

# Assessing Buyer-Supplier Relationship Management: Multiple Case-Study in the Dutch Construction Industry

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**Abstract:** The objective of this paper is to shed light on obstacles to, and opportunities for, increasing the effectiveness of construction firms in managing buyer-supplier relationships. More specifically, the focus is on assessing the maturity level of buyer-supplier relationship management by construction firms. First, on the basis of a literature review and discussions with industry experts, five constructs were defined and, on the basis of these constructs, a measurement tool was developed. Following this, the maturity level in terms of the five constructs was assessed by applying the measurement tool in 19 Dutch construction firms. The results demonstrate a large potential for improved management of buyer-supplier relationships. Although there are major factors impeding, there are, at the same time, developments stimulating the effectiveness of managing buyer-supplier relationships. A useful next research step would be to determine the optimum portfolio of relationship types between contractors and suppliers in the construction industry. DOI: [10.1061/\(ASCE\)CO.1943-7862.0000418](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000418). © 2012 American Society of Civil Engineers.

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## Introduction

Most construction companies operate in a decentralised network of suppliers and customers in which they acquire production capacity from external suppliers. Construction projects can be viewed as temporary organisations among firms. The development and management of long-term buyer-supplier relationships at the cross-project-level is therefore difficult, as project teams and product designs change from project to project. Many researchers have expressed dissatisfaction with the temporary nature of these buyer-supplier relationships (Briscoe and Dainty 2005; Egan 1998; Voordijk et al. 2000; Vrijhoef and Koskela 2000). Although contractors spent up to 90% of the project turnover on buying goods or services (Hinze and Tracey 1994; Nobbs 1993; Vrijhoef and Koskela 2000), they do not take full advantage of opportunities to make use of external resources through buyer-supplier cooperation (Dubois and Gadde 2000).

Various types of buyer-supplier strategies are recognized in manufacturing, but their applicability in the construction industry is less well understood (Barlow and Ozaki 2003, 2005; Barlow et al. 2003). Furthermore, as Dainty et al. (2001) noted, the focus in the

construction industry has been on the client-contractor relationship rather than the contractor-supplier one (e.g., Bresnen and Marshall 2000; Eriksson and Laan 2007; Kadefors et al. 2007). Exceptions to this trend are the studies by Kamann et al. (2006) and Eom et al. (2008), which did focus on the contractor-subcontractor relationship. Kamann et al. (2006) focussed on problems in buyer-supplier relationships and the effects of having a shared past or future. Eom et al. (2008) presented a framework for subcontractor evaluation and management to develop closer relationships with subcontractors. The research reported in this paper similarly focuses on the relatively less researched relationship between contractors and their suppliers.

The objective of this paper is to shed light on obstacles to, and opportunities for, increasing the effectiveness of construction firms in managing buyer-supplier relationships. More specifically, the focus is on assessing the maturity level of buyer-supplier relationship management by construction firms. Following Rozemeijer et al. (2003) and Schiele (2007), maturity is defined in this paper as the level of professionalism. The next section contains a literature review discussing conditions to improve the management of buyer-supplier relationships. Second, a methodological justification and an empirical research design are provided. Third, the management of buyer-supplier relationships in the construction industry is assessed in 19 in-depth case studies of Dutch construction firms. The results of the case studies are discussed in a subsequent section. The paper ends with conclusions and managerial implications.

## Literature Review

The issue of managing buyer-supplier relationships has attracted a growing body of academic research in recent decades (Terpend et al. 2008). This increased attention reflects the growing awareness of the link between the effective management of such relationships and firm performance. Various aspects are important in determining the effectiveness of buyer-supplier relationship management. First, it is crucial for a buying company to optimize its supply base in terms of both the number and the quality of its suppliers. Second,

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attention should be given to activities related to managing a buying company's portfolio of suppliers. Third, buying companies need to decide to what extent suppliers have to be integrated into their own processes. This integration aspect can be split into two distinct parts: operational processes and value creation. Finally, effective buyer-supplier relationship management requires attention to be given to developing suppliers, on the basis of an ongoing monitoring of their performance.

In this section, a literature review on these five aspects of managing buyer-supplier relationships is presented and for each a construct is defined. Following this, attention is paid to the effect of a distinctive feature of the construction industry—project-based working—on the management of buyer-supplier relationships.

### **Optimize Supply Base**

Effective and efficient management of buyer-supplier relationships starts with determining the number and most suitable suppliers for the company, i.e., the optimization of the supply base. Monczka et al. (1993) discuss several strategies to improve the supply base, such as setting higher performance expectations and direct supplier development. As a prerequisite to pursue supply base improvements the results of the existing purchasing processes and strategies have to be measured. According to Cousins (1999), extensive supply base reduction strategies have been witnessed in a wide range of firms in various sectors. Many of these companies have claimed they had to reduce the size of their supplier bases to become more competitive and flexible, and to reduce costs. Companies need a systematic approach to realize these goals, and several frameworks have contributed significantly to an effective and efficient optimization of the supply base, for example the portfolio models presented by Kraljic (1983), Krapfel et al. (1991), and Bensaou (1999). The Kraljic model is a product-oriented model, whereas the models of Krapfel et al. and Bensaou are relationship-oriented. In the Kraljic model, purchased items can be classified into four different categories: strategic, bottleneck, leverage, and noncritical items. Each of these categories require a different purchasing strategy. Gelderman and Semeijn (2006) argue that the Kraljic model is not only useful for developing effective purchasing strategies, but also for managing a supply base. In using this product-oriented model, the company applies a one-sided buyer perspective for the development of the purchasing strategies and managing the supply base. The relationship-oriented models apply a two-sided perspective in which the position of the own company in the client-portfolio of the supplier also is taken into account.

In this study, “optimize supply base” is defined as a process to determine the correct number and most suitable suppliers for a company. This includes ensuring that the supply base is kept up-to-date. Ideally, the optimization of the supply base would be driven by product group strategies. In addition to paying attention to the number of suppliers, it is important to focus on the policy of the company regarding the supply base. For instance, a company can have a policy to use only regional suppliers, or can demand certain certifications from suppliers.

### **Manage Supplier Relationships**

Zolkiewski and Turnbull (2002) concluded that adopting a portfolio approach may be a key factor in successful relationship management. A portfolio approach provides a framework for relationship management at both the strategic and the tactical levels. On the basis of a portfolio approach, relationships with strategic suppliers can be developed, managed, and optimized. The portfolio approach enables managers to invest their resources in the most efficient and effective way, by focussing on a customer-orientation

rather than a product-orientation (Zolkiewski and Turnbull 2002). In the context of the project environment found in the construction industry, buyer-supplier relationships are often characterized as a typical market-exchange relationship. Bensaou (1999) defines such relationships as ones in which “information exchange between two firms takes place mainly during bidding and contract negotiations.” The normal systems of tender-based procurement, and the project-organization of most construction work, naturally leads to arms-length relationships, even if the firms repeatedly encounter their counterparts in various construction projects over time. Price remains the most important selection criterion for contractors (Hartmann et al. 2009). For certain construction products and services, however, arms-length transactions could be replaced by more collaborative relationships. A first development for a supplier to a more collaborative relationship is becoming a preferred supplier of the buyer. In this relationship type, annual agreements are formed and the supplier becomes more involved in the quality control process (Van Weele 2009). The most collaborative relationship is a partnership. Li et al. (2000) presented a literature review on partnering in the construction industry, and refer to the Construction Industry Institute's (CII) definition of partnering as the most comprehensive one: “A long-term commitment by two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost-effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services” (CIIA 1996). Storey et al. (2005) argue there are several organizational factors that impede the development of such collaborative relationships: a lack of commitment, diverging corporate strategies and priorities, and differences in levels of trust and commitment at the operational and strategic levels in the organization. Barratt (2004) also mentions lack of trust as one of the key inhibitors of collaborative planning in supply chains. Furthermore, Lee et al. (2009) argue that forming and sustaining long-term and close relationships can be time-consuming and cost-intensive. When realized, collaborative relationships like partnering can lead to improved risk management and total quality management (Tang et al. 2006). Collaborative relationships often start by integrating suppliers into one's own operational processes, later to be followed by their integration into the value-creation process.

In this study, “manage supplier relationships” is defined as the process of managing and optimizing the relationship with strategic suppliers. It is necessary to classify suppliers into various categories (e.g., supplier, preferred supplier, comaker, or partner) to focus attention on the most important suppliers, to set the correct priorities, and to manage all suppliers according to their importance to the business. Successful relationships with strategic suppliers require very high levels of coordination, trust, information sharing, creativity, and senior management support to fully exploit joint opportunities.

### **Integrate Suppliers into the Operational Process**

The integration of suppliers into the operational process involves strategies and activities which help simplify, standardize, and synchronize the operational processes of the company. Evans and Jukes (2000) suggest that synchronization can be achieved through the following four key steps: process standardization, knowledge sharing, alignment of existing practices, and continuous elimination of waste within joint development cycles. They highlight

the importance of joint team-working and multicompany involvement within the alignment process. To achieve effective planning and delivery of a project, the expertise and knowledge of suppliers should be integrated. The case studies described by Khalfan et al. (2008) demonstrate that such integration efforts can yield both cost savings and enhanced relationship-building opportunities.

In this study, “integrate suppliers into the operational process” is defined as the set of strategies and activities directed at simplification, standardization, and synchronization with the operational processes of the company. The goals include increasing speed, support, service, and client satisfaction, reducing logistical costs, and improving asset utilization/cash flow, the speed of cash flows, and cross-enterprise relationships, decision-making and communication.

### ***Integrate Suppliers into the Value-Creation Process***

Involving suppliers in the value-creation process of a buying firm can be a profitable option, but one that is difficult to achieve in practice. Vonderembse and Tracey (1999) found a positive correlation between the dimensions of both supplier involvement and supplier performance and manufacturing performance. Further, they concluded that involving suppliers has a positive effect on the buyer’s performance. Similarly, McGinnis and Vallopra (1999) argued that purchasing and supplier involvement can contribute to process development/improvement, especially in manufacturing industries. Earlier research by Clark (1989) showed that, in the engineering phase of a development project, intensive supplier involvement creates advantages in terms of lead times and costs. Utilization of suppliers’ knowledge can be maximized in developing new products, processes or services. However, a problem with this in the construction industry is that suppliers tend not to get involved in component design and usually manufacture to a buyer’s specifications (Bensaou 1999). Dubois and Gadde (2000) argued that the lack of ongoing relationships between firms is the main reason for the construction industry’s failure to increase efficiency and innovation. It has been argued that, for certain products and services in the construction industry, arms-length transactions could be replaced by relationship and network-oriented approaches; approaches that stimulate adaptation and joint development between buyers and suppliers (Dubois and Gadde 2002; Storer et al. 2003). According to Eriksson et al. (2007), actors in construction projects should adopt a long-term perspective and actively work to establish an innovation-friendly climate to increase subcontractor contributions to innovation and value creation. These observations point toward the importance of supplier development, another important aspect of buyer-supplier relationship management.

In this study, “integrate suppliers into the value-creation process” is defined as using the knowledge of suppliers to develop new products, process or services that are aimed at maximizing the performance of one’s own company (in terms of costs, time, and quality). Integration of suppliers into the value-creation process (VCP) is probably the most profitable process in the long-term, but also difficult to achieve in practice. If suppliers are repetitively integrated in various of these development projects, learning effects occur which smooth the value-creation process.

### ***Develop Suppliers***

Supplier development focuses on identifying opportunities for improvement, and then facilitating performance improvements at suppliers. Monczka et al. (1993) argue that there are significant opportunities to accelerate the development of supplier capabilities and performance. Krause and Ellram (1997, p. 21) offered the

following definition of supplier development: “Supplier development is defined as any effort of a buying firm with its supplier to increase the performance and/or capabilities of the supplier and meet the buying firm’s supply needs.” In their research, they see the following elements as critical to the success of supplier development: effective communication, top management involvement, cross-functional buying firm teams, price versus the total cost of ownership, long-term perspective, large percentage of supplier’s annual sales, supplier evaluation, and supplier recognition. Modi and Mabert (2007) also note the importance of inter-organizational communication. Their research on the development of suppliers showed that evaluation and certification efforts are the most important prerequisites before undertaking operational knowledge transfer activities such as site visits and supplier training.

In this study, “develop suppliers” is defined as identifying possibilities for ongoing performance improvements. In particular, attention is paid to facilitating performance improvements at suppliers.

### ***Project-Based Working in the Construction Industry***

Cox and Thompson (1997) have argued that models developed for manufacturing industries (such as automotive and electronics), in which production takes place within controlled factory environments, are often of limited use in the construction industry. In manufacturing industries, the supply of goods is merely a repeat process in the form of a production line, whereas in construction most work is organized as projects. A project can be viewed as a temporary network of parties that disperses after finishing a project. However, to a firm, these fixed-term projects are part of a more-or-less permanent network of firms that provide people, equipment, and other resources to each other (Dubois and Gadde 2000). Each construction firm can be modeled as a layered structure made up of project, regional, business unit, and corporate levels. When attempting to measure different aspects of the maturity of construction firms in managing the buyer-supplier relationships, a tool is needed that recognizes the relevance of this layered structure as a contextual factor.

### ***Empirical Research Design***

For this paper, empirical research on current buyer-supplier relationship management practices has been conducted in the Dutch construction industry. This exploratory empirical research consists of a multiple case-study of 19 Dutch construction firms active in civil and utility building or in infrastructure. The empirical research design involved two stages. In the first stage, maturity levels were defined for each construct presented in the previous section and, on the basis of these constructs and maturity levels, a measurement tool was developed. In the second stage, the maturity level in 19 Dutch construction firms, in terms of these five constructs, was assessed by applying the measurement tool.

The first stage of the research was carried out by a team consisting of the researchers of this study and industry experts [a consultant and two Chief Purchasing Officers (CPOs) of large Dutch construction firms]. The basis for the discussions within the team was the Michigan State University (MSU) model (Axelsson et al. 2005; Faber et al. 2007; Hoffmann et al. 2008), an existing industry auditing tool (in which 10 levels of maturity are distinguished) often used by the Dutch Purchasing Association. In interactive sessions, the various subjects and criteria of the auditing tool and other aspects raised in the literature were assessed for their suitability for the project-based



construction industry. The end product of the team's work was a measurement tool on the basis of the five constructs described in the literature section above. For each of these five constructs, maturity levels were described and assessment criteria developed by the team (a detailed description of the 10 maturity levels for each construct can be found in the appendix). These maturity levels and assessment criteria served as a basis in the development of a measurement tool. In the interactive sessions, the researchers presented the constructs and corresponding subjects of the auditing tool to the industry experts. After an open discussion, the industry experts individually provided their comments to the researchers. The researchers analyzed all comments and drafted the maturity levels and assessment criteria per construct. In the next session, these were presented to the experts and the whole process of discussing, commenting, and revising was repeated until consensus was reached. As a further check, the five constructs (and defined maturity levels) and the measurement tool were evaluated by a new group of industry experts consisting of 15 CPOs of Dutch construction companies. On the basis of this evaluation, refinements were made to the constructs and the tool. By involving industry experts, specific characteristics of the construction industry were included. The main characteristic to take into account was the project-based, temporary network nature of the construction industry as described in the previous section.

In the following subsection, the measurement tool is described. In the final subsection, data collection and characteristics of the 19 case companies are presented.

### Measurement Tool

On the basis of the defined constructs and associated maturity levels (see appendix), a measurement tool has been developed to assess the maturity level of a contractors' current management of buyer-supplier relationships. For each construct, a result matrix was created to assess all the criteria and to present the results in a clear way. The horizontal axis of this matrix shows the maturity levels; the vertical axis, the general aspects of the maturity levels. These general aspects are distilled from the constructs and associated maturity levels. For example, the subject of supplier selection is part of maturity levels 1, 2, 4, and 8 of the "optimize supply base" construct.

In the construction industry, much work is done on a project basis, so many processes and procedures in a company are adjusted to this project-based way of working. As such, many activities take place on different levels as discussed previously. To capture this specific contextual factor, stratification is applied in attributing maturity levels to the five constructs as follows:

- Project-level: maturity levels 1, 2, and 3;
- Regional level: maturity levels 4, 5, and 6;
- Business unit (division) level: maturity levels 7 and 8; and
- Corporate level: maturity levels 9 and 10.

Some exceptions had to be made when the construct demanded certain criteria on lower levels of maturity (e.g., maturity level 5) to contain corporate criteria. The following example helps to explain this stratification. On the three lowest levels, the purchasing is carried out by a project purchaser and decisions are on the basis of project strategies. On levels 4 to 6, multiple project purchasers in a region cooperate and, for instance, jointly purchase certain product groups. Decisions are on the basis of regional strategies, and there are regional systems for knowledge sharing. On levels 7 and 8, purchasing also is carried out at the divisional level with multiple regions working together. Divisional policies are leading in the decision-making process and systems are in place to share knowledge on a divisional level. On the highest levels, purchasing

is arranged for the whole corporation. This does not indicate that all product groups have to be centrally purchased, but that a corporate purchasing policy is in place to provide a framework for purchasing activities and decision-making at all levels. Furthermore, corporate systems are in place to facilitate knowledge sharing. For smaller construction companies there is less stratification, but the requirements for each level still have to be satisfied.

The measurement tool uses the strict step principal when determining the maturity level for each construct, i.e., all criteria for a certain level have to be satisfied before the criteria of the next maturity level are considered. A company scores a maturity level of 3 for a construct when not all aspects of level 4 are met (whereas all the aspects of the first three levels are met), even if all the criteria at levels 5 and 6 also were met. However, if, in this situation, the company took the required actions to satisfy the criteria of level 4, it would automatically rise to level 6 for that construct. This strict step principle indicates that a company will be given a maturity level of 0 if one or more of the level 1 maturity criteria are not met.

The working of the result matrix is illustrated with the matrices as presented in the Results section. In the matrix, a cell in which a percentage is presented indicates that, related to the aspect considered on that maturity level, a specific criterion has to be met. A hatched cell indicates that there is no criterion at that maturity level. If the criterion for an aspect of a maturity level is met, then the cell is colored black, if not it becomes white. Hence, following an assessment, all the nonhatched cells have turned either black or white, and the resulting matrix shows which maturity level has been reached. Moreover, the white cells indicate room for potential improvement at the assessed company.

### Data Collection at the Case Companies

In the second stage of the research, maturity levels for the five constructs were assessed by applying the measurement tool in 19 Dutch construction firms. This multiple-case approach was chosen for two main reasons. First, the importance of studying the management of buyer-supplier relationships in a real-life context, and by using multiple sources of evidence (Yin 2009). The second reason is on the basis of the structure of the Dutch construction industry. There is a great diversity of companies active in this industry, and companies with different sizes and business focus were selected, although their accessibility and willingness to cooperate also played a major part in the selection process. The Dutch construction industry has two main subsectors, the civil and utility building subsector and the infrastructure subsector, and companies from both subsectors were included. The selected companies also differed in size, with both small-to-medium enterprises (SMEs) and large companies involved. In Table 1, an overview of the case companies on the basis of these characteristics is provided. A company is regarded as an SME if a maximum of 100 or less full-time employees (FTE) are working for the company. This number also was used by Dutch Purchasing Association in their research in different industries in the Netherlands. The work

**Table 1.** Overview Case Companies

Case companies	Civil and utility building		Total
	Infrastructure		
Large companies	6	5	11
Small and medium size companies	2	6	8
Total	8	11	19

portfolio of companies active in the civil and utility building subsector consist primarily of residential housing and office building projects. Companies active in the infrastructure subsector primarily focus on road construction projects. Suppliers of the case companies are subcontractors, material suppliers, and service suppliers.

Each assessment took place as follows. First, the case company would provide documentation for the researchers to review that offered insights into their daily routines and strategies (related to the identified constructs). The documentation included internal reports such as minutes of meetings and memos, company policies, annual reports, and internal process descriptions. After reading all this documentation, one or more researchers would visit the company and interview four or five representatives by using the developed measurement tool as a reference. The following functions within the company were targeted in identifying representatives:

- Responsibility for purchasing (manager of the purchasing department/CPO),
- Their superior (usually a board member),
- Controller (person who oversees all relevant company procedures), and
- Internal customer of purchasing (usually project managers).

These functions were chosen to enable assessment of the maturity levels by using multiple sources. In the interviews, recorded for future reference, the interviewer essentially followed the questions derived from the measurement tool. To assess the maturity level of the different constructs related to the purchasing function, the interview format was partly open-ended, allowing the interviewer to explore areas that came to light during the course of the discussion. When required, the researchers would ask the interviewees to provide additional documentation to support the given answers. Following the set of interviews, data analysis was performed in three steps. First, after the visit, the researcher prepared a case report on the company. Second, to achieve construct validity, these draft reports were submitted to the respondents for verification. After the verification and integration of comments, the final case report was written. Finally, when all 19 assessments were completed, the overall results were analyzed. These results are presented in the next section.

## Results

In this section, the results of the multiple-case study are presented. Table 2 summarizes the lowest, highest, and average maturity levels for each construct obtained from the 19 case companies. The data from the 19 assessments show that there is a large potential for improvement in the Dutch construction industry. The average maturity level for the various constructs varies between 0.8 and 3.6 on a scale of 0 to 10. Moreover, looking at the spread between the lowest and highest maturity levels, it can be concluded that there are plenty of possibilities for benchmarking within the Dutch construction industry.

The percentages of companies achieving each maturity level for each construct are presented in Table 3. These results clearly show that the vast majority of companies have maturity levels which fit within the project-level classification (i.e., maturity levels 1–3). Some companies have reached maturity levels that belong to the regional classification (maturity levels 4 and 5), but only one company obtained, and then only for two constructs, a maturity level belonging to the business unit classification (maturity levels 7 and 8). None of the companies achieved corporate level classifications (maturity levels 9 and 10). The detailed results for each

**Table 2.** Overall Results

Overall results	Lowest maturity level	Average maturity level	Highest maturity level
Optimize supply base	1.0	3.6	8.0
Manage supplier relationships	0.0	1.2	5.0
Integrate suppliers into the operational process	1.0	2.8	5.0
Integrate suppliers into the value-creation process	0.0	0.8	8.0
Develop suppliers	1.0	2.5	5.0

construct are presented in next subsections, including an overall result matrix (as described in the previous section) per construct. These result matrices show the percentages of companies per construct that have met a specific criterion (see Tables 4–8). Table 3 presents the percentage of construction companies that have reached a certain maturity level per construct; these percentages are explained by analyzing the detailed results per construct presented in Tables 4–8.

### *Optimize Supply Base*

The analysis reveals that 89% of the case companies reached maturity level 3 (see Table 3, Optimize supply base) in terms of this construct. At this level, companies use a basic supplier rating system; for this rating system, they measure at least the quality and the delivery performance of key suppliers. Further, there is multidisciplinary cooperation within a project over the selection and contracting of suppliers. Only about 37% of the case companies had reached maturity level 4 (see Table 3, Optimize supply base). One reason for this sharp decline from 89% at level 3 to 37% at level 4 in Table 3 is that only 58% of the case companies have a formal and documented supplier selection process in place that is focused on the current needs and capabilities of the company (see Table 4, Supplier selection—level 4). A second reason is that only 42% of the case companies have a supply base optimization plan on the basis of the supplier rating system (see Table 4, Optimizing supplier base—level 4).

The communication aspect provided a remarkable result. Although 79% of the case companies communicated internally about suppliers and their performance, only 11% of the companies communicated regularly with suppliers in meetings to discuss improvements (see Table 4, Communication—level 6 and 7, respectively). Looking at the results on the documentation aspect, 58% of the companies have documented evidence of analyses of their supplier base using purchasing models, but only 21% of the companies have documented evidence of adopting differentiated strategies toward the suppliers on the basis of these analyses (see Table 4, Documentation—level 5 and 6, respectively).

As shown in Table 3, there are a few notable exceptions in which construction companies did reach a more mature level. A closer analysis shows that these high performers have an optimization plan and also structurally pay attention to supply market research. These companies also carry out regular assessments at their key suppliers to clearly understand and communicate current and future capabilities of their suppliers.

**Table 3.** Obtained Maturity Levels for the Five Constructs

Obtained maturity levels	Maturity level (%)									
	1	2	3	4	5	6	7	8	9	10
Construct										
Optimize supply base	100	95	89	37	21	11	5	5	0	0
Manage supplier relationships	42	42	26	5	5	0	0	0	0	0
Integrate suppliers into the operational process	100	84	53	26	21	0	0	0	0	0
Integrate suppliers into the value-creation process	42	5	5	5	5	5	5	5	0	0
Develop suppliers	100	53	53	32	11	0	0	0	0	0

**Table 4.** Result Matrix “Optimize Supply Base”

Optimize supply base	Maturity level (%)									
	1	2	3	4	5	6	7	8	9	10
Aspects										
Supplier selection	100	100	—	58	—	—	—	11	—	—
Supplier rating system	100	—	95	79	53	26	—	37	—	11
Team arrangement	—	—	100	—	—	63	—	—	—	—
Needs of the company	—	—	—	—	—	—	—	74	42	—
Supplier market research	—	100	—	—	—	37	—	—	0	—
Supplier differentiation	100	—	—	—	84	53	32	—	—	16
Optimizing supplier base	100	95	—	42	—	37	16	16	—	—
Differentiated policy	—	100	—	—	—	42	—	—	—	—
Documentation	—	100	—	—	58	21	21	—	0	—
Communication	—	—	89	—	—	79	11	—	—	—

**Table 5.** Result Matrix “Manage Supplier Relationships”

Manage supplier relationships	Maturity level (%)									
	1	2	3	4	5	6	7	8	9	10
Aspects										
Purchasing policy	42	—	—	—	—	—	—	—	—	—
Assessment process	100	—	—	32	—	—	—	16	11	—
Documentation	95	—	42	21	—	—	—	—	11	—
Cooperation with supplier	—	74	—	74	68	26	16	16	16	0
Improvement programs	—	—	—	—	—	47	—	16	0	—
Communication	—	95	—	68	—	—	—	—	—	0

**Table 6.** Result Matrix “Integrate Suppliers into the Operational Process”

Integrate suppliers into the operational process	Maturity level (%)									
	1	2	3	4	5	6	7	8	9	10
Aspects										
Supplier integration	—	100	84	—	53	—	—	—	—	—
Multidisciplinary cooperation	—	—	—	84	—	26	—	11	5	—
Communication	—	—	63	47	—	—	37	16	—	0
Documentation	—	—	53	—	—	—	16	37	0	—
Planning process	—	100	100	95	—	47	—	5	16	—
Improvement plan	—	—	58	—	74	16	—	—	5	0
Evaluation process	—	—	—	—	—	47	—	—	—	0

### **Manage Supplier Relationships**

For this construct, the majority of the companies do not meet all the criteria set for maturity level 1 and thus obtain a level 0 ranking.

Only 42% met all the criteria for the first maturity level, and all these companies also satisfied the level 2 criteria (see Table 3, Manage supplier relationships). Level 1 first requires a company to have a formal process in place to identify the criteria and

**Table 7.** Result Matrix “Integrate Suppliers into the Value-Creation Process”

Integrate suppliers into the value-creation process Aspects	Maturity level (%)									
	1	2	3	4	5	6	7	8	9	10
Value-creation process policy	100	5	—	—	—	—	—	42	—	—
Involvement of purchasing	42	58	—	—	—	—	—	—	—	—
Supplier selection	—	—	58	—	—	—	—	—	—	5
Assessment of supplier processes	—	—	53	—	—	—	—	—	—	—
Evaluation of supplier performance	—	—	—	—	—	—	16	—	5	—
Corrective actions	—	—	—	—	—	—	58	—	11	—
Decision-making process	—	—	—	11	—	—	—	—	—	—
Targets and objectives	—	—	—	58	11	11	16	—	—	—
Cooperation with suppliers	100	—	—	47	16	—	—	26	—	5
Communication	—	—	—	—	—	21	—	47	11	—
Multidisciplinary	—	—	—	—	—	26	—	—	—	—
Usage of information technology systems	—	—	—	—	—	—	—	—	16	—
Documentation	100	47	—	53	26	—	16	21	—	—

**Table 8.** Result Matrix “Develop Suppliers”

Develop suppliers Aspects	Maturity level (%)									
	1	2	3	4	5	6	7	8	9	10
Existence of supplier-improvement programs	100	58	—	—	—	—	—	—	0	—
Follow-up improvement programs	100	—	53	—	—	—	—	16	—	0
Certifying suppliers	100	84	89	63	42	—	—	—	—	—
Evaluation of supplier performance	—	89	100	89	16	11	26	37	21	16
Identification of corrective actions	—	95	—	89	—	—	63	79	5	5
Communication	—	95	95	95	37	26	—	—	0	—
Complaint procedure	—	—	—	89	—	—	79	—	—	—
Documentation	100	95	—	53	—	47	47	—	16	—

objectives of relationships within a project, and for these to be in line with the project purchasing plan. Second, a company should have a documented and structured process in place to identify, assess, and select potential partners on the project-level. Finally, reaching level 1 indicates that the companies have a formal definition in their purchasing policy explaining the category of suppliers they want to establish a partnership (see Table 5—level 1). Maturity level 2 requires companies to have evidence of a formal communication framework and shared goals with their suppliers that go beyond the specific project.

A closer look at the “cooperation with suppliers” aspect reveals that almost 74% of the companies do have strategic partnership agreements with one or more suppliers, and that, at 68% of the companies in such relationships, the executive managements at both companies (contractor and supplier) are involved in leading and managing the relationship (see Table 5, Cooperation with suppliers—level 4 and 5 respectively). Nevertheless, only 16% of the companies (see Table 5, Cooperation with suppliers—level 8) jointly analyze processes and integral costs (by sharing their own cost structures and cost calculations).

The highest maturity level found on Manage supplier relationships was level 5, and only one company had achieved this (see Table 3, Manage supplier relationships). This company had

a formal process in place to identify its criteria and objectives for each relationship, and these were in line with a purchasing plan that went beyond the project, and also in line with its business objectives.

### ***Integrate Suppliers into the Operational Process***

The results for this construct revealed that 84% of the companies had reached maturity level 2 (see Table 3, Integrate suppliers into the operational process). These companies could show evidence that they had started to integrate suppliers into their own operational processes. On a project-level, they had a planning and scheduling process that satisfied limited requirements (such as including a supplier’s delivery times in the planning). A barrier to many companies obtaining maturity level 3 was the associated requirement to formalise, document, and communicate an improvement plan for the operational process (see Table 6, Communication, Documentation, and Improvement plan—level 3). In this improvement plan, targets (such as a reduction in lead times and throughput times) have to be formalised and internally communicated.

The results shown in Table 6 do reveal some positive developments in terms of operations integration in construction supply chains. First, about 74% of the case companies have an active



process to reduce the number of logistical steps, the number of invoices, and the amount of stock (see Table 6, Improvement plan—level 5). Approaches included setting up web shops with suppliers, forming analysis teams (a few even involving suppliers), and producing monthly status reports. In working on such improvements, 84% of the companies indicated this involved an internal multidisciplinary team (see Table 6, Multidisciplinary cooperation—level 4). Second, suppliers were increasingly asked to contribute to internal process improvements (some even had this included in their contracts). The weakest area related to this construct was the lack of documentation on such improvement actions and the associated results (see Table 6, Documentation).

The companies reaching maturity level 5 (21%, see Table 3, Integrate suppliers into the operational process) showed evidence of an active integration and optimization process resulting in fewer process steps, fewer invoices, and lower inventory levels. Moreover, there was an internal optimization of the requirement planning and scheduling process on a regional level.

### ***Integrate Suppliers into the Value-Creation Process***

In terms of supplier integration into the value-creation process, the participating construction companies were, with one notable exception, truly underdeveloped (see Table 3, Integrate suppliers into the value-creation process).

As with the “manage supplier relationships” construct, only 42% of the companies were able to satisfy the maturity level 1 criteria for this construct. Unlike the majority, these companies had taken the first steps in creating a value-creation process policy/procedure. To satisfy the criterion, the policy/procedure had to describe the role of purchasing and define the tasks and responsibilities for both purchasing and suppliers at every milestone along the way. A positive finding was that almost half of the companies (47%, see Table 7, Communication—level 8) indicated that if they did create a policy/procedure for the value-creation process, they would include an open-door policy on sharing information (including technology roadmaps, costs calculations and customer information) with their suppliers.

The notable exception that achieved maturity level 8 (see Table 3, Integrate suppliers into the value-creation process), was the only company that had a formal decision-making process to determine the external technologies and capacities that were needed to develop new products, processes, or services. By using this formal decision-making process, the company could maximize its use of suppliers’ knowledge.

### ***Develop Suppliers***

Turning to the final construct, all companies had reached maturity level 1 (see Table 3, Develop suppliers). This indicates that all companies carry out ad hoc supplier-improvement actions, but not necessarily with any structured follow-up activity. To a limited extent, they did examine suppliers on legally required aspects before contracting. The primary reason companies did not qualify for maturity level 2 was that only 58% of them had a formal system in place to measure supplier performance (see Table 8, Existence of supplier-improvement programs—level 2). The case companies have a predominantly reactive response to their suppliers, they identify bad performances (100%, see Table 8, Evaluation of supplier performance—level 3), communicate internal complaints to suppliers (95%, see Table 8, Communication—level 4), and have a working system to check whether agreed corrective actions are executed (89%, see Table 8, Evaluation of supplier performance and Identification of corrective actions—level 4). A closer analysis of the “evaluation of supplier performance” and “communication” aspects reveals a large drop in the numbers satisfying the level 5

criteria compared with the lower levels (see Table 8). Only 16% of the participating companies conducted formal audits at the suppliers and only 37% visited them to evaluate the supplier and communicate business strategy and purchasing objectives.

The analysis of data on the supplier development construct also yields some positive signs. First, 53% of the case companies were busy developing formal supplier-improvement programs (see Table 8, Follow-up improvement programs—level 3). Second, precontract auditing of suppliers has become quite common in our sample of construction companies, mostly on certification (e.g., ISO) and quality demands as can be seen in Table 8 under the “certifying suppliers” aspect.

The few companies that did reach maturity level 5 (11%, see Table 3, Develop suppliers) do satisfy the above criteria in terms of conducting formal audits at the suppliers and visiting them to communicate business strategy and purchasing objectives. Furthermore, they review their strategic suppliers before entering into contracts, not only where legally necessary but also on other aspects they see as relevant (e.g., quality certificates and environmental certificates).

## **Discussion**

The results from the Dutch case studies illustrate that there is a large potential for improvements in the management of buyer-supplier relationships in the construction industry. On the basis of the case studies, it is concluded that the vast majority of companies have maturity levels that remain within the project-level classification (maturity levels 1–3). This finding emphasizes the dominance of the project-based way of working in construction supply chains. An important implication is that construction companies do not maximize the use of the knowledge and competences of their suppliers when buying in goods and services. Most construction firms operate in a decentralised network of suppliers and customers, and draw on the production capacity of various external suppliers. A construction project can be seen as a temporary organization among and within the organisations involved (Hofman et al. 2009). In such business environments, strategic partnerships are costly to develop and to maintain, and bring risks associated with the specialized investments they require (Bensaou 1999).

The case-study results are in line with recent research on the UK construction industry by Akintoye and Main (2007). Their research showed that 68% of construction companies have strategic collaborations with clients, and 24% with other contractors. Moreover, UK construction firms have a larger number of arrangements with clients than with suppliers, and a higher proportion of the relationships with suppliers are contractual. The most important reason, as identified by the UK contractors studied, for collaborative relationships is the requirement to respond to customers needs (Akintoye and Main 2007). Earlier research by Akintoye et al. (2000), involving 40 construction companies, showed that only one-third of these firms value relationships with suppliers more than the relationship with the client, with the other two-thirds arguing the opposite. We expect that this perception of the contractors will change given the recent requirements for sustainability. Because of these developments, contractors are not only judged on their own sustainability performance, but also on the sustainability performance of their suppliers.

In more detail, the case results from our study yield the following factors as impeding the effective management of buyer-supplier relationships in the Dutch construction industry:



- Lacking a formal and documented supplier selection process that is focussed on the current needs and capabilities of the company;
- Lacking a supply base optimization plan on the basis of a supplier rating system;
- Lacking a formal definition in the purchasing policy of which category of suppliers should be targeted in establishing partnerships;
- Lacking a formal, documented and communicated improvement plan (with targets including for the reduction of lead times and throughput times) for their own operational processes;
- Not taking the first steps to create a policy/procedure for the value-creation process, in which the purchasing role is described and the tasks and responsibilities, at each milestone, for both purchasing and suppliers are explained;
- Lacking a formal system to provide a basic measurement of supplier performance; and
- Lacking a proactive mindset toward suppliers (visiting and auditing suppliers, evaluating suppliers, communicating business strategy and purchasing objectives) to develop suppliers in the desirable direction.

These obstacles reinforce the natural tendency for temporary project work to result in a lack of continuous relationships between firms (see also *Dubois and Gadde 2000*). The difficulties in achieving continuous relationships is especially illustrated by the relatively low maturity levels found for the “manage supplier relationships” construct. *Cox (2004)* argued that strategic collaboration with suppliers is not always feasible or desirable for construction companies because: (1) in some situations potential relationship benefits are exceeded by investment costs; and (2) any investment competes with other opportunities. Despite this, companies should at least investigate with which suppliers it would make sense to establish more collaborative relationships.

The case results also highlight some positive developments and opportunities in the Dutch construction industry. A substantial minority of construction firms do already invest in improving relationship management. In more detail, the cases yield the following positive developments and corresponding opportunities for improving the management of the buyer-supplier relationship in the Dutch construction industry:

- Nearly all the case companies did communicate about suppliers and their performances internally, but not with the suppliers.
- A majority of the companies analyzed their supply base with the help of purchasing models. They could go on to use these analyses to develop differentiated strategies toward their suppliers.
- Strategic partnership agreements with suppliers do exist, but only a few companies jointly analyze processes and integral costs with their suppliers.
- Three-quarters of the case companies have an active process to reduce the number of logistical steps, the number of invoices, and stocks.
- The majority of companies indicated that they are improving their internal operational processes with an internal multidisciplinary team. Involving suppliers is a genuine opportunity.
- Almost half of the companies do have an open-door policy in sharing information with suppliers in the value-creation process, but they lack a policy/procedure for their value-creation process in which this could be explicitly stated.
- Half of the case companies are developing formal supplier-improvement programmes, but two-way communications with suppliers is not yet common practice.

These positive developments and opportunities reinforce the improvement potential of buyer-supplier relationship management in the construction industry.

## Conclusions and Managerial Implications

The objective of this paper was to shed light on obstacles to, and opportunities for, increasing the effectiveness of construction firms in managing buyer-supplier relationships. More specifically, the focus was on assessing the maturity level of buyer-supplier relationship management by construction firms. This assessment demonstrated a large potential to improve the management of buyer-supplier relationships in the Dutch construction industry.

It can be concluded that there are, at the same time, both major factors impeding, and positive developments and opportunities stimulating, improved management of buyer-supplier relationships in Dutch construction firms. The impeding factors can be summarized as the lack of formalization, documentation and communication (both internally and with suppliers) linked to the various policies, plans, processes and measurement systems that form part of the management of buyer-supplier relationships. On the positive side, many initiatives regarding the optimization of the supply base, the management of supplier relationships, the integration of suppliers into the operational and value-creation processes, and the development of suppliers have been started. The opportunity exists for these companies to further develop these initiatives, by paying specific attention to involving suppliers.

A strong recommendation is that construction companies should not only react toward suppliers when something goes wrong, but communicate proactively with suppliers to develop closer and trusting relationships. Construction firms and their suppliers should jointly analyze processes and integral cost to reduce costs linked to failures and improve the quality of the final product. In this paper, we saw that a minority of construction firms already do invest in formal supplier-improvement programs, do analyze processes and costs jointly with suppliers, and do ask suppliers to contribute to process improvements. By involving suppliers in value-creation projects, construction companies can maximize their use of the knowledge of suppliers in developing new products, processes, or services. To further optimize the supply base, companies should develop an optimization plan (and document this) and structurally pay attention to research on the supply market. Furthermore, on the basis of their analyses with purchasing models of the supply base, they should develop differentiated strategies toward their suppliers.

Taking the large potential for improvements in the management of the buyer-supplier relationship by Dutch construction firms as a starting point for further research, the optimum relationship types, between contractors and suppliers in the construction industry, should be determined through further research. The portfolio approach by *Bensaou (1999)* could be an interesting starting point in that it argues that the various product, market, and supplier conditions require a portfolio of relationship management approaches. *Cox (2004)* builds further on the principle of a portfolio of relationships by differentiating strategies for managing these relationships. If a portfolio of relationships is developed, on the basis of the appropriate management styles, the competitive advantage of construction firms will increase (*Bensaou 1999*). More specifically, further research could focus on determining under what conditions a supplier is able to provide structural added value for a contractor.

## Appendix: Maturity Levels of the Constructs

In this appendix, the maturity levels in terms of the five constructs are presented in Tables 9–12.

**Table 9.** Maturity Levels on a Project-Level

Project levels	Maturity level		
	1	2	3
Optimize supply base	Supplier selection is on the basis of price and availability. There are no initiatives to optimize the current supplier base, supplier assessment on the basis of qualitative perception of performance, and basic evaluation of costs and risks. Basic differentiation is made between key and nonkey suppliers.	As 1, plus ad hoc (work) instructions are applied for supplier selection. To a limited extent there are initiatives for optimization of the supplier base. No or little evidence of a policy for differentiation in strategic and nonstrategic suppliers. Ad hoc supplier market research takes place with the objective to learn more about potential suppliers.	As 2, plus basic supplier rating system in place; at least quality and delivery performance of key suppliers are measured. There is a multidisciplinary involvement within a project. Little evidence of formal communication towards key stakeholders.
Manage supplier relationships	In the purchasing policy a formal definition identifies for which categories of suppliers to establish strategic supplier partnerships. Formal process in place to identify the criteria and objectives for relationships within a project, in line with the project purchasing plan. Documented and structured process in place to identify, assess, and select potential partners against relationship criteria on a project-level.	As 1, plus little evidence of formal communication framework and common project exceeding goal setting.	As 2, but a documented and structured process is present to identify, assess, and select potential (strategic) suppliers on corporate level, on the basis of defined criteria.
Integrate suppliers into the operational process	No evidence of supplier integration into the operational process. No requirement planning and scheduling process, this primarily happens ad hoc and/or on the basis of on gut feeling.	As 1, but there is little evidence for integration of suppliers into the operational process. There is a limited requirement planning and scheduling process on a project-level.	As 2, plus there is evidence of targets for reduction of lead times and throughput times as part of the purchasing improvement plan (only internally discussed). There is evidence of internal optimization of the requirement planning and scheduling process on a project-level.
Integrate suppliers into the value-creation process	No or little evidence of a value-creation process (VCP) policy/procedure available, including a description of the role of purchasing and determining tasks and responsibilities at every milestone for purchasing and suppliers. No or little evidence of supplier integration in the VCP.	As 1, but there is a VCP policy/procedure and formal (make/buy) decision-making process is in place to identify project needs of external technologies and capabilities. Evidence of purchasing involvement in the VCP from early start (in preconcept phase).	As 2, plus the selection of suppliers is on the basis of clear understanding of (development and process) capabilities against those needs identified in level 2. Further (process) assessments if necessary.
Develop suppliers	No evidence of a supplier-improvement program. Ad hoc supplier-improvement actions, without structured follow-up. Important suppliers are on the process side, before contracting, marginally examined on legally necessary aspects (this is not documented).	As 1, plus limited evidence of a formal system in place for basic measurement of supplier performance. A simple checklist is present for basic measurement of supplier performance. Little evidence of communication of these results (towards suppliers) with appropriate analysis and corrective action planning (towards internal organization). Important suppliers are on the process side marginally reviewed before contracting, on legally necessary and relevant aspects.	As 2, plus ad hoc response to supplier problems (e.g., poor quality or late delivery) communicated towards suppliers; reactive supplier development. Measurement is aligned with the internal organization and there is a further development of the supplier-improvement program. All suppliers are on the process side marginally reviewed before contracting, on legally necessary aspects.

**Table 10.** Maturity Levels on a Regional Level

Regional levels	Maturity level		
Construct	4	5	6
Optimize supply base	Formal and documented supplier selection process in place, focused on current needs and capabilities of the company, with a supplier-rating system extended with a basic supplier categorization system which supports a supply base optimization plan.	As 4, but supplier base is extensively analyzed on the basis of turnover and risk. Documented evidence of analysis on the basis of purchasing models. There is little evidence of differentiated actions in line with these analyses.	As 5, but there is clear evidence of differentiated supply base management on the basis of purchasing models. Documented evidence of differentiated strategy/actions towards suppliers. Also, an advanced supplier rating system is in place; covering on-going production and value-creation process, criteria are weighted (aligned with business objectives), multidisciplinary involvement within the company, objective measurements. Communication about the results are used internally concerning the assessment of repetitive use of the suppliers. There is the possibility to spend time and resources on structural supplier market research.
Manage supplier relationships	As 3, plus a formal process is in place to identify the criteria and objectives for each relationship, in line with the project exceeding purchasing plan and the business objectives. And, if relevant, for the most strategic supplier, there are partnerships agreements available, including documented evidence that they work on a partnership program (improving supplier relations). Supplier relationships are sometimes discussed as a separated agenda point in meetings of the management team. Multiple-level communication in all functions is established, including a formal communication framework.	As 4, plus senior management is involved at both companies to lead and manage the relationship.	As 5, the point when (if applicable) the strategic supplier relation is integrated in the value-creation process. Shared improvement programs (with supplier) are started.
Integrate suppliers into the operational process	As 3, plus there is a formal internal communication structure and internal multidisciplinary teams are organized to align market demand, production capacity, and supply. Suppliers are involved in the process to optimize operational purchasing.	As 4, plus there is evidence of an active process resulting in less process steps, fewer invoices, and lower inventory levels. There is an internal optimization of the requirement planning and scheduling process on a regional level.	As 5, plus there is evidence of cross-organizational teams (client, contractor, and supplier) to reduce inventories, lead times, and throughput times, and to optimize the internal administrative process. Evidence of an action plan, implementation of actions, and review of targets.
Integrate suppliers into the value-creation process	As 3, plus formal decision-making process to determine moment of supplier involvement, on the basis of degree of development responsibility and development risk. Some evidence of target setting and contracting (at least nondisclosure and intellectual property agreement).	As 4, plus project objectives are clearly set (including timing, quality, and costs), and translated into purchasing and supplier objectives. Development contracts available, in which supplier objectives are defined.	As 5, plus regular meetings are scheduled. Cross-functional multiple-level communication established to address project objectives (more than product functionalities).

**Table 10.** (Continued.)

Regional levels	Maturity level		
	4	5	6
Construct			
Develop suppliers	<p>As 3, plus formal complaint procedure in place to communicate efficiently internal complaints towards suppliers. The general supplier performance is communicated towards suppliers. Evidence of follow-up of suppliers' corrective actions on the basis of these complaints and the supplier rating results. All suppliers are on the process side marginal reviewed before contracting, on legally necessary and relevant aspects.</p>	<p>As 4, plus supplier visits and/or days are organized for supplier recognition/evaluation and to communicate structurally business strategy and purchasing objectives. The strategic suppliers are reviewed at the process side before contracting on relevant aspects. Several formal supplier audits have taken place.</p>	<p>As 5, plus there is evidence of process studies and audits at all strategic suppliers to fully understand all suppliers' current and future capabilities. This information is documented, regularly updated, and effectively communicated towards key stakeholder and is internally accessible for all personnel.</p>

**Table 11.** Maturity Levels on a Business Unit Level

Business unit levels	Maturity level	
	7	8
Construct		
Optimize supply base	<p>As 6, plus evidence of improving results and achieved targets. Information is communicated towards suppliers, and discussed in regular improvement meetings/improvement programs. Following information is available for all key suppliers and communicated towards stakeholders on the basis of current requirements and skills: current status of the supply base, supplier performance and improvement actions.</p>	<p>As 7, plus there is a formal documented supplier selection process on the basis of future needs. Also, regular assessments take place for all strategic suppliers to clearly understand and communicate current and future capabilities of suppliers (in relation to current and future needs of the business).</p>
Manage supplier relationships	<p>As 6, plus shared project exceeding objectives are formalized with suppliers. There is a joint objective setting and joint planning process in place. Little evidence of alignment of future strategies and objectives.</p>	<p>As 7, plus value chain cost and processes are jointly analyzed. Open book policy to share cost calculations and cost breakdowns for the whole value chain and exceeding multiple projects.</p>
Integrate suppliers into the operational process	<p>As 6, plus there is an automated integrated scheduling and order processing system (production planning system) in place to optimize internal information exchange. There is evidence of a documented evaluation process. There is an internal optimization of the requirement planning and scheduling process on a corporate level.</p>	<p>As 7, plus there is a comprehensive alignment and integration over the full supply chain with both multiple tier suppliers and clients for planning, inventory reduction, and invoicing, and there is evidence that key first tier suppliers are involved in the requirement planning and scheduling process. Automated forecasts are shared with those suppliers.</p>
Integrate suppliers into the value-creation process	<p>As 6, plus supplier performance is measured and reviewed against expectations. Corrective actions are planned and implemented if necessary. There is a formal advanced supplier rating system for supplier performance in value-creation process. There is evidence of improving results and achieved targets.</p>	<p>As 7, plus an open-book policy of sharing appropriate technology roadmaps, costs, and customer information is practiced. Evidence of key supplier involvement in (preconcept) stages of development.</p>
Develop suppliers	<p>As 6, plus process control systems have been agreed with all appropriate strategic suppliers. There is statistical evidence of stability and capability from those suppliers, or there is evidence that corrective actions are planned. The complaint procedure is evaluated.</p>	<p>As 7, plus there is evidence of proactive supplier development concentrating efforts to the most important commodities/product groups and suppliers. On-site supplier assessments have been organized.</p>



**Table 12.** Maturity Levels on a Corporate Level

Corporate levels	Maturity level	
	9	10
Optimize supply base	As 8, plus time and resources are available for fundamental market research, on the basis of full understanding of business requirements on the supplier base. Documented evidence of market research planning and execution.	Differentiated commodity/product group strategies in place to optimize the supplier base and to maximize performance with the correct number and correct suppliers.
Manage supplier relationships	As 8, plus clear evidence of a joint ambitious and continuous improvement agenda (with the supplier), on the basis of benchmarks. Continuous assessment of the partnership against objectives. Evidence of achieved targets and improving results.	As 9, plus there is a formal alignment of mutual future plans on technologies, objectives, and strategies. Complete openness to share future product and technology information.
Integrate suppliers into the operational process	As 8, plus there is evidence that supply chain capabilities are maximized through optimal design of systems and procedures, and the use of among other things e-tools and other innovative systems.	As 9, plus information systems allow information sharing across the full supply chain with multiple tier suppliers and clients. Cross-organizational supply chain benchmarking resulting in permanent improvement programs.
Integrate suppliers into the value-creation process	As 8, plus internally/externally linked information systems facilitate information exchange to reduce throughput time and development costs. There is a formal evaluation process in place to evaluate development projects with the supplier and to determine future improvement programs.	As 9, plus preferred supplier lists are available per product group, supported by worldwide searches, continuous industry monitoring, and joint technology roadmap discussions.
Develop suppliers	As 8, plus advanced quality measurement systems are in place; cost of non quality is measured and targets are set and communicated towards suppliers and key stakeholders. Evidence of a zero defect/error program for critical deliveries. Evidence of improving results and achieved targets.	As 9, plus supplier assessment and joint/mutual trainings are organized to learn in two directions and to establish common improvement programs (with targets and follow-up). Trained and dedicated personnel are accessible for supplier quality and development.

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