

# DISSERTATION DEFENSE

Erkut Sonmez

## Capacity Management with Technology Considerations

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Capacity and technology management are typically interlaced activities: Technology management commonly involves capacity planning; capacity management often begins with the choice of technology among available options. In this thesis, we study capacity management problems that arise as a result of the development of new technologies, with applications in the banking and energy industries.

We first study capacity sizing and deployment problems in the check clearing house (CCH) of a major commercial bank. Check processing institutions are being forced to downsize their workforce to cut cost and improve efficiency. This is a result of the continued growth of electronic payments, increasing popularity of debit/credit cards, and the growing use of online banking. For check processing institutions, these events are making the decision of how to staff a CCH more urgent. Such decisions involve determining the best tradeoff between efficiency and the expected costs associated with the risks of delayed checks, which include fraud and float costs. We develop a simulation-based optimization model to systematically analyze the nature of this risk/efficiency trade-off at a specific CCH, and determine its optimal staffing. The main insight of this investigation is that effective capacity sizing requires taking into account the *sequence* of processing activities at the CCH.

A fundamental issue in the management of technology innovation is the evaluation of a new technology relative to the incumbent technology. Such an evaluation may occur along dimensions such as cost, installation time, and performance. In the second part of this thesis, we study this issue of technology innovation in the context of the liquefied natural gas (LNG) industry, in which new offshore vessel-based regasification technology has recently been developed as an alternative to conventional onshore terminal-based regasification. Our strategic analysis, based on analytical and simulation models, gives managerial insights into the drivers of LNG regasification technology selection, system capacity sizing, and the relative benefits of alternative configurations of the new technology. We also investigate how these insights may depend on how one models *stochastic variability* in the relevant processing times

In the last part, we propose a simple approximation method to estimate the throughput of a closed queueing network that features a single fork/join station receiving inputs from multi-station subnetworks, motivated by the transshipment based LNG chain studied in the second part.

The research presented in this thesis highlights the importance of detailed modeling of the *operations* in a processing network for strategic capacity and technology related decision.