

# Understanding Innovation Processes

**Sue Newell**

*Bentley College, USA*

## INTRODUCTION

Knowledge integration is a process whereby several individuals share and combine their information to collectively create new knowledge (Okhuysen & Eisenhardt, 2002). Here we are interested in knowledge integration in the context of innovation project teams tasked with developing a new product or organizational practice. Knowledge integration is crucial in relation to innovation, since innovation depends on the generation of new ideas (new knowledge) that leads to the development of new products or organizational practices. Knowledge integration, rather than simply knowledge per se, is important for innovation because it is not simply the possession of new knowledge that will create success in terms of improved practice or new products, but rather, the ability to *integrate* knowledge across groups and organizations (Gibbons et al., 1994). This is especially the case in relation to radical innovation, which depends on involvement of an increasingly dispersed range of professional groups and organizations (Powell, Koput, & Smith-Doerr, 1996). For example, in the medical domain there are an increasing number of breakthroughs in scientific and technical knowledge that could drastically change medical practice. Achieving such breakthroughs, however, does not necessarily result in performance improvements in medical practice. Major pharmaceutical companies take, on average, 11 years and a minimum of one-third of \$1 billion to bring a drug to market, and over 90% of development processes fail (CMR International, 2000). Similarly, in relation to major transformational IT innovation projects in organizations, many do not just fall short of meeting cost, functionality, and scheduling targets, but actually fail outright (Johnson, 1995).

While there are many reasons for such failure, one important reason relates to the problem of integrating knowledge, because breakthroughs leading to radical innovation are highly disruptive (Christensen, Bohmer, & Kenagy, 2000) and potentially “competency destroying” (Henderson, Orsenigo, & Pisano, 1999). For example, the development of the new drug or the new IT system will often cut across established institutionalized domains and structures for the production of knowledge, and therefore require radical shifts in relationships among professional and functional groups. New developments made possible by breakthroughs in science may not align

well, for example, with existing professional regimes and medical practices (Christensen et al., 2000).

In this article then, we consider the issue of knowledge integration in the context of innovation projects and relate it to social capital, since understanding the process of knowledge integration involves exploring the “micro-social interactions among individuals” (Okhuysen & Eisenhardt, 2002). It is helpful to explore these micro-social interactions through the lens of social capital since social capital refers to the social networks and the assets that can be mobilized through these networks that enable social action generally and knowledge sharing more specifically (Nahapiet & Ghoshal, 1998). In other words, given that the development of new products and practices typically involves teams of people from different backgrounds (i.e., multi-disciplinary project teams) working together, exploring how individual team members share and combine their respective knowledge in order to generate new ideas to support innovation is important. Specifically, we will consider how different approaches to creating and using social capital leads to different levels of knowledge integration, which in turn influence the innovation achieved, which can be either incremental or radical.

## BACKGROUND

### The Concept of Knowledge Integration

To reiterate, in this article we are interested in how a project team, tasked with developing a new product or practice, shares and combines the information of the different team members and of other stakeholders who have relevant information in order to create new knowledge that supports innovation. While the Okhuysen and Eisenhardt definition (above) suggests that knowledge integration is a simple process, the reality is that sharing and combining information is often very difficult. This is because knowledge is dispersed (Tsoukas, 1996) and ambiguous (Dougherty, 1992), as well as being potentially competency destroying (Henderson et al., 1999) in the sense that new products or practices may make obsolete the knowledge of particular groups who may then resist involvement in the knowledge integration process and so limit progress.

Teams will differ in terms of what they achieve in relation to knowledge integration. To simplify this we can identify two extremes in the way that knowledge can be taken to be integrated in the context of a project team tasked with developing a new product or service—"mechanistic pooling" (Knights & Wilmott, 1997) versus "generative" (Cook & Brown, 1999) knowledge integration. Mechanistic pooling occurs when each project member works independently on a set of clearly defined tasks or processes with which he/she is familiar and uses his/her existing knowledge to consider the potential of the new scientific/technological breakthrough on the particular problem domain, be this a new drug to help treat cancer or a new IT system to support information integration within an organization. In such circumstances, the new drug or IT system is perceived as simply fitting independent pieces together, like a jigsaw puzzle. This mechanistic pooling of knowledge is likely to result in a new product or service that may have higher performance than current products or services, in which case it may replace what currently exists. However, the innovation is likely to be incremental and is unlikely to lead to any radical change in practice, because radical change is likely to require a more generative and interactive approach to knowledge integration (Newell, Huang, & Tansley, 2004).

Generative knowledge integration occurs when there is joint knowledge production achieved through the combination and exchange of knowledge (Nahapiet & Ghoshal, 1998) and experimentation (Rosenberg, 1982) between individuals from diverse backgrounds (Grant, 1996; Hitt, Nixon, Hoskisson, & Kochhar, 1999). Through this exchange and experimentation, new and novel ways of doing things are identified that could not have been predetermined by the independent parts (Cook & Brown, 1999). In other words, generative knowledge integration occurs when communication and exchange within a group or a team evokes novel associations, connections, and hunches such that new meanings and insights are generated. In this case, knowledge integration involves a process of social construction in which organizational members negotiate, achieve, and refine a shared understanding through interaction, sense-making, and collective learning (Ayas & Zeniuk, 2001; Boland & Tenkasi, 1995). It is this process that provides the basis for creativity, and it is precisely such creative, generative knowledge integration that is much more likely to lead to radical change—for example, radical changes in medicine that many declare is possible with new scientific/technological breakthroughs.

As indicated, exploring knowledge integration processes involves understanding the network relationships and social interactions within and across communities that support this activity (Okhuysen & Eisenhardt, 2002; Grant, 1996). Grant (1996) points out that there is a dearth

of empirical research exploring these networking processes supporting knowledge integration. In the next section we consider how these micro-social processes are viewed through the lens of social capital.

## The Concept of Social Capital

Effective knowledge integration during an innovation project depends on selecting project team members with an appropriate mix of knowledge, skills, and expertise (Teram, 1999). This will include both organizational and technical/scientific knowledge. This intellectual capital of the team comprises both human and social capital. The human capital of the team refers to the "knowledge and knowing capability of the collectivity" (Nahapiet & Ghoshal, 1998). While important, it is unlikely that team members will have all the relevant knowledge and expertise necessary. Thus, the development of a new drug or a new IT system requires the integration of an extremely broad base of knowledge, but the number of individuals that can be directly involved in the project is necessarily small because of communication and resource constraints (Grant, 1996). So the project team will need to network with others. In doing this they will be drawing upon their collective *social capital*. Social capital is derived from the network of relationships that connect people together and refers to the "goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action" (Adler & Kwon, 2002, p. 17), here to access and integrate knowledge needed for innovation. Social capital would, therefore, appear to be highly relevant in understanding these processes of knowledge integration.

The concept of social capital has become very popular in Management literature, based on the recognition that social networks are useful in a variety of contexts (Coleman, 1988) and can influence a wide range of outcomes (Burt, 1997). Here, we are interested in the ways in which social capital influences knowledge integration during innovation projects. We focus on the antecedent conditions for social capital in such projects (Adler & Kwon, 2002). Thus, networks will vary in their quality and configuration. For example, networks will differ in terms of the extent to which actors' contacts are also connected (Coleman, 1988). They will also differ in the content of the network ties (Uzzi, 1996, 1999), for example the extent to which the connected actors share common knowledge (Nonaka, 1994) and/or beliefs and norms (Portes, 1998). This will influence the development of social relationships and influence the strength of the ties (Granovetter, 1973). As individuals interact with each other, social relationships are built, and goodwill develops (Dore, 1983). This can be drawn upon to gain benefits at some later point in time. While the terms of exchange are not clearly specified,

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