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Worker Productivity in Operations Management

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Worker Productivity in Operations Management

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ABSTRACT

From Frederick Taylor's study of brick laying manual laborers in the early 20th century, to the multi-year benchmarking of automotive plant productivity as part of the International Motor Vehicle Program, the systematic observation, measurement, and analysis of work has a strong tradition in operations management. Traditional manufacturing provided the setting for much of the early research on worker productivity. However, as we have now seen an inexorable shift towards more service driven economic output, especially in the industrialized economies, the research in operations management on worker productivity has also increasingly focused on services.

This monograph will take stock of the literature in operations management on worker productivity. The research is not exhaustive but is meant to showcase some of the interesting and relevant papers that fall into a few key themes. Mainly, the individual worker is the focal unit of analysis, and the goal is to explore the various operational factors that allow the worker to become more productive. Key areas of emphasis include the behavioral microfoundations of productivity, the effect of peers and workplace dynamics, the design and organization of work, and ways to improve human capital. Although much is known about the drivers of

worker productivity, much remains unexplored. Furthermore, looming changes to the modern workplace call for new ways to think about worker productivity. For example, artificial intelligence, new models of business, and novel workplace arrangements, all have important implications for the design and organization of the modern workplace, and for the roles and responsibilities of the knowledge worker. Collectively, these developments will continue to make worker productivity a rich and exciting area of research.

1

Introduction

Worker productivity is the value created by a worker for each unit of his or her input. Economic theory dictates that workers are paid according to the marginal product of what they produce; consequently, rising standards of living are possible because of improvements in worker productivity (Marshall, 2009). Globally, average wages have been empirically found to be strongly correlated with worker productivity (Freeman and Katz, 2007). The influential business thinker Peter Drucker has claimed that *all* economic and social gains over the last century are attributed to these productivity gains (Drucker, 1999). More recent work has estimated that a one percentage point increase in the growth rate of productivity is associated with between 0.7 and 1 percentage point increase in the growth rate of median and mean worker compensation (Stansbury and Summers, 2017).

For a firm, increasing worker productivity not only allows it to pay its workers more, but also confers a competitive advantage in the marketplace, increased profitability, and greater likelihood of survival. Worker productivity is also a critical component of a nation's gross domestic product (GDP), and high labor productivity endows a nation with competitive advantage in the global marketplace. As such, improving worker

productivity has been fundamental to increasing economic prosperity at the level of the individual, firm, and broader society.

From Frederick Taylor's (1911) study of brick laying manual laborers in the early 20th century, to the multi-year benchmarking of automotive plant productivity as part of the International Motor Vehicle Program (Womack *et al.*, 1990), the systematic observation, measurement, and analysis of work has a strong tradition in operations management. In fact, the term "operation"—can be etymologically traced to the Latin verb *operari* (to work), from the noun *opus* (work); the study of work and productivity is therefore central to the field of operations management.

Traditional manufacturing provided the setting for much of the early research on worker productivity. However, as we have now seen an inexorable shift towards more service driven economic output, especially in the industrialized economies, the research in operations management on worker productivity has also increasingly focused on services. Due to innovations in technology, new models of business, advances in human capital, and improvements in the design and organization of work, worker productivity has experienced a largely steady increase over the last few decades, and now accounts for an ever-growing share of economic output. In the US, worker productivity has steadily increased at the average rate of 3% per year compounded over the last century (Drucker, 1999). For example, Figure 1.1 shows that the output per worker (measured in 2010 dollars) has more than doubled since 1970.

In the last 20 years, significant contributions have been made to the operations management literature on worker productivity. Several factors have led to this growth in interest and research output. First, there is increasing availability of data from the field. Such field data is often the natural byproduct of service or product delivery or collected by human resource systems. For example, sensors connected to patients transmit data in real-time to a doctor's office; retail scanner data allow real-time inventory monitoring; GPS data from Uber drivers provide insights into the behavior of drivers. These data are not only voluminous, but also granular, allowing the researcher to gain deeper insights into the nature of work and the micro-level activities of workers. At the same time, advances in statistical methods have allowed researchers to more rigorously and confidently estimate the underlying productivity.

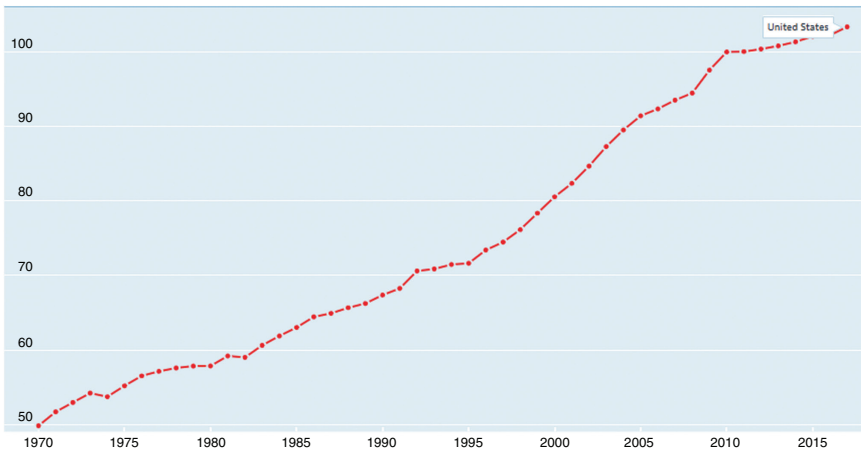


Figure 1.1: GDP per hour worked in US: 1970–2017 (in 2010 dollars).

Source: OECD productivity statistics: GDP per capita and productivity growth.

Second, the research in operations management has drawn on other academic disciplines, including psychology, economics, and sociology. This interdisciplinary work has allowed researchers to develop a richer understanding of the underlying human processes that explain worker productivity. A better understanding of the mechanisms for productivity improvements can in turn inform more effective managerial practice.

Third, there are now the extensive collaborations on the topic of worker productivity between academic researchers and industry practitioners. These partnerships have allowed academic researchers to tackle important and managerially relevant questions, while providing industry practitioners with rigorous academic analysis to help inform their workforce planning decisions.

This is a particularly exciting time for academic research on worker productivity. New models of business, technological advances, novel employee-employer workplace arrangements, and the global interconnected nature of business hold the promise for exciting ways to deploy workers to generate greater productivity, and to challenge the traditional notions of the roles and responsibilities of the worker.

This monograph will take stock of the existing literature in operations management on worker productivity and will outline interesting

and promising areas of future research. In contrast to approaches that involve estimating productivity at the national level (for example, in using labor as an input in total factor productivity), or at the firm level (for example as an input alongside capital in a Cobb-Douglas production function), we will be looking at the individual worker as the atomic unit of analysis in order to examine the drivers that impact worker output. Specifically, we will focus on the operational factors that have been empirically shown to improve the individual worker's productivity. The research is not exhaustive but is meant to showcase some of the interesting and relevant papers that fall into a few key themes explored in this monograph.

The monograph is divided into several sections that logically build on the preceding sections (see Figure 1.2). Section 2 explores the behavioral micro-foundations of worker productivity. This section considers the individual worker as the focal unit of analysis, and building on foundational ideas from economics and psychology, examines the internal forces that drive the worker's output.

Section 3 considers the worker as a peer in the modern workplace. The behavior of workers changes in the presence of peers, and this section explores the social dynamic aspects of competition, shirking, collaboration, and learning in a team environment. Sections 4 and 5 examine the design and organization of work, such as how work is assigned to workers, and how tasks are completed, including topics of task division, sequencing, and early task initiation. Section 6 (Improving Human Capital) looks at how individual workers can learn to become more productive over time. This section discusses the role of technology, worker experiences, and aspects of organizational design and firm-level factors that explain worker productivity growth.

Finally, Section 7 examines interesting areas of future research. Many of the tasks of the future can be classified as knowledge work. The work performed by the modern knowledge workers is distinctive in several key ways. Most notably, knowledge worker is hard to define and often subjective. Tasks that are knowledge-intensive often require a worker to have undergone multiple years of formal education and specialized training; work is increasingly specialized, requiring tasks to be coordinated amongst multiple specialists who are often not co-located; tasks

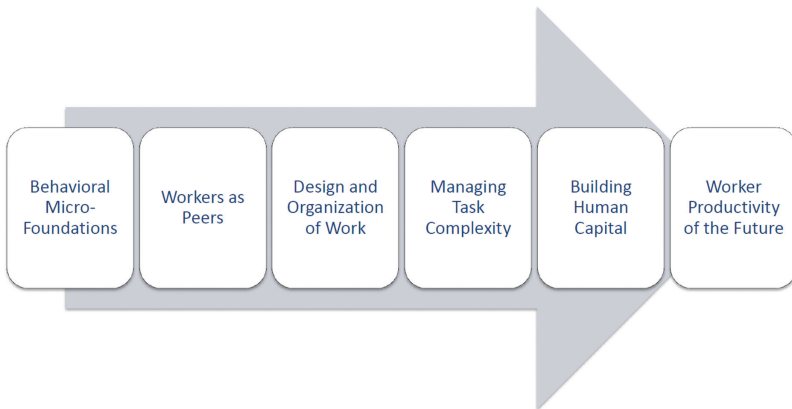


Figure 1.2: Ordering of sections.

have become more complex, and outcomes more nebulous. Examining new ways to understand and quantify the multidimensional output of knowledge workers is a much-needed area of future research. At the same time, artificial intelligence, new models of business, and novel workplace arrangements, have important implications for the design and organization of work, and for the roles and responsibilities of the knowledge worker. Collectively, these developments will continue to make worker productivity a rich and exciting area of research.

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