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Innovation spaces: Workspace planning and innovation in U.S. university research centers

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Abstract

This paper reports findings of a study designed to test whether differences in spatial layout of research offices and labs (workspace planning) affects face-to-face technical consultations, and ultimately innovation process outcomes in research settings critical to government supported innovation strategies—university research centers (URCs). The study involved a mixed-method (multivariate predictive and multiple case comparison) evaluation of six organizationally similar but spatially different URCs. Data analysis revealed relationships between workspace planning, consultations and innovation process outcomes. Multivariate analyses showed that configurational accessibility, visibility and walking distances significantly affect the frequencies and locations of unprogrammed face-to-face consultations. Cross-case comparisons revealed that URCs featuring overall high configurational accessibility, shorter walking distances and intact territories exhibit higher face-to-face consultation rates, consultation network connectivity, and subjective/objective innovation process outcomes. Implications for research policy, practice and research are discussed.
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1. Introduction

Over the past decade or so space, or perhaps more accurately spatial analyses, has begun to play an increasingly prominent and important role in the innovation process literature. Interestingly, most of this recent work has focused on spatial relationships that happen at a very large scale, such as the national, regional or local level. For instance, stimulated by a recognition of the importance of technological clusters in local economic development, Porter and Stern (2001) in their influential "Innovation: Location matters" and others (Castells and Hall, 1994) have examined the role played by spatial factors like geographic proximity and concentration of various industrial, educational and technological assets (including firms, universities and research laboratories) on innovation outcomes and ultimately economic development. Not surprisingly, based on an empirical analysis of data from the European Regional Innovation Survey (ERIS), Koschatzy and Sternberg (2000) acknowledge the complexity of these relationships by concluding, "spatial proximity might be a prerequisite for certain kinds of innovation networks within national boundaries, i.e. innovation systems, but is outweighed by cultural and

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institutional distance when spatially close knowledge sources are divided by national border" (pg. 492).

Research at a local level (e.g., Casas et al., 2000) has had a similar focus but has also included a more defined examination of the spatial factors underlying the value and success of initiatives like research parks (e.g. Appold, 2004). Similarly, Adams (2001) and others who have examined factors that affect the payoffs from interorganizational relationships between firms and cooperative research centers have noted the importance geographic proximity plays in the receipt of various benefits.

Interestingly, there has been much less recent interest in and research on spatial factors operating at a micro-level of analysis. For instance, in spite of a long-standing consensus about the importance of workspace-level spatial factors for innovation-related outcomes, very little recent research has focused on this connection. Further, with the advances in information technologies, arguments about the "death of distance", hence the decreasing need for spatial proximity based on electronic communications, are becoming more and more common. We find this surprising, since there is a substantial amount of evidence about the effects of spatial factors on human behavior in a variety of contexts. Hall's seminal work on space (1966) suggests a proxemic framework that offers three levels of spatial analysis: fixed-feature space (i.e. defined by walls, slabs, etc.), semi-fixed feature space (i.e. defined by furniture arrangements), and non-fixed feature space (i.e. perception and use of space based on behavioral thresholds or socially acceptable behavior). Over the last few decades, research in environment–behavior studies and environmental psychology has demonstrated how each of these spatial levels relate to human behavior—such as socializing behavior in schools (Peatross and Peponis, 1995), and interactive behavior in workspaces (Bechtel, 1977). Nevertheless, very few studies have considered the innovation process in relation to individuals' and organizations' day-to-day work patterns and the immediate spatial context they operate in.

The current paper begins to fill this void by summarizing a recent mixed-method (multivariate predictive study and a multiple case comparison) research study (Creswell and Clark, 2006) that focused on the relationships among workspace planning, technical "consultation" and innovation process outcomes in a work setting that has great importance for the research policy community—university research centers. Toward this end, we will review the existing body of literature related to workspace design and innovation from both S&T and design research traditions, highlight a promis-

ing new analytical tool – space syntax analysis, present our research questions and describe our methodologies. Findings of the study will then be reported through discussions about the observed relationships between workspace planning and scientist-to-scientist consultation, and, ultimately, innovation process outcomes in university research centers.

2. Workspace planning, consultation and the innovation process

To a large extent, a belief in the impact of workspace spatial factors on the innovation process appears to rest on two related but surprisingly distinct research foci: (i) research on consultations (face-to-face and other types) and various innovation process outcomes, and (ii) research on workspace design and face-to-face consultations. Based on theory and research from these two traditions, it is possible to construct a conceptual model of relationships that can be represented by a three-ring chain: workspace–consultations–innovation process outcomes. This conceptual model suggests that consultations, particularly face-to-face consultations have a mediating role in the relationship between workspace and innovation. Surprisingly, however, research support for the linkage between these three rings is neither complete nor methodologically robust. In the following sections, we will focus on information consumption, its facilitating role in the innovation process, and how workspace may relate to information consumption through facilitating idea exchange.

2.1. Information consumption for innovation: information resources and information horizons

Given the demonstrated importance of social and cognitive factors in the innovation process, it should not be surprising that there also near-universal agreement within the science and technology (S&T) literature on the importance knowledge plays in the innovation process (i.e. Kanter, 1988; Tornatzky and Fleischer, 1990; Hargadon and Sutton, 1997; Nonaka and Konno, 1998; Mascitelli, 2000; among others). In her conceptual framework of access to information, Sonnenwald (1999) indicates that the information resources available to individuals form their information horizons, which are critical in facilitating information consumption. In this respect, being exposed to higher numbers of information resources (i.e. availability of peers for consultation, available literature, subject matter experts, among others) expands the available knowl-