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IMPACT OF INFORMATION TECHNOLOGY ON TOLL COLLECTION AT THE PENNSYLVANIA TURNPIKE

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ABSTRACT

Measuring and understanding the business value of information technology (IT) is a significant and difficult problem facing researchers. We propose that the impact of IT applications can be best understood through an analysis at the task level. We report on a field research conducted to study the impact of IT on the toll collection system of thirty-eight interchanges at the Pennsylvania Turnpike. The advantages of this setting are clear causal links between information technology and the nature of work, access to data of excellent quality and the ability to isolate relevant factors in the production process. Our results indicate that the new IT at the turnpike had a substantial impact on the efficiency of processing complex transactions but no impact on simple transactions. These results can be explained by examining the nature of the toll collection task and the changes on this task produced by the new IT.

The toll charged for each vehicle is based on its class (determined by the number of axles and the weight of the vehicle) and the distance travelled. The old toll collection system at the turnpike was replaced in July 1987. Unlike the old system, the new system is automatic at entry. The new system also automatically matches entry and exit classifications and calculates the toll, leaving the operator to collect the toll and deal with possible mismatches funds, in classifications. Finally, it is easier to handle exception transactions such as authorized U-turn, insufficient funds, or lost ticket in the new system.

We define passenger cars as simple transactions because they can be classified by sight (without weighing and counting axles), thus eliminating the need for matching entry and exit classifications. All other vehicles (complex transactions) require matching the two classifications and resolving any possible discrepancy.

We measure labor productivity before and after the introduction of the new IT for toll collection. We summarize and explain the results below:

- The new technology reduced indirect labor at the interchange level. We expected indirect labor to decline with the new system due to its improved reliability and flexibility. The new system also makes the scheduling task easier because it does not require entry lanes to be manned.
- The new IT reduced direct labor for complex transactions. Complex transactions get the full benefits of the new system. The automation of the vehicle entry process, matching of entry and exit classifications, and calculation of the toll charge significantly reduce worker effort.
- The new system did not have an impact on simple transactions. The new system improves the processing of simple transactions by automating the vehicle entry process and providing easier methods to deal with exception transactions. However, the advantage of automating the matching of entry and exit classifications does not apply to passenger cars which are not subject to classification problems. Moreover, with the old system, a collector at the exit point could often verbally tell the driver of a passenger car the toll charge because most collectors remembered the toll charge for local interchanges. The new system requires all cards to be read by the machine, which slows down the processing of passenger cars at exit. This effect possibly negates the advantages of the new system for simple transactions.

In future work, we will compare the impact of the technology by assessing the relative productivity of the interchanges using Data Envelopment Analysis. Our goal is to understand the specific factors that facilitate or hinder the utilization of technology in this setting. We will also analyze how the technological change accentuates or attenuates the importance of these factors in the production process at each interchange.