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## A proposal to support the value proposition in Product Oriented Service business model of Product Service Systems

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### Abstract

The product service system offers opportunities for companies by introducing new ways of offering value to the customer. Thus, the value proposition needs to take into account uncertainties and tangible and intangible assets in an integrated way leading to more complex decisions. To address these decisions, the study proposes the application of scenarios with real options considering the most suitable financial performance indicators. This research followed the design research methodology. As a result, the proposal considers three scenarios: optimistic, moderate and pessimistic, each showing three possible real options: to expand, to abandon and to defer the incorporation of the service.

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### 1. Decision making to support the PSS value proposition

The product service system (PSS) offers opportunities for companies interested in gaining a competitive advantage in the current marketplace by the introduction of new ways of dealing with businesses, customers and with the value chain [1]. A PSS can be defined as an innovation strategy, shifting the business focus from merely designing and selling physical products, to designing and selling a system of products and services which are jointly capable of fulfilling specific customers’ needs [2].

There are three types of PSS: in the first category called product-oriented, the business model is geared primarily to the sale of products, the traditional way, including some extra services. In the second category use-oriented, the sale of traditional product still plays a central role, but the business model is not geared by selling products. The ownership of the product remains with the provider and is made available in a different form, like services of renting, sharing or pooling to use the product. In the third category, result oriented, the supplier offers a mix of services. The result is delivered

through a product, while the PSS suppliers maintain its ownership, the customer pays only for the results [3].

In this way, the PSS by considering tangible and intangible assets in an integrated way leads to completely modified requirements towards the service provision process [4]. A service is any act or performance that one party can offer to another that is essentially intangible and does not result in ownership of anything. Its production may or may not be tied to a physical product [5]. Thus, the service part in the PSS concept comprises services that make products available to the consumer (marketing, sales-service, sharing, leasing, etc.) and services that service products in the use and end-of-life stage (maintenance, upgrading, take back, closed loop or safe product disposal) [6].

In any case, the ability to react to changing conditions in the future gains importance as new information arrives all the time and current business environments are characterized by dynamic growth and uncertainties. Hence, the company should be flexible enough to reconsider the decision impacted by additional information in the succeeding stages [7]. The uncertainties are more prevalent at the beginning of the new product service system development process (NPSSD), in the

front end [7,8,9]. However, they also continue to appear during the entire NPSSD [10]. Thus, it is important to manage these uncertainties through the process because each stage entails increasingly investments and resource allocation as the project evolves [10,11, 12].

In order to enable the flexibility in the PSS value proposition, several studies suggest that real options approach addresses the uncertainties [7,11,12,13,14,15,16]. A sound proposal is to combine real options approach with scenarios method. By integrating the two, real options approach and scenarios method, it is possible to seek the best of both and show how they complement each other [12,17,18]. The opportunity to integrate has a significant impact in other organizational processes, for instance, the performance measurement as they both share the perspective of future cash flows. In this way, performance indicators should assist the integration of the real options approach and scenarios method [18].

The real options “are perhaps the most promising area for valuation of intangible assets” and are especially useful in estimating the value of intangible assets [19]. The traditional methods to evaluate intangibles are limited in capturing the value of intangible assets, because ignore the flexibility. However, the option pricing method, one way to apply real options approach, represents a new direction for evaluating intangible [20].

Despite these suggestions, systematic methods and tools from the scientific point of view need to be developed to design PSS. This development requires a holistic solution [4,10]. Such a solution should address the real options approach and scenarios method integration along with performance indicators. So, the research question is *how real options approach and scenarios method can be integrated and, later, be assisted by performance indicators to support the definition of PSS value proposition?* Therefore, this study aims to propose the application of scenarios with real options considering the most suitable financial performance indicators to support the PSS value proposition. This application should take place during the formal assessments, gates, through the NPSSD.

The remaining discussions are structured into four main sections: 0 treats the main concepts; 3 illustrates the research method; 4 describes the proposal and 0 reasons implications of the findings and directions of future research.

## 2. Research background

This section describes the main concepts of: uncertainties, real options approach, financial indicators, scenarios method and performance indicators.

### 2.1. Uncertainties and real options approach

Uncertainty can be defined as the missing and the imprecision of information and knowledge, which consequently jeopardize the forecast of the future [11]. Generally, there are four types of uncertainty that can be

distinguished: market, technological, environmental and resource allocation uncertainty [16][4]. Besides, a great deal of literature has been dedicated to the problem of market uncertainty in the NPSSD of innovative products [12, 17,21].

There may be situations in which uncertainty over future market conditions should prompt a company to delay certain investments. In these situations, the traditional investment evaluation ignores the value of creating options because is built on faulty assumptions that the investment is irreversible and it is a now or never proposition. Thus, the value of waiting for more information is not reflected in the conventional Net Present Value (NPV) [21]. By contrast, real options approach recognizes that managers can kill the project after each incremental investment is made, so it provides to managers options along the way. The argument is that real options approach rather than NPV is the appropriate way to evaluate the worth of a new product project at each gate [11].

The classical definition states that a real option is “the right but not the obligation to take an action at the future” [14,16,22,23]. There are different ways of applying real options approach: Black-Scholes model; binomial lattice valuation; options pricing theory and its variant options thinking [17,22,24]. The Black-Scholes and binomial lattice models require sophisticated data like historical series and complex calculations such as Monte Carlo simulation respectively; however in the NPSSD these data are not available especially regarding innovative products. In contrast, the option pricing and options thinking principles can be used in a more flexible and strategic way to deal with uncertainty. In addition, they two provide the concepts of real options value (ROV) (1) and premium (PR) (2) to assess the worth of options [16]:

$$ROV = (\text{Strategic NPV} - \text{Passive NPV}) \quad (1)$$

$$\text{Premium} = \left( \frac{\text{Investment with the option} -}{\text{Investment without the option}} \right) \quad (2)$$

The ROV characterizes the managerial flexibility which corresponds to the strategic NPV (NPV of the option) decreased of the passive NPV (NPV without the option). The PR, in turn, represents the amount that must be invested to acquire the option [16]. Indeed, flexibility might add to any asset, intangible or not, an “intangible value”, as long as the premium of the real option is lower than the benefits that it should provide [20]. So, at each gate managers are, in effect, buying options on the project by considering these concepts. Moreover, the use of financial indicators is also suggested as they can complement the differentiation of between options [11].

### 2.2. Scenarios method

As mentioned before, scenarios method and real options approach have complementary strengths for managers to make strategic investment decisions under uncertainty [18]. A scenario can be defined as a generally understandable description of a possible situation in the future [25,26].

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