# Chapter 11

## Building Information Systems and Managing Projects

## LEARNING TRACK 4: INFORMATION TECHNOLOGY INVESTMENTS AND PRODUCTIVITY

Information technology now accounts for about 35 to 50 percent of total business capital investment in the United States. Whether this investment has translated into genuine productivity gains remains open to debate, although most of the evidence suggests that the answer is positive. Productivity is a measure of the firm's efficiency in converting inputs to outputs. It refers to the amount of capital and labor required to produce a unit of output. For more than a decade, researchers have been trying to quantify the benefits from information technology investments by analyzing data collected at the economy level, industry level, firm level, and information systems application level. The results of these studies have been mixed and the term productivity paradox was coined to describe such findings.

Information technology has increased productivity in manufacturing, especially the manufacture of information technology products, as well as in retail. Wal-Mart, which dominates U.S. retailing, has experienced increases in both productivity and profitability during the past decade through managerial innovations and powerful supply chain management systems. Competitors, such as Sears, Kmart, and Costco, are trying to emulate these practices. A 2002 study estimated that Wal-Mart's improved productivity alone accounted for more than half of the productivity acceleration in U.S. general merchandise retailing (Johnson, 2002).

However, the extent to which computers have enhanced the productivity of the service sector remains unclear. Some studies show that investment in information technology has not led to any appreciable growth in productivity among office workers. The banking industry, which has been one of the most intensive users of information technology, did not experience any gains in productivity throughout the 1990s (Olazabal, 2002). Corporate downsizings and cost-reduction measures have increased worker efficiency but have not yet led to sustained enhancements signifying genuine productivity gains (Roach, 2003). Cell phones, home fax machines, laptop computers, and information appliances enable highly paid knowledge workers to get more work done by working longer hours and bringing their work home, but these workers are not necessarily getting more work done in a specified unit of time.

Researchers have not made a systematic effort to measure the impact of these devices on unit output or quality of product or service. For instance, university professors who answer their students' e-mail queries within set office hours are clearly communicating with their students more than in the past, and in that sense the service of higher education has improved. Measuring the value of this improvement is a challenge.

The contribution of information technology to productivity in information and knowledge industries may be difficult to measure because of the problems of identifying suitable units of output for information work (Panko, 1991). How do you measure the output of a law office? Should productivity be measured by examining the number of forms completed per employee (a measure of physical unit productivity) or by examining the amount of revenue produced per employee (a measure of financial unit productivity) in an information- and knowledge-intense industry?

Other studies have focused on the value of outputs (essentially revenues), profits, ROI, and stock market capitalization as the ultimate measures of firm efficiency. A number of researchers have found that information technology investments have resulted in increased productivity and better financial performance, including higher stock valuations (Banker, 2001; Brynjolfsson and Hitt, 1999, 1993; Brynjolfsson, Hitt, and Yang, 1999; Chatterjee,

Pacini, and Sambamurthy, 2002; Davamanirajan, Mukhopadhyay, and Kriebel, 2002; Hitt, Wu, and Zhou, 2002).

Information technology investments are more likely to improve firm performance if they were accompanied by complementary investments in new business processes, organizational structures, and organizational learning that could unleash the potential of the new technology. In addition to this organizational and management capital, complementary resources, such as up-to-date IT infrastructures, have been found to make e-commerce investments more effective in improving firm performance (Zhu, 2004; Kraemer and Zhu, 2002). Firms that have built appropriate infrastructures—and view their infrastructures as sets of services providing strategic agility—have faster times to market, higher growth rates, and more sales from new products (Weill and Broadbent, 1998; Weill, Subramani, and Broadbent, 2002).

In addition to reducing costs, computers may increase the quality of products and services for consumers or may create entirely new products and revenue streams. These intangible benefits are difficult to measure and consequently are not addressed by conventional productivity measures. Moreover, because of competition, the value created by computers may primarily flow to customers rather than to the company making the investments (Brynjolfsson, 1996).

For instance, the investment in automatic teller machines (ATMs) by banks has not resulted in higher profitability for any single bank, although the industry as a whole has prospered and consumers enjoy the benefits without paying higher fees. Productivity gains may not necessarily increase firm profitability. Hence, the returns of information technology investments should be analyzed within the competitive context of the firm, the industry, and the specific way in which information technology is being applied.