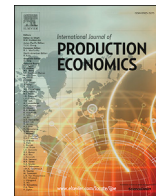


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journal homepage: [www.elsevier.com/locate/ijpe](http://www.elsevier.com/locate/ijpe)Reprint of “Decision support models for supplier development: Systematic literature review and research agenda”<sup>☆</sup>Christoph H. Glock<sup>a,\*</sup>, Eric H. Grosse<sup>a,\*</sup>, Jörg M. Ries<sup>b</sup><sup>a</sup> Institute of Production and Supply Chain Management, Technische Universität Darmstadt, Hochschulstr. 1, 64289, Darmstadt, Germany<sup>b</sup> Cass Business School, City University London, 106 Bunhill Row, London, EC1Y8TZ, UK

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## ABSTRACT

The continuing trend towards sourcing components and semi-finished goods for less vertically integrated manufacturing systems globally leads to a dramatic increase in supply options for companies. To ensure that companies benefit from the potentials global sourcing offers, supplier-buyer relationships need to be managed efficiently. Due to the decreasing share of value-adding activities provided in-house, suppliers are more and more considered as an essential contributor to the buying company's competitive position. Consequently, to realize and sustain competitive advantages, companies try to establish institutionalized long-term relationships to their most important suppliers and to actively improve the productivity and performance of their supplier base. To support supplier development in practice, researchers have developed decision support models that provide assistance in selecting and implementing suitable supplier development activities.

The aim of this paper is to provide a comprehensive and systematic overview of decision support models for supplier development and to develop a research agenda that helps to identify promising areas for future research in this area. First, typical applications for supplier development as well as potential development measures that can be adopted to improve the performance of suppliers are identified. Secondly, a systematic literature review with a focus on decision support models for supplier development is conducted. Based on the analysis of the literature, we define a research agenda that synthesizes key trends and promising research opportunities and thus highlight areas where more decision support models are needed to foster supplier development initiatives in practice.

## 1. Introduction

In the presence of increasing fragmentation and global dispersion of manufacturing, suppliers are considered as an essential contributor to a company's competitive position (Krause et al., 1998; Mol, 2003). Especially in situations with limited substitution opportunities available, or where suppliers contribute components or services that are critical for the buying decision of the final customers, the performance of the suppliers directly influences the competitiveness of a company.

Consequently, whenever a buying company is not satisfied with the performance of its suppliers (e.g., due to low quality, low service levels, insufficient capacity, low innovative strength, or low environmental awareness) or the range of products or services provided, it may decide to develop the suppliers' capabilities (Krause, 1997; Wagner, 2006).

Supplier development may broadly be defined as any effort undertaken to increase the performance of the existing suppliers (Hahn et al., 1990; Watts and Hahn, 1993; Hartley and Choi, 1996; Krause and Ellram, 1997; Krause, 1999), and it might be the preferred option in many cases as compared to vertical integration or supplier switching (Wagner, 2010). Supplier development measures can be short-term oriented (e.g., with the aim of improving supplier delivery times) or have a long-term focus (e.g., with the aim of strategically enhancing the buyer's supply base), and they can have a direct or an indirect character (Wagner and Krause, 2009; Wagner, 2010). In the case of direct measures, the buying firm directly invests resources into a supplier, e.g. for on-site consultation, training programs, temporary personnel transfer, or providing equipment (Sucky and Durst, 2013; Prahinski and Benton, 2004; Wagner, 2006; Bai and Sarkis, 2011; Kumar et al., 2012). In the case of indirect

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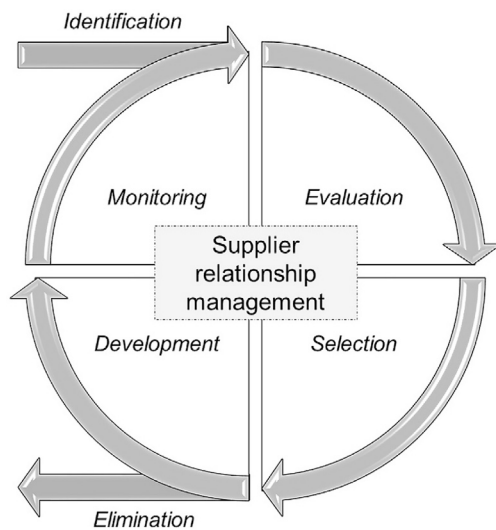


Fig. 1. Supplier relationship management process.

supplier development, the buying firm adopts a passive role, for example by setting performance goals or improvement targets or by offering incentives to the supplier(s) (Wagner, 2006; Wagner and Krause, 2009; Sucky and Durst, 2013). The success of supplier development activities depends on various internal and external factors, such as the capabilities of the supplier, the duration of the customer-supplier relationship, the distribution of power, technological uncertainties, or the organizations' corporate strategies (Bai and Sarkis, 2011; Sucky and Durst, 2013). In addition, successful initiatives also provide long-term benefits for the involved suppliers that continue beyond the project scope (Nagati and Rebolledo, 2013).

Supplier development has attracted increased attention in recent years, with the majority of publications being empirical or conceptual in nature. Examples include case studies on green and environmentally sustainable supplier development (Ağan et al., 2016; Blome et al., 2014), on the impact of supplier development on buyer-supplier performance improvement (Humphreys et al., 2004), or on successful supplier development activities implemented in certain industry cases (Modi and Mabert, 2007). Apart from empirical and conceptual research, researchers have also started to propose mathematical models supporting managers in selecting, implementing and monitoring supplier development activities. We refer to such mathematical models as 'decision support models' in the following. Decision support models for supplier development can give valuable support in practice, for example by identifying suppliers suitable for development or by deriving optimal investment volumes for supplier development activities. As will be shown in this paper, decision support models for supplier development have attracted increased attention in recent years.

At the same time, however, other research areas that belong to the broad domain of 'supplier relationship management', such as supplier selection, supplier evaluation, or the management of supplier-buyer relationship, also witnessed increasing publication numbers, which led to a couple of related literature reviews appearing in these areas in recent years. A closer analysis of these literature reviews, however, reveals that they either focus on empirical and conceptual works, or that their object of analysis are decision support models, albeit not for supplier development. The Appendix provides a structured overview of related literature reviews in the area of supplier management and differentiates the work at hand from existing surveys.

As research on decision support models for supplier development has experienced a strong increase in the number of publications in recent years (see Fig. 4), there is a need for a review that analyses and synthesizes existing works in this area and that highlights potentials for future research. Since no review of decision support models for supplier

development exists so far, the paper at hand conducts a systematic literature review on this topic. The contribution can be summarized as follows:

- The paper presents a comprehensive and structured overview of research on decision support models for supplier development summarizing development measures considered, modeling approaches and application areas;
- The paper synthesizes and categorizes the existing approaches, which helps researchers in positioning their own work in the literature and practitioners in finding suitable decision support for specific supplier development topics;
- The paper identifies promising research gaps and develops an agenda on future research opportunities.

The remainder of the paper is structured as follows: The next section discusses a typical supplier development process and develops a framework with content and modelling categories that are used to classify the literature. Section 3 describes the methodology used for searching the literature. Works that propose decision support models for supplier development are reviewed and discussed in Section 4. Suggestions for future research are discussed in Section 5 based on the results of the literature review. The paper concludes with Section 6.

## 2. Conceptual framework

To ensure a methodologically rigorous evaluation of the literature retrieved in our systematic review (see also Melnyk et al., 2009; Cooper, 2010), this section introduces a conceptual framework that will later be used for classifying and discussing the literature sample. The conceptual framework considers two dimensions of decision support models for supplier development. The first dimension systematizes the attributes of the supplier development approach (such as the objective of supplier development or the supplier development measure that is implemented, for example), while the second dimension focuses on technical properties of the proposed decision support model (such as model type and solution approach, for example). The framework was first developed deductively based on conceptual works on supplier development (e.g., Hahn et al., 1990; Krause et al., 1998; Sucky and Durst, 2013) and quantitative modelling frameworks in operations management (e.g., Sasikumar and Kannan, 2009; Brandenburg et al. 2014; Zimmer et al., 2016), and then inductively refined during the coding process after evaluating the results of the systematic literature search (see also Hochrein et al. (2015) for a more detailed description of deductive and inductive content category building). Both dimensions of the framework are discussed in the following.

### 2.1. Content categories

Supplier relationship management (SRM) is concerned with strategically planning and managing all interactions between a buying company and its suppliers. SRM encompasses various activities, such as the identification of suitable suppliers and their selection, the evaluation and development of suppliers, as well as a continuous monitoring of the suppliers' performance. These and other activities need to be addressed comprehensively in the buying company's purchasing strategy, with the result being a cyclic integrated SRM process that is illustrated in Fig. 1. Even though SRM has started to attract attention in the literature many years ago, researchers have just recently started to investigate the different dimensions of SRM from an integrated perspective (cf. Park et al., 2010). According to the integrated SRM process illustrated in Fig. 1, SRM starts with the identification of potential suppliers, followed by a systematic evaluation and selection process. Suppliers that do not meet the required performance targets either need to be developed or replaced. All investments into the supplier base should be monitored to keep track of their costs and performance impact. After the suppliers have

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