Data Science and Operational Efficiencies

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My professional career since the year 2000 has focused on data driven projects with the objective of optimizing strategies for operational efficiencies. I have used systemic approaches by defining problem domains and boundaries and the inter-relationships of the components. Once the problem is clearly defined and delimited, I have applied technologies ranging from operations research, mathematical optimization, machine learning, probability theory, statistics, etc.

At RTI International, I developed a quantitative framework to aid in decision making for integrated municipal solid waste (MSW) management. The MSW Decision Support Tool (MSW DST) uses a flexible framework to represent many site-specific issues and considerations. It incorporates revenue, cost and environmental objectives. The MSW DST has an optimization module that selects the best group of technology options based on cost or environmental criteria. I developed the mathematical model with a linear programming (LP) formulation solved by CPLEX (now IBM CPLEX). The MSWDST also includes multi-objective optimization capabilities to choose the objective function among competing objective functions such as cost, environmental emissions, energy consumption and recycling levels. Impact: Improved waste management operations resulting in reduced waste management and engineering costs for business operations and municipalities with improved decision making in technology adoption, potential new markets and regulation compliance.

At RTI International, I developed accurate models for electric power load forecasting that are essential to the operation and planning of a utility company. These models help electric utilities make important decisions, including purchasing and generating electric power, load switching, and infrastructure development. I developed methodologies using agent-based model simulations and synthetic populations to create a new electric forecasting paradigm: the forecast of future electricity consumption quantities and geographical locations could be analyzed in concurrent rather than separate models. The “how much,” “when,” and “where” could be simulated and answered at once in one combined simulation. Impact: Improved grid operations resulting in reduced capital and maintenance costs for electric grid planners with load forecasting tools to help make decisions on capital investment, network maintenance, etc.

As a data scientist for MAANA, I worked in multiple operational optimization projects for diverse customers. One of my customers was the Aramco Trading Company (Tradeco), responsible for the trading of Aramco products after domestic demand has been met. They need to identify trade opportunities and arrange shipment schedules that optimize profitability. One of the challenges I had was that, given the number of variables (ship speed/cost calculations, port waiting times, third party leasing prices, tanker capacities, etc.), it was hard to identify a shipping schedule to maximize the shipping fleet utilization. I developed an optimization model using Maana’s Knowledge based model to optimize crude oil deliverable routes. This resulted in preventable operating cost losses due to underutilized ships; potential missed trade opportunities,

where an optimal schedule could have found masked capacity for new trades; and lack of transparency into the "real cost" of incremental trades, as it was impossible to measure shipping cost impact.

With MAANA, I developed an optimization model for Maersk, the Integrated container logistics and supply chain services company. The route planning in Maersk Inland procurement was built on systems that were not integrated; dispatchers spent significant time on manual processes optimizing routing and updating systems; existent routing systems were not optimized on price for carriers available in the system. I developed a model for Maersk to allow the inland procurement representative to input origin and destination for the route and be provided a list of optimized (by price) routing options of intermodal transport for a set of criteria specified by the user. The impact was an optimized logistic solution that provided for example: multiple suggestions for transporting cargo from corridor origin to corridor destination and multiple carrier options based on price per leg on corridor.