should also have special interest to R&D managers for several reasons beyond the issues raised above. First, the case study focuses on a co-location effort at the level of basic research, while most studies on co-location focus on efforts in product development. Second, the case study involves the co-location of a basic research unit within a manufacturing unit, which, to our knowledge, is relatively rare. Finally, the need for scientific and technological research units for manufacturing is becoming greater because frequently radical innovations utilize advanced process technologies and the challenge of these manufacturing units involves addressing technical complexities in the product and the manufacturing process.

In the next section of the paper, we discuss the applied theory of radical innovation that underlies some of the assumptions in the analysis of the case study. After a brief discussion of the methodology, we discuss the efforts of the unit in developing complexity or diversity and how integration is perceived by the five scientists in this unit, using both the interviews and the results of a research environment survey. To provide some basis of comparison, the survey results of the unit's scientists are compared to another experiment in co-location within the NATLAB, which we will refer to as COLO, as well as the overall researcher perceptions for NATLAB. In the subsequent section, we discuss the management practices and leadership style of the unit's manager that facilitated the co-location effort, including a long-term scientific vision, cognitive mentoring and providing emotional support to