Uncertainty of scheduling operations in Maritime Transportation Systems

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Abstract
One of the main objectives in the optimization of a supply chain is to reduce uncertainty in order fulfillment time. The Panama Canal is a critical link in many global supply chains (e.g., automotive, agricultural, chemical, and consumer products); therefore, reducing uncertainty in canal transit time can lead to significant improvements in supply chain performance. Currently, the Panama Canal is operating at its maximum capacity with a throughput of 38 to 40 commercial ships per day. A canal expansion project is underway to increase the capacity of the canal and is scheduled to be completed in 2014. The objective of this research is to characterize the uncertainty in canal operations and identify factors that contribute to these uncertainties, so that new technologies can be introduced and real-time operational decisions can be made that will result in significant reductions in the mean and variance of the transit time.

Maritime transportation systems are subject to many elements of uncertainty due to internal and external factors such as, the highly interactive nature of maritime operations, weather conditions, and variability in equipment performance. The summative effect of these uncertainties can produce significant variability in the performance of a maritime transportation system (MTS) such that the outcome can appear to be unpredictable. Certain system elements do not significantly contribute to the overall uncertainty while other elements have a much greater influence on MTS variability. In addition, there can be interaction between elements due to coordinated efforts. The challenge in understanding the contributions of uncertainty is that these effects may be unknown because they can be hidden within subsystems.

In this project, we used an information theoretic approach to quantify the uncertainties of a MTS with a primary goal of improving overall system performance. Understanding the contribution of individual elements to the overall uncertainty is critical to the development of effective scheduling methods for system operation. Our premise is that overall system performance can be improved by addressing external and internal factors that contribute to uncertainty. By using an information theoretic approach, we will be able to categorize contributions of individual elements to the uncertainty of the system and its output.

Biography
Zoila Guerra de Castillo, Ph.D., is a research leader at the Supply Chain and Logistics Research and Innovation Center, UTP and a professor at Universidad Tecnologica de Panama. Her teaching interests include industrial engineering, operations research, management science, and supply chain management. Her research interests include stochastic processes, simulation optimization, and supply chain management. She was a Fulbright Scholar in 2009, received the Senacyt grant for Research in 2009, and received a Fulbright Scholarship for her Ph.D. studies in 2002. She is a member and chairperson of the Panama Roundtable of the Council of Supply Chain Management Professionals, and a member of the Fulbright Alumni Association.