



## Power-based supplier selection in product development projects

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### ABSTRACT

As stronger supplier might exert their power to influence a product development project for their own benefit, business negotiations will be more efficient if the customer has a clear understanding of its power with regards to each of its potential suppliers. This article takes the customer perspective in dealing with supplier selection and proposes a method to estimate the power of a customer versus potential suppliers. Based on an evaluation of their power, potential suppliers are then ranked. This selection procedure is illustrated with an example and evaluated against a case study taken from academic literature.

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### 1. Product development and partner selection

Development and manufacturing of products by a company require the support of a reliable supply chain (SC) (see [18,22]). The quality of collaborations with suppliers can either improve or worsen the performance of the overall project. Well coordinated activities between customer and supplier improve the chances of the project to succeed by potentially decreasing costs, order cycle times, reducing the risk of delivery delay and improving of quality (see [10,11,29,31]). But the dependency generated by necessary collaborations with suppliers can also become a threat for the company's success or production capability, especially if conflicts appear or if suppliers' problems are propagated across the supply chain (see [3]). Building up a supply chain and creating an efficient basis for collaboration are two of the crucial issues for any product development project.

This research is focused on the design and deployment of supply chains and the supplier selection process in particular. Conventional supplier selection methods concentrate on the performance or cost of the suppliers or their products. By contrast this paper research focuses on the relationship between the customer and the supplier through the notion of power and provides a formal method to assess the relative power of the customer and the supplier according to a set of criteria selected as part of the method. A large powerful business can enforce unfavourable conditions on its suppliers, while other businesses

negotiate as equal partners. If a company overestimates or underestimates its power, it could damage its ability to negotiate, the collaboration with the supplier or customer and reduce its own profitability and agility. A customer, who overestimates its power will have challenging discussions with potential suppliers. While a supplier, who overestimates its power, could bid at the wrong conditions or refuse a contract expecting to be able to obtain more positive conditions and loose business. Underestimated power might lead companies to accept uncomfortable concessions. Therefore to reach a fair deal companies need to be aware of their own power and that of their potential suppliers or customers.

To set a context the paper presents in Section 2 a generic model of the supplier selection process, before discussing the literature on selection criteria for suppliers and different theories of power. Section 3 presents the main concepts and the power-based partner selection method using performance metrics as the key to an approximate description of the relative power of actual or potential players in a supply chain and illustrated by a small factious example. In this approach every performance metric or selection criterion is transformed into a power factor, which are aggregated by rules to develop a single power value as explained in Section 4. In Section 5 the approach is applied to a case study extracted from a joint work of Huang and Keskar [20], and the results are compared regarding their value and robustness. Section 6 discusses the role the method can play in a design process. Finally, some conclusions and suggestions for further work end the paper.

### 2. Related work

It is impossible in this paper to cover the whole state of the art of supplier selection, which has been addressed from diverse fields

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such as purchasing or operations management. A review of seminal papers is provided for instance by Benyoucef et al. [5] or Aissaoui et al. [1]. Instead this discussion will focus on the selection of suppliers and in particular the criteria used in the pre-selection or final selection of suppliers and how bargaining power can be measured, conceptualized and used as a high-level selection criterion.

### 2.1. A generic model of the partner selection process

Partners in the supply chains are selected through a sequence of activities. Various models of the process partner selection are proposed in the literature (see for instance [1,12]) covering different steps to follow in order to find out the most adequate partners. For the purpose of this paper these models are synthesized into a 5-phase process, of partner selection as illustrated in Fig. 1, which can lead to the gradual design and deployment of a network of partners. While the phases are shown here in linear order, in practise this process is highly iterative, as some partners are selected earlier than others, some negotiations fall through and emerging requirements and design changes can lead to the need for different or further suppliers late in the overall selection process. However each individual selection of a partner goes through the same steps, even those these might be out of sink in the overall process.

**Phase 1: Identification of the need for collaboration.** The goal of this phase is to identify the needs for collaboration based on approved concepts of the target product or the recognition of the need for a specific supplier input. Main key partners of the firm, especially risk and revenue sharing partners do participate to the definition of needs and concepts. The required external contributions are specified in terms of technical or technological inputs, product modules, tools, knowledge and know-how, and human or technical resources such as specific machines.

**Phase 2: Pre-selection.** During this phase a shortlist of potential suppliers is determined. Potential suppliers able to meet the needs are identified by analyzing the market. Aissaoui et al. [1] discuss some methods for pre-selection.

**Phase 3: Consolidation of the identified needs.** During this third step, first discussions with these pre-selected potential partners lead to a consolidated understanding of the needed external contributions so that the target product specifications can be finalised. During this period, pre-selected suppliers might participate to the definition of technical specifications and even have an input into decision-making about the details of the product architecture without any guarantee of being selected afterwards. This phase, called Plateau Phase is common in the AIRBUS™ supply chain.

**Phase 4: Final partner selection.** The pre-selected partners are then evaluated against certain selection criteria. The selection criteria can be subdivided into two classes: objective or subjective criteria (see [1]). Objective criteria refer to those criteria that do not depend on the observer and that “can be measured by a concrete quantitative

dimension like cost”, whereas the evaluation of subjective criteria could vary between observers. Various selection techniques can be applied for this final selection phase (for instance, optimisation techniques in Refs. [32,17,8] or analytical hierarchy in Refs. [2,21]). Interested readers should refer to Refs. [12,5,1] for a complete survey of significant methods.

**Phase 5: Contract signing.** Finally, contracts negotiations with selected suppliers are opened defining various collaboration parameters and protocols.

The main goal of our research is to empower companies in negotiations with their potential partners by allowing them to assess their bargaining power compared to that of their potential suppliers or customers and find out what their respective strengths and weaknesses are. As stronger partners could exert their power to influence projects for their own benefit, a clearer understanding of their bargaining power could help companies during the supplier selection phase in supply chain deployment to make the right decisions. This paper introduces a supplier ranking technique called *power-based partner selection method*, which employs a performance assessment of partners and transforms it into a representation of power. This technique can be used either in the pre-selection phase or the selection phase (phase 2 or 4). It does not replace existing selection methods; rather it provides a complementary view of the potential relations between a company and its future partners. The results provided by this technique, if used in conjunction with results coming from established selection methods, allow companies to understand better the challenges in obtaining comfortable and realistic conditions in terms of price, delivery delay, quality, etc. during negotiations with potential suppliers.

### 2.2. Selection criteria

The choice of suppliers and service providers is a critical decision, because it has direct impact on the financial health and production capability of the company (see [4]). This impact is potentially even greater if partners contribute to the design (see [26]) and manufacturing of the target product through, for instance providing modules.

Selection criteria have been the subject of a lively on-going discussion in the research community, which will be summarised in Table 1. Dickson [13] conducted a survey based on a questionnaire sent to buyers and supplying directors in the USA and Canada. He collected from this survey 23 criteria and ordered them in 1960s. The highest rated selection criteria in that period were quality and delivery delay. In 1991, Weber et al. [32] classified various selection criteria and found that price, delivery, quality, production capacity and the geographical position of the suppliers were considered as the most important selection criteria, based on 74 articles analysed. The list of selection criteria has been revisited by Barabarasoglu and Yazgac [6]. They structure these criteria in a hierarchy around three categories, which describe the suppliers' characteristics: performance assessment, business structure/manufacturing capability assessment and quality system assessment. Shore and Venkatachalam [27] propose several

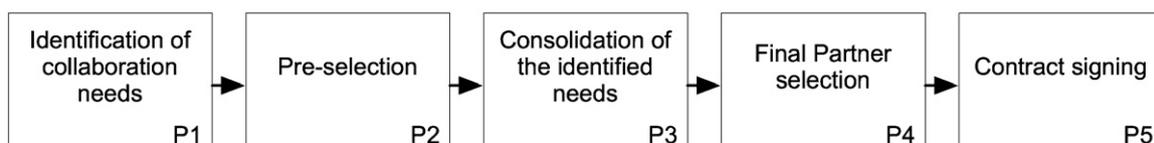


Fig. 1. Partner selection process.

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