Developing Service Operations Strategy for Optimal Delivery of Long-Term Service Agreements Using an Integrated Risk Framework

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ABSTRACT

Long-term service agreements (LTSAs) for the maintenance of capital-intensive products are gaining popularity. Without a thorough understanding of risk exposures and their impact on the service delivery, the providers can be exposed to the possibility of extensive losses and financial ruin, as well as endanger the products' end-consumers. This article develops a rigorous risk assessment and management framework for developing an optimal service operations strategy for the delivery of LTSAs. The framework includes several important sources of risks, such as, engineering reliability, maintenance, service infrastructure, contract definitions, and the financial structure of the service. The goal of LTSA management is to fulfill the service requirements imposed by the contract while minimizing costs and risk exposures during service delivery. The framework utilizes simulation-based optimization to obtain the optimal service strategy and insights for risk management, which can be used to develop a detailed service delivery plan. The single LTSA based framework will also benefit the management of a portfolio of LTSAs.

Keywords: *Optimal Service Strategy, Risk Management, Service Agreements, Service Information Systems, Simulation-Based Optimization*

INTRODUCTION

In today's service oriented economy, providing better services to customers is an essential growth strategy, even for organizations traditionally known to be manufacturers, such as, General Electric (GE) Company, United Technologies Corporation (UTC). A particular service being provided is a service agreement for high-cost, high-tech, long-lived products, such as, aircraft engines, gas turbines, locomotive engines, and medical equipments. These

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agreements, often called long-term service agreements (LTSAs), or variants thereof, are agreements between the provider and a customer that make the provider responsible for guaranteeing the output from a product to the customer over an extended contract period. For instance, GE sells aircraft engines bundled with long-term service agreements to United Airlines, hence sells not only its product but also the 'functionality' of the product. Bound by the contract, GE is obligated to maintain the aircraft engine in order to deliver its required functionality – flight distance traveled, take-offs and landings. Therefore, the physical product, here the aircraft engine, only facilitates the service delivery. The provider fulfills its delivery of service agreement when the product functions at the specified level defined in the contract. United Airlines, on the other hand, takes advantage of the service to improve its flight services to its customers. LTSAs have gained popularity and are provided not only by the product manufacturers but also third party service providers.

LTSAs are arguably beneficial for both customers and providers. Since the customer often has limited knowledge of the product compared to the provider, the customer relieves itself of its maintenance infrastructure and spare part inventories by purchasing LTSAs and transferring the responsibility of maintaining the product over to the provider. The provider capitalizes on the knowledge of its product, thereby generating new revenue streams. Moreover, LTSAs help the provider establish a long-term relationship with its customers, which can help generate future revenues. However, these benefits can be realized only if LTSAs are delivered satisfactorily and effectively.

A key factor for the efficient management of LTSAs is to appropriately allocate the responsibility of various risks into the most suitable hands. Figure 1 presents a normative view for the management of LTSAs. The customer transfers risks of operating and maintaining a product to the provider via purchase of an LTSA. The provider plays the central role in delivering the service, where it develops an effective service operations strategy and a risk management strategy. Risks to which the provider is exposed can be divided into three categories, i.e., strategic risk, operational risk, and extreme-event risk (Gupta, Sondheimer, & Wallace, 2008). Strategic risk relates to long-term decisions and outcomes which crucially affect the service delivery. While strategic risk focuses on long-term decisions, operational risk focuses on tactical decisions which facilitate the day-to-day operations and varies from customer to customer. An extreme-event risk is a risk related to rare events that can have a catastrophic impact on the product and/or its service delivery. Some risks are borne by the provider after appropriately imposing operational constraints on the customer. Some risks beyond the provider's control, e.g., extreme-event risks, are transferred by the provider to a third party (e.g., insurance companies) via purchase of insurance coverage. Risks of future technological changes and changes in government regulations are transferred back to the customer through a renegotiation clause in the contract.

In this paper, we create a quantitative framework for risk analysis and management of the service delivery of LTSAs from the provider's perspective, since the provider plays the central role in defining and delivering the service. The framework includes several important sources of risks, such as, engineering reliability, maintenance, service infrastructure, contract definitions, and the financial structure of the service. The framework focuses on the analysis of the strategic risks of a single LTSA. The provider must thoroughly understand risks relevant to the service process of a single LTSA before a risk management and service strategy for a portfolio/group of LTSAs is developed. Understanding the risk profile of one contract can help take advantage of the interrelation between different risks and manage the risks of a portfolio effectively. A portfolio analysis is also important, since a provider sells many LTSAs to take advantage of economies of scale. Portfolio analysis is, however, beyond the scope of the paper and is left for future exploration.