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Outcome-based contracts – towards concurrently designing products and contracts

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Abstract

Outcome-based contracts that pay for effectiveness and penalize performance shortcomings have been introduced to incentivize cost reduction efforts on the contractor side of product service systems (PSSs). Outcome-based contracting concepts are being used for PSS acquisitions in healthcare, energy, military systems and infrastructure. These contracts allow customers to pay only for the specific outcomes achieved (e.g., availability) rather than the workmanship and materials delivered.

Given the rise in interest in outcome-based contracts, it is incumbent upon the through-life engineering services (TES) community to determine how to design systems (including designing the sustainment of systems) to operate under these contract mechanisms, and to ultimately coordinate the system design with the design of the contract terms. Furthermore, sustainment decisions made under outcome-based contracts must target the optimum action for the population of systems managed under the contract, rather than the optimum action for an individual system. Today, outcome-based contract design is always performed separate from the engineering and TES design processes, and provided as a requirement to the design process, an approach that creates significant risks for all parties. For systems managed under outcome-based contracts, contract failure may mean significant money is spent by the customer (potentially the public) for either no outcome or inadequate outcome, or result in the contractor being driven out of business, which can lead to disaster for both parties.

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1. Introduction

The product-service system (PSS) [1] industry deals with complex systems with stochastic features that have significant influence throughout the life-cycle of the system. These systems are increasingly being provided and managed via outcome-based contracts in which the customer purchases the performance of the product (rather than purchasing the product and/or purchasing specific product support activities). For example, Rolls-Royce introduced power-by-hour for its aircraft engines where maintenance, repair, and overhaul of the engines are all charged per hour of flight; and Michelin charges for truck tires per kilometer driven [2]. For complex safety, mission, and infrastructure systems, when the outcome-based contract becomes a competition between two parties, there is a significant risk that either the customer overpays (and/or does not get the performance they desire) or the contractor is driven out of business - if this is the case, then both sides lose.[1] To

[1] For example, in the case of the SR-125 highway in California, the public-private partnership (which is a form of outcome-based contract) drove the contractor (private sector) into bankruptcy in 2010; subsequently, the non-compete clause of the contract forced the State of California to buy back the toll-way, including its debt, creating a financial disaster for all parties and an unfinished/unusable toll road [3].

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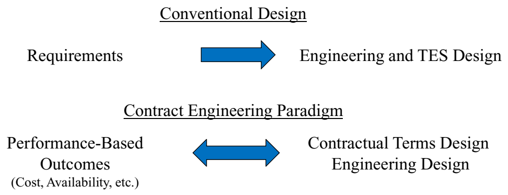

Fig. 1. Contract engineering concept.

design systems that can satisfy these types of outcome-based contracts, a new design paradigm in which engineering and contract design are integrated is needed (Fig. 1).

In a common maintenance contract with a pay-per-replacement/repair agreement, an original equipment manufacturer (OEM) has no incentive to change the system design to make the system more reliable or maintainable. In fact, the service provider might benefit from the system being less reliable. Alternatively, with an outcome-based availability contract mechanism where the customer only pays for the time that the system is operational, both the service provider and the OEM are motivated to improve the system reliability (and maintainability). The service literature has attempted to address the supply chain and inventory design portion of this paradigm shift [4], however, existing approaches are based on the assumption that OEMs are less incentivized than service providers to benefit from the freedom provided by such contracts.[2] By directly involving the OEM, an opportunity is created for engineering design (including but not limited to reliability), to address the contractual terms including outcome-based metrics and payment models.

Section 2 of this paper provides an introduction to outcome-based contracts. In Section 3 we discuss the ways in which engineering (PSS) design interacts with the design of contracts. Finally, Section 4 introduces the concept of contract engineering, which treats engineering, TES and contract design as a system design problem.

2. Outcome-based contracts

Outcome-based logistics (also referred to in the literature as "Performance Contracting" [6], "Availability Contracting", "Contract for Availability" (CfA) [7], "Performance-Based Service Acquisition (PBSA)" [8], "Performance-Based Logistics (PBL)" [9], and "Performance-Based Contracting" [10]) refers to a group of strategies for system support that instead of contracting for goods and services/labor, a contractor delivers performance outcomes as defined by performance metric(s) for a system under contract.[3] The fundamental idea behind outcome-based contracting is reflected in a famous quote from Theodore Levitt [11]: "The customer doesn't want a drilling machine; he wants a hole-in-the-wall." Outcome-based contracts, pay for effectiveness (availability, readiness or other related performance measures) at a fixed rate, penalize performance shortcomings, and/or award gains beyond target goals.

Before providing background on relevant outcome-based contracts, it is useful to clearly distinguish outcome-based contracts from other common contract mechanisms that are applied to the support of products and systems (Table 1). Performance contracts are not warranties [12,13], lease agreements [14] or maintenance contracts [15], which are all break-fix guarantees. Rather these contracts are quantified "satisfaction guaranteed" contracts where "satisfaction" is a combination of outcomes received from the product, usually articulated as a time (e.g., operational availability, readiness), usage measure (e.g., miles), or an energy-based availability.

Table 1. Common mechanisms that are applied to the support of products and systems.

Contract mechanism	Examples	Key Characteristics	Support Provider Commitment
Break-fix guarantee	- Common warranties - Leases - Maintenance contracts	Definition of, or threshold for, failure	Replace or repair on failure
Satisfaction guarantee	- Warranties - Leases	Satisfaction is not quantified	Replace or repair if not satisfied
Outcome guarantee	- Outcome-based contracts (PBL, PPP, and PPA)	Carefully quantified "satisfaction"	Provider has the autonomy to meet required outcomes any way they like

"Outcome-based" contracting originated, because in many cases customers with high availability requirements are interested in buying the availability of a system, instead of actually buying the system itself [16]. In this class of contract, the customer pays for the delivered outcome, instead of paying for specific logistics activities, system reliability managements, or other tasks. Examples of outcome-based contracts include the Availability Transformation: Tornado Aircraft Contract–ATTAC [17]. Outcome-based contracting includes cost penalties that are evaluated for failing to fulfill a specified availability requirement in a defined time frame.

Product Service Systems (PSS) [1,18,19] is a common product management approach that can include elements of performance contracting. PSS provides both the product and its service/support based on the customer's requirements, which could include an availability requirement. Lease contracts [20] are use-oriented PSS where the ownership of the product is usually retained by the service provider. A lease contract may indicate not only the basic product and service provided; but also, other use and operation constraints such as the failure rate threshold. In leasing agreements, the customer has an implicit expectation of a minimum availability, but the availability is generally not quantified contractually.

Public-private partnerships (PPPs) have been used to fund

[2] In some cases, the OEM and the service provider are the same "company", however, even in these cases they are often different "organization" and may operate separately and represent separate profit centers within the company. Note, the contract and mechanism design for PSS presented in [5] clearly separates the two activities and we will also treat them as separate in this paper.

[3] In this paper we will use outcome-based to infer general contracts that may or may not use availability as their key performance measure, and availability-based when the performance measure is actually an availability.