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# Benchmarking procurement functions: causes for superior performance

Benchmarking  
procurement  
functions

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## Abstract

**Purpose** – The purpose of this paper is to gain a better understanding between procurement strategy, organization, processes, methods and tools, human resources, supplier management, and overall procurement success.

**Design/methodology/approach** – In order to achieve the above-mentioned results, a holistic benchmark with highly recognized companies is conducted. Applying a cohesive questionnaire of open and closed questions, the paper covers all relevant aspects of procurement functions. Regression analysis is used to identify significant correlations.

**Findings** – The benchmarking (BM) proved the following significant success factors for the overall procurement process: use of cross-functional teams, high hierarchical positioning of the procurement function within the company, strong cooperation with other functions, training and development of the procurement personnel as well as supplier integration and continuous evaluation.

**Practical implications** – The paper provides the reader with sound evidence of how to improve the overall performance of procurement.

**Originality/value** – The analytical results of the research rely on statistical/mathematical methodology to substantiate qualitative BM results.

**Keywords** Benchmarking, Supply chain management, Procurement, Regression analysis, Correlation analysis

**Paper type** Research paper

## 1. Introduction

Roughly over 60 percent of a company's spend amounts to procurement/supply chain management (SCM) expenses[1]. Especially, in competitive sectors and during recent crisis the strategic significance of this function cannot be denied, and lots of efforts are continuously put into practice to strengthen procurement units. In particular, benchmarking (BM) of operative and strategic tasks served as a powerful method to identify weak spots as well as procurement best practices, see, e.g. Youssef and Zairi (1996a), Le Sueur and Dale (1997), Homburg *et al.* (1997), Gilmour (1998), Andersen *et al.*

The authors would like to thank the anonymous referee for her/his suggestions to more stringently display the results of this paper and especially for her/his speed when delivering feedback. It is awesome to submit a paper at Friday noon and receive the profound referee's report the following Monday morning.



(1990), Frehner and Bodmer (2000), Sánchez-Rodríguez *et al.* (2003), A.T. Kearney (2004), Aberdeen Group (2006), Saad and Patel (2006), Schuh *et al.* (2007), Wong and Wong (2008) or Raymond (2008).

Often, time demands require a careful selection of approximately five BM partners with whom actual interviews are conducted – a number too small to really apply powerful statistical tools. The alternatives often are broad surveys of hundreds of companies where just some – more or less – specific questions are issued. Here, some middle way is discussed which allows the application of statistical methods such as regression analysis, to analyze causes and effects of best practice. See also Codling (1997) and Codling (1998) for a multidimensional analysis of benchmark findings and their incorporation into a company.

We had been fortunate to execute a rather extensive individual BM project for an international automotive company, where, after a careful selection of possible cross industry BM partners, 14 highly recognized companies agreed to be interviewed (Brandmeier *et al.*, 2008). The assessment type questionnaire guiding these interviews contained over 170 closed and open questions. This allowed us to apply evolved statistical methods and achieve sound cause and effect statements for the set-up of a tangible business plan. Thus, we intend to provide an extensive look into the data processing processes and how correlations and insights can be distilled from the information gathered by BM interviews.

## 2. Research background and literature survey

Considering BM as the method of choice to determine procurement best practice is, for instance, confirmed by Sánchez-Rodríguez *et al.* (2003): this evaluation of over 300 companies shows a significant positive impact of BM on purchasing performance and an indirect positive effect on business performance. Raymond (2008) comes to the same conclusion with respect to public instead of private procurement. Moreover, Wong and Wong (2008) present a detailed literature survey on 16 research articles dealing with aspects of procurement best practice dating from 1995 to 2003. They also highly emphasize the requirement to analyze data from supply chain benchmarks in a rigorous way.

The consequent next step is to ask, what the practices are that constitute a superior performing procurement unit and to validate these findings mathematically.

Empirical studies show a huge bunch of different sometimes interwoven, sometimes clearly separated “key” features/levers that need to be strengthened in order to gain overall procurement success. Table I classifies some approaches to drive procurement to superior performance. Hereby, we classified the indicators given in the selected sources (Frehner and Bodmer, 2000; A.T. Kearney, 2004; Aberdeen Group, 2006; Schuh *et al.*, 2007) according to six fields of excellence with cover all activities of a procurement function.

At a first glance it is rather obvious, that every aspect counts. Following the combined guidelines of the research given in Table I and the previously discussed sources the procurement function needs to be perfect in any task operated and simultaneously guided by the most accurate strategy. Thus, it is reasonable to come back to the ground and ask what the really essential aspects of procurement success are. “We do not need to measure everything that matters; we only need to measure the things that matter” (Saad *et al.*, 2005, pp. 383-97). Hence, are there a few key features

Field of excellence	Indicator <sup>a</sup>	Sources
Strategy	Precisely defined and communicated strategy	Frehner and Bodmer (2000)
	Senior management support for procurement	
	P as driver for company-wide saving activities	
	Early involvement of P in development projects	
	Right key performance indices	Frehner and Bodmer (2000) and Aberdeen Group (2006)
	Early involvement of key suppliers in development projects	A.T. Kearney (2004)
	Advanced cost cutting methods/levers (A.T. Kearney (2008), too)	
	Risk management w.r.t. to future evolution possibilities of suppliers	A.T. Kearney (2004), Aberdeen Group (2006) and Schuh <i>et al.</i> (2007)
	Corporate thinking and cross-functional responsibility for all expenses	Aberdeen Group (2006) and Schuh <i>et al.</i> (2007)
	Global sourcing w.r.t. total cost of ownership	Schuh <i>et al.</i> (2007)
Organization	Central coordination and local execution	Schuh <i>et al.</i> (2007)
Processes	Standardized procurement processes	Frehner and Bodmer (2000)
Methods and tools	Procurement handbook	Frehner and Bodmer (2000)
	Intranet as procurement knowledge base	
	Continuous establishment of data transparency	
	e-Procurement	
	Shared e-platform with suppliers	
	Methods for forecasting, inventory management, and replenishment	Aberdeen Group (2006)
HRs	Highly qualified buyers	Frehner and Bodmer (2000)
	P personnel must be on face value with members of other units (as development, production, etc.)	
Supplier management	Specialized procurement roles	Schuh <i>et al.</i> (2007)
	Structured supplier portfolio	Frehner and Bodmer (2000), A.T. Kearney (2004) and Schuh <i>et al.</i> (2007)
	Holistic supplier evaluation	Frehner and Bodmer (2000) and Schuh <i>et al.</i> (2007)
	Cost reduction by supplier development	Schuh <i>et al.</i> (2007)
	Supplier value integration	
	Management of sub-suppliers	

**Note:** <sup>a</sup>As provided in source; here P denotes procurement

**Sources:** Frehner and Bodmer (2000), A.T. Kearney (2004), Aberdeen Group (2006) and Schuh *et al.* (2007)

**Table I.**  
Success factors for the procurement function (P) proposed in the recent sources/surveys

of superior performance that should be known by any manager? Well, let us benchmark companies acknowledged for their procurement performance[2], gather the raw data and analyze them.

### 3. Research methodology

The overall BM process conducted does not deviate from that of other studies, see Camp (1989) and, in particular, Brandmeier *et al.* (2008). That is to say, first the key issues were defined and the questionnaire developed and tested by company internal interviews[3] (Carpinetti and de Melo, 2002). Then, best practice companies were identified, selected and contacted; *cf.* Razmi *et al.* (2000) for guidelines for the identification/selection process of best practice BM partners. Third, the interviews were conducted at the locations of the BM partner. Usually, an interview took three to five hours whereby one to two members of the partner were interviewed by two members of the BM team (one asked the questions issued in the questionnaire and the other took notes on the answers[4]). Finally, the interesting work begins: the evaluation of the data received via the interviews.

Here, a brief overview is provided on the questions/themes issued during the BM interviews, together with an evaluation methodology to end up with an unbiased numerical classification of the answers. Last, we define the excellence of a procurement function by means of their handling of 12 procurement levers. This setting will provide the ground for the mathematical analysis in Section 4.

#### 3.1 The questionnaire's internal structure

Yasin (2002) already signified that the direction of addressing BM – especially in the complex world of supply chains and procurement – is no longer process oriented, but rather on an holistic approach encompassing strategies and systems orientation. This is reflected by our questionnaire, which deals with the following six assessment fields (Section 2). Each of these fields is being divided into finer clusters to provide a more integrated view on the subject (the titles of the sub-fields are given after the field title):

- (1) *Strategy*[5]. Development and timeliness of a superordinate procurement strategy, application of the superordinate procurement strategy, content and level of detail of product group strategies, application of procurement levers.
- (2) *Organization*[6]. Position of procurement within the company organizational structure, structure of the procurement department, interaction with other divisions in the company, company-wide coordination of procurement activities, interface to suppliers and supplier quality management (SQM), organizational changes.
- (3) *Processes*[7]. Early integration of procurement and supplier quality, order processes, logistics processes, supply security, and make or buy decisions.
- (4) *Methods and tools*[8]. Information management, e-procurement.
- (5) *Human resources (HRs)*[9]. Setting and controlling of targets, employee level of education, employee development and level of satisfaction, and internationality.
- (6) *Supplier management*[10]. Supplier portfolio, supplier selection, supplier controlling, supplier development, and supplier integration.

These sections are analyzed and statistically evaluated in greater detail. Open-ended questions in this segment of the questionnaire supplement the data collection process. The goal of evaluating the questionnaire is to distil significant cause-effect relationships between the answers given to these fields and overall best practice in procurement.

Before starting the evaluation, two methodical aspects still need to be mentioned: the grading of the questions and the assignment of the answers to the fields.

During the preparation of the questionnaire most of the questions were designed with specific answer choices to provide a clear grading within a Likert scale with marks from 1 to 5 (Likert, 1932). Let us take, for instance, the following closed question:

To what extent is essential order information sufficiently specified by internal users?

(Exchange of order information with users):

- (1) There are no specifications.
- (3) We get some specifications but have to verify/supplement them.
- (5) We receive all required specifications.

This system provides enough flexibility to specifically classify the answers of each BM partner.

To ensure an unbiased approach to the questions, the final version of the questionnaire sent in advance to the BM partners before the actual interviews took place contained only a fraction of these choice possibilities. As the interviews were carried out, the interview teams classified the answers of the BM partner according to this choice system.

Besides, these closed questions, the questionnaire contains a portfolio of open questions for which no pre-defined set of answers were provided, for instance:

What is the inventory turnover rate in your company?

After all benchmark interviews had been carried out, the team compared all given answers in order to constitute a social basis of comparison. This process ensured an unbiased a posteriori grading of the answers.

To keep the number of questions in the questionnaire to a necessary minimum and also consider all relevant influences a single question has, the evaluation respects a multiple contribution of questions to different sectors. Hence, the questionnaire becomes like a cobweb of interlocking questions. Just take the above-mentioned closed question on order specifications as an example: this question with its answer scheme located in the “organization” sub-field “order processes” also provides insight in how the company-wide coordination of procurement activities is performed and thus contributes to a sub-field of “organization,” too.

It seems reasonable to present the pathway from the questionnaire to the reports, in order to have a blue print handy for other BM projects. After the questionnaire is completed in the BM interviews, the results are transferred to an Excel document which allows a digitalization of the data and a first statistical pre-analysis[11]. Next, Excel-Macros export the digitalized data into the powerful statistics software R[12, 13]. By the use of R the statistical key measures (mean, median, quartiles, etc.) as well as the linear models, regression analysis and general studies on the dependency of the data sets that were carried out in this study were generated. In order to automatically generate the final BM reports, the typesetting software LaTeX was used[14]. Here, one final report is generated from which the individual reports for the BM partners can be easily separated. Furthermore, copy-and-paste errors can be avoided and the total amount of time spend on the report is reduced by not handling the data manually.

### *3.2 Indicators for procurement best practice*

Defining reliable/tangible measures for outstanding performance in complex economic situations is a tough topic (Kaplan and Norton, 1996). We choose the so-called

procurement levers as these performance indicators. The procurement levers are a set/toolbox of different methods to strategically classify procurement activities. Thus, their degree or implementation serves as a good guideline of how successful the overall procurement function should be. On the basis of A.T. Kearney (2008), we asked each BM partner on how successfully – on a scale from one to five[15] – the following 12 procurement levers, grouped by three themes, are applied within his/her function:

- (1) Commercial levers:
  - Pooling (bundle between different factories and use economies of scale).
  - Negotiation concepts (lead negotiations, follow a specific methodology, use of e-procurement).
  - Global sourcing (use request for information/request for quotation (often in combination with a request for proposal), optimize sourcing process, transfer volume to emerging procurement markets).
  - Supplier portfolio (introduce controlling tools for purchasing activities and savings, focus on core suppliers).
  - Target costing (break down the costs, view the life cycle costs, and total cost of ownership, make or buy decision).
- (2) Technical levers:
  - Supplier development (reduce waste, develop optimization approaches at supplier sites, supplier risk management).
  - Standardization (set up cross-functional teams, eliminate over-variety).
  - Redesign to cost (conduct function and value analyses, redesign the specification of the product).
  - Simplifying technical specifications (reduce over-specifications, implement standards, define functional specifications).
- (3) Supply chain process levers:
  - Supply chain integration (optimize material flow, warehousing, procurement systems, implement IT-solutions).
  - Procurement processes (accelerate the order process, standardize procurement process, long-term procurement, simultaneous procurement (2nd source)).
  - Supplier value integration (decide the level of outsourced process steps, cooperate and integrate suppliers).

Figure 1 shows an estimation of today's degree of application of these levers. Traditionally, just the commercial levers are exploited to a considerable amount whereas technical and supply chain process levers are underdeveloped. Interviewing procurement managers, the application of these later types need to be pushed forward in order to maintain company-wide growth and not to get lost economically hard times.

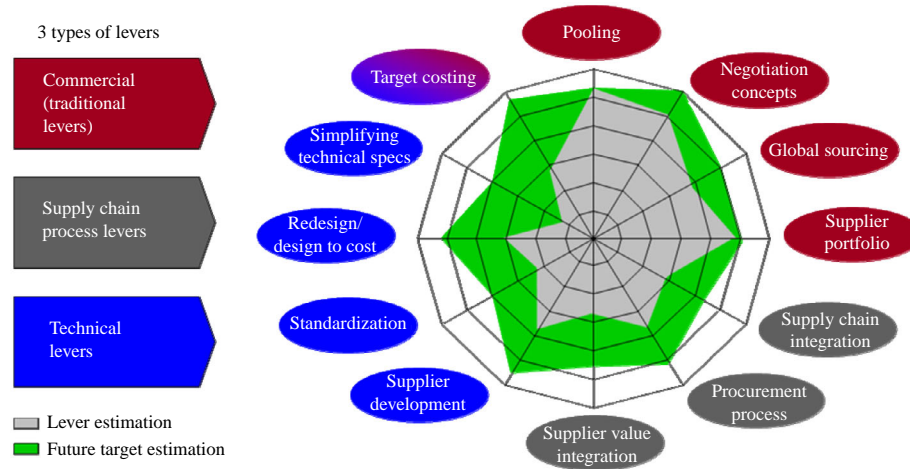
Comparing the 12 levers and their defining characteristics with the lists given in Table I we immediately recognize a huge overlap. Hence, taking the average over all degrees of implementation of these levers gives us a reliable number for the procurement performance (in accordance with earlier studies, Table I). To identify



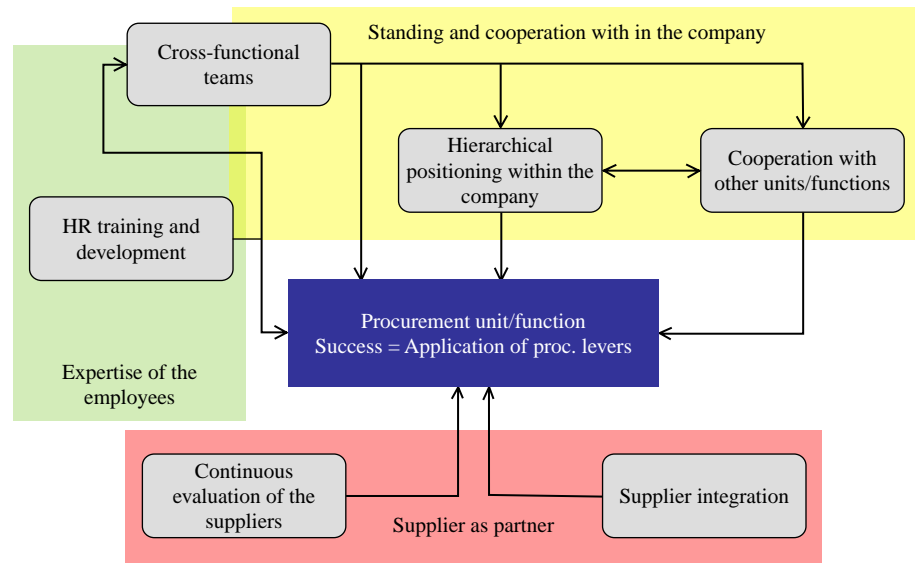
the factors having a major contribution to the thus defined procurement performance, we inspect the correlation of this “use of procurement levers” with other variables gained from our raw data. In particular, the correlations found will (Figure 2), in a sense, enhance the degree of implementation of all levers simultaneously.

#### 4. Empirical results and analysis

Since the successful application of Gauss in 1801 linear regression/the least square method is a popular tool to fit empirical data to linear laws. In breve, given empirical



**Figure 1.** Traditional/today’s degree of application of the 12 procurement levers (inner area within the spider diagram) and trend prognosis on how the application of these levers will have to change to ensure further growth



**Note:** Positive correlations among different key features of the questionnaire are represented by arrows

**Figure 2.** Dependencies



variables  $X_1, X_2, \dots$  one can construct a linear model  $Y = a + b_1 X_1 + e$  or a multi-linear model  $Y = a + b_1 X_1 + b_2 X_2 + \dots + e$  with constant coefficients  $a, b_1, b_2, \dots$  that governs the empirical realization. The condition under which this method can be applied to gain such correlation insights is that the error  $e$  which measures the deviation of the empirical data from the linear model is distributed normally.

Figure 2 shows the key results of this section: the correlations between different features of the BM questionnaire. For instance, there is a high correlation between the “use of procurement levers” and “integration” of the procurement function within the company. In other words, this states, that the higher the integration of the procurement function is, the better is the degree of procurement lever application (Finding 1). The remaining correlations are summarized in the Findings 2-7.

Though this would be enough to satisfy the requirements on any executive level, let us go one step back and discuss the evaluation of the raw data. The goal of this paper is to derive these cumulative findings step by step, despite the fact that, traditionally, the data basis to apply advanced statistical methods is rather small.

The structure of this section is aligned with this quest for major correlations: first the use of procurement levers is examined, then that of cross-functional teams. The influence of changes of the procurement organization could not be decided, despite the fact that all top performing companies performed major changes of their procurement organizations during the last two years[16]. Finally, the consistency of the questionnaire is checked.

As the number of observations is rather small we have to consider the influence of any outlying observations on the results of the linear model fit. In order to check the assumption made by fitting the multiple regression model estimated residuals are used[17]. The simplest and most useful possibility of checking these residuals is a normal probability plot of these ordered residuals. This so-called quantile-quantile (q-q) plot is a graphical technique for determining if two data sets come from populations with a common distribution and the normal probability plot assesses, whether or not a data set is approximately normally distributed (Fahrmeir *et al.*, 2004, p. 490). This is an essential part of the mathematical methodology, as without a normal distribution of the data, the whole regression analysis is worthless.

#### 4.1 Effects on the use of procurement levers

First, the implications on the optimal use of procurement levers are analyzed by a linear regression ansatz[18] (Table II). The correlations[19] show a direct relationship between the use of procurement levers and the fields strategy (correlation  $> 0.60$ ), organization, processes, methods and tools, HRs, and supplier management (each with correlation  $> 0.40$ ). Note, that the data basis is too small to consider any correlation  $< 0.4$ .

**Table II.**  
Effects of the use  
of procurement levers

	Procurement levers Correlation	Comment
Strategy	0.65	Significant
Organization	0.42	Moderately significant
Processes	0.46	Moderately significant
Methods and tools	0.46	Moderately significant
HRs	0.42	Moderately significant
Supplier management	0.56	Significant

During our analysis, we found that 0.75 is the highest (meaningful) correlation factor achieved, and thus categorized correlation factors between 0.4 and 0.5 as “moderately significant,” factors between 0.5 and 0.7 as “significant” and those above 0.7 as “highly significant” (Sachs, 2002, p. 536), on confidence regions for correlation coefficients.

To further study the influence on the use of the procurement levers, we separately consider their relationship to the single sub-fields. This is especially necessary as the use of procurement levers is also contained in the strategy sub field “application of procurement levers” such that a highly significant correlation trivially exists between these factors of influence.

*4.1.1 Strategy against procurement levers.* The most important finding is that if you do not have a procurement strategy, the application of procurement levers is almost of no significant impact. In case, a company does not take the time to think about a procurement strategy (e.g. number of sourcing activities in emerging procurement markets like China and India) applying the procurement lever “negotiation tactics” may turn out completely useless because of a lack of alternative – cheap – supply sources. In practical reality, before starting to use a set of levers, design a strategy and follow a roadmap.

In Table III, the correlation between “use of procurement levers” and the sub-fields is displayed.

As mentioned before, the use of procurement levers is directly included in the strategy sub field “application of procurement levers.” So a correlation coefficient of 0.98 is not surprising and does not provide any new information. This phenomenon of a correlation caused by internal factors (e.g. contributing to both examined data sets) is well known in statistical analysis and called “causal correlation” (Sachs, 2002, p. 508), for a (pretty nice) thorough discussion of different types of causes for correlations. The remaining categories in the sub-field “strategy” show that there is no relationship of significance.

This finding is rather surprising: we would expect that a stringent strategy should be the cornerstone of superior performance. Though we can argue with the difference between theory and actual living of a theory, i.e. that there has always been a gap between written strategy and day-to-day practice. In fact, the careful analysis and development of a cohesive procurement strategy and its reflection in a company-wide document should be studied in further research.

*4.1.2 Organization against procurement levers.* Let us have a more detailed look at the relationship between “organization” and “use of procurement levers,” to interpret Table II more precisely: Table IV shows, that the most significant aspects to enhance the use of procurement levers by “procurement organization” are integration of the procurement function within the company organization and interaction of the

	Procurement levers Correlation	Comment
Strategy development	0.19	Not significant
Strategy implementation	0.26	Not significant
Strategy commodities	0.20	Not significant
Application of procurement levers	0.56	Highly significant

**Table III.**  
Strategy against  
procurement levers

procurement functions with the other units. Apparently, there is no effect by the structure of the procurement organization, coordination with other units and SQM:

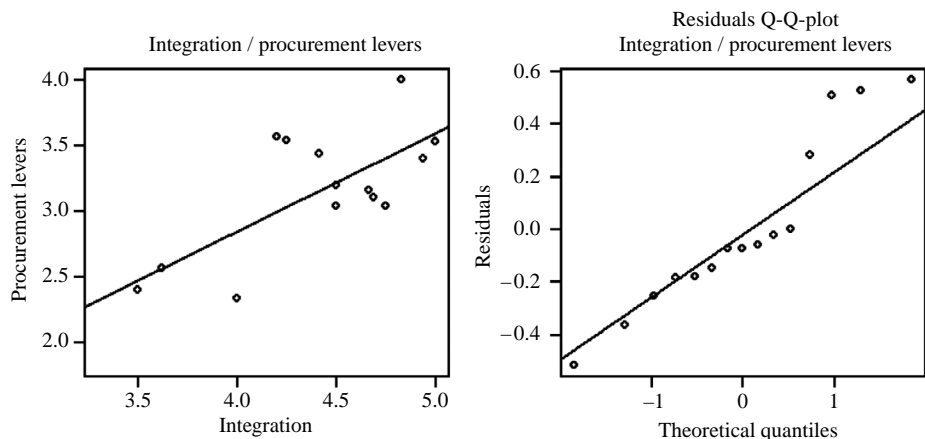
- *Finding 1 (Procurement success depends on integration).* The better the integration of the procurement unit within the company, the better is the overall application of the procurement levers and vice versa (Figure 3).
- *Finding 2 (Procurement success depends on cross-functional interaction).* The better the cross-functional interaction of the procurement with other units, the better is the overall application of the procurement levers and vice versa.

These findings are easy to understand if we think about a – realistic – scenario of un-coordinated sourcing activities of isolated procurement department that function mostly as fulfillment department for engineering or production. Demoted to order fulfillment, not integrated into decision-making processes and not respected cross-functionally for their expertise, a lot of procurement effort just evaporates, regardless which levers are applied. Note that in Section 4.4, a correlation between “integration” and “interaction” is proven.

Considering the clear result of Schuh *et al.* (2007) (Table I), that procurement best practice is characterized by central coordination vs local execution, we found a more informal characteristic of integration and interaction. It is worth to note, that all of the

**Table IV.**  
Details for the analysis of organization against procurement levers

	Procurement levers Correlation	Comment
Integration	0.75	Highly significant
Structure	0.1	Not significant
Interactions	0.6	Significant
Coordination	0.29	Not significant
SQM	0.04	Not significant



**Figure 3.**  
Use of procurement levers against integration of procurement organization within the company

**Note:** The correlation of “integration” vs “procurement levers” is 0.75

companies interviewed already structured their procurement organization in the way Schuh *et al.* (2007) suggests. Thus, a regression ansatz, which always compares relative contexts, cannot gain any further insights (we just unable to compare different organizational concepts if there are not any).

4.1.3 *HRs against procurement levers.* Table V and Figure 4 allow an in-depth look at the relationship between “HRs” (especially “education”[20] and “training”[21]) and “procurement levers,” see Fawcett *et al.* (2004) for a broader benchmark on the efficiency criteria of employees. We can state that the use of procurement levers is correlated with the training of the employees whereas the education level does neither provide a barrier nor an extra chance for the optimal exploitation of procurement levers:

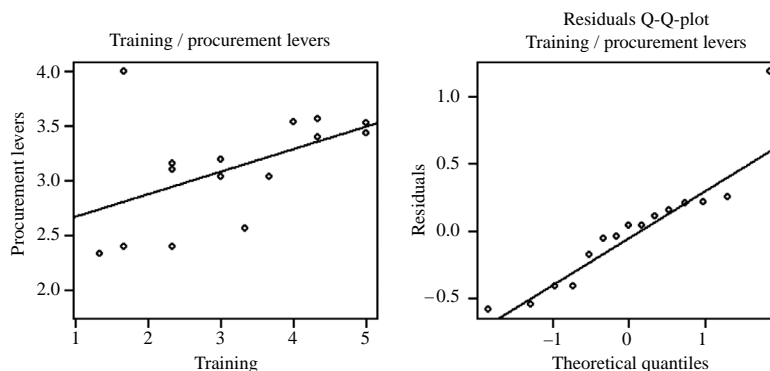
- *Finding 3.* The better the training, the better is the overall application of the procurement levers and vice versa.

This finding(s) surprised us momentarily. Knowing that a lot of procurement departments of even global players and cutting edge technology companies suffer from lack of expertise, the not existing correlation between education and the (successful) use of some procurement levers might be doubted. A tough negotiator does not necessarily has to carry a MBA or PhD degree but more advanced procurement levers like “reverse engineering” or “design to cost” do very well require a more basic understanding of engineering and cost calculation. Answering this section of the questionnaire, interviewees may have been biased through their own biography.

4.1.4 *Supplier management against procurement levers.* One of the core competencies of the procurement function is supplier management (Youssef and Zairi, 1996a, b; Briscoe *et al.*, 2004). It does not surprise, that a high correlation to the use of procurement levers can be found with this field (Table VI).

	Procurement levers Correlation	Comment
Education	-0.22	Not significant
Training	0.5	Moderately significant

**Table V.**  
Use of procurement  
levers against education  
and training



**Note:** The correlation of “training” vs “procurement levers” is 0.5

**Figure 4.**  
Use of procurement levers  
against training

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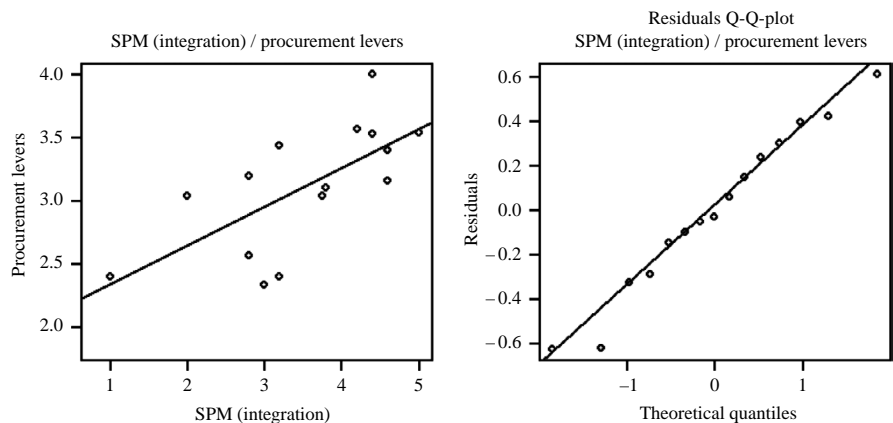
It is important to note, that the single sub-field “supplier integration” correlates rather strongly with the overall use of (all) procurement levers (commercial, technical, SCM) (Figure 5):

- *Finding 4 (Procurement success depends on supplier integration)*. The better the supplier integration, the better is the overall application of the procurement levers and vice versa.
- *Finding 5 (Procurement success depends on supplier evaluation)*. The better the supplier evaluation process (controlling), the better is the overall application of the procurement levers and vice versa.

The above-mentioned findings are pretty much self-explaining: a high degree of integration does definitely facilitate the application of almost every procurement lever. It is much easier to get into price negotiations or reverse engineering projects with suppliers closely aligned than others only remotely coordinated. Not to mention a faster pace of getting results, a higher “product-to-market-rate” and reduced failure rate. Also the correlation of procurement success and supplier evaluation does not come as a complete surprise. The more time you spend on pre-screening and filtering the set of possible suppliers, the more professional you calibrate filter criteria and the better you integrate an expert team of relevant departments, the higher the quality of the selected base of suppliers.

**Table VI.**  
Use of procurement  
levers against  
“supplier integration”

	Procurement levers Correlation	Comment
Supplier portfolio	0.35	Not significant
Supplier selection	-0.04	Not significant
Supplier controlling	0.53	Significant
Supplier development	0.5	Moderately significant
Supplier integration	0.68	Significant
SQM	0.04	Not significant



**Figure 5.**  
Use of procurement  
levers against  
“supplier integration”

**Note:** The correlation of “supplier portfolio management (integration)” vs “procurement levers” is 0.68

Comparing our results with Section 2/Table I, we recognize that the supplier portfolio and supplier selection as a key driver for procurement performance could not be rediscovered. Again, we seem to have a discrepancy between best possible theoretical procurement strategies and actual living of these strategies.

#### 4.2 Cross-functional teams against HRs

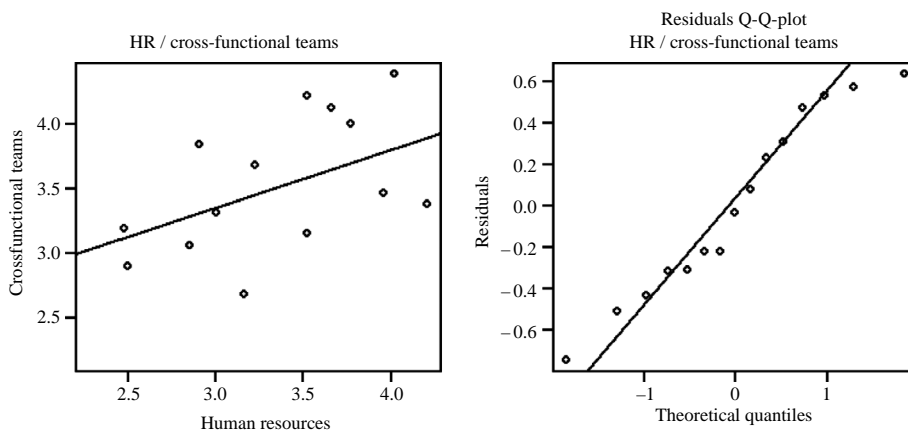
Second, the influence factors on cross-functional teams are inquired: the most significant correlation is that to “HRs” (Table VII and Figure 6).

The single most important factor for the correlation with cross-functional teams is “training”: Figure 6 shows a relationship of significance between the training[21] of staff and the integration of cross-functional teams. It is quite interesting to note, that the sub-fields for “training,” i.e. existence of a training plan, career advancement, and the measure of the employees satisfaction, alone do not lead to high-correlation factors, but instead enhance each other positively to gain the high-correlation factor of “training”:

- *Finding 6 (A holistic staff development program is key for cross-functional teams).*  
The better the training, the better is the efficient cooperation of cross-functional teams and vice versa (Figure 7).

	Cross-functional teams Correlation	Comment
Education	0.2	Not significant
Language competence	0.01	Not significant
Level of qualifications	0.01	Not significant
Level of special education	0.37	Not significant
Training	0.6	Significant
Training plan	0.37	Not significant
Career advancement	0.49	Moderately significant
Measurement of employee satisfaction	0.46	Moderately significant
Internationality	0.1	Not significant

**Table VII.**  
HRs against  
cross-functional teams



**Figure 6.**  
“HRs” against  
“cross-functional teams”

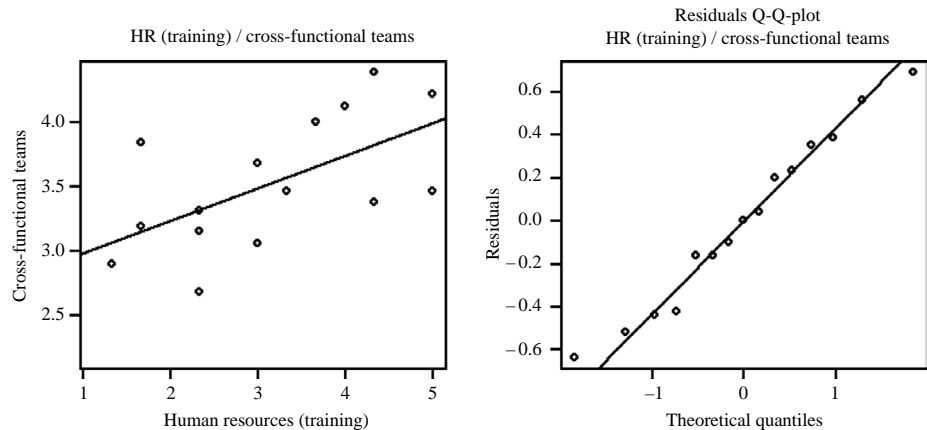
**Note:** The correlation is 0.5

Moreover, significant correlations between “cross-functional teams” and “integration” or “interactions” can be detected. There is a relationship highly significant relationship of “cross-functional teams” and “procurement levers,” too. The corresponding correlations are summarized in Table VIII:

• *Finding 7:*

- The better the integration (organization), the better is the efficient cooperation of cross-functional teams and vice versa.
- The better the interactions (organization), the better is the efficient cooperation of cross-functional teams and vice versa.
- The better the overall application of the procurement levers, the better is the efficient cooperation of cross-functional teams and vice versa.

This section provides some answers to questions regarding the impact of motivation, incentive, career opportunities and the overall appreciation of working in the procurement department within a company (i.e. cross-functional teams). Still, the procurement department does not belong to the “chosen few” departments where fast track careers are developed. Sales and marketing, production, research departments are considered better places to start a successful company career and learn the trade.



**Figure 7.**  
“Training” against  
“cross-functional teams”

**Note:** The correlation is 0.6

	Cross-functional teams Correlation	Comment
Integration	0.64	Significant
Interactions	0.76	Highly significant
Procurement levers	0.64	Significant

**Note:** Correlations between organization details (integration and interactions), procurement levers, and cross-functional teams

**Table VIII.**



Therefore, training facilities and career advancement plans are a vital part for successfully integrate procurement staff into cross-functional teams and leverage procurement levers.

#### 4.3 Analysis of effects by organizational changes

Finally, we ask whether there is any relation between organizational changes and the six fields (strategy, organization, processes, methods and tools, HRs, and supplier management).

Table IX shows the corresponding correlations: apparently the organizational changes of the last two years in the procurement department have no detectable effect on strategy, organization, processes, HRs, and supplier management (correlation  $< 0.10$ ). As you can see in Table IX the correlation between organizational changes and methods and tools is 0.22. Thus, if there are any effects by organizational changes they show up in methods (information management) and tools for e-procurement. (Note that the data basis is too small to consider any correlation  $< 0.4$ ).

#### 4.4 Internal correlation analysis

Last, we check the consistency of the given answers of the BM partners. This is done in a two-step approach:

- (1) We know that there are specific correlations within the sub-fields.
- (2) We check by means of correlation matrices if these relations occur in the answers.

To our first item: the questionnaire has specific correlations between some of the sub-fields of one field, in particular, we assume:

- “strategy development” against “strategy implementation”;
- “integration of organization” against “interactions”;
- “coordination” against “interactions”;
- “process security” against “involvement”;
- “ordering processes” against “logistic processes”;
- “supplier portfolio” against “supplier controlling”;
- “supplier portfolio” against “supplier development”;
- “supplier portfolio” against “supplier integration”; and
- “supplier development” against “supplier integration”.

	Organizational change Correlation	Comment
Strategy	0.03	Not significant
Organization	-0.06	Not significant
Processes	0.05	Not significant
Methods and tools	0.22	Not significant
HRs	-0.03	Not significant
Supplier management	-0.09	Not significant

**Table IX.**  
Effects by organizational  
changes

Next, Tables X-XV show the correlation matrices for the single fields. Here, we see exactly the expected consistent behavior of the answers, despite “internationality” and “targets” at the field HRs. We assume this side effect to be due to the small amount of gathered data. A careful inquiry of “internationality” and “targets” shows a rather instable behavior of the regression line with clearly patterns of the underlying data (column structure and staircase behavior of residual plot (Figure 8). Another ansatz would be to design the questionnaire a prior in such a way, that no interdependencies between the sub-fields are expected and later on check in the just conducted way, whether the correlation matrices are unit matrices (like in Table XIII).

Thus, we really have a consistent set of answers. This fact is supported by the impressions of the interview teams, that none of the BM partners was holding back information or construction unreliable positive statements about his procurement function.

### 5. Résumé

Throughout this paper, we have set-up a metric to measure procurement best practice by means of day-to-day tasks to be accomplished in order to select best suppliers and to implement cost cutting activities: the procurement levers. This metric was applied to reevaluate the performance indicators derived in earlier studies (as shown in Section 2).

**Table X.**  
Internal correlation  
strategy

	Development	Implementation	Commodity strategy	Procurement levers
Development	1	<i>0.66</i>	-0.16	0.19
Implementation	<i>0.66</i>	1	-0.33	0.26
Commodity strategy	-0.16	-0.33	1	0.2
Procurement levers	0.19	0.26	0.2	1

**Table XI.**  
Internal correlation  
organization

	Integration	Structure	Interactions	Coordination	SQM
Integration	1	0.03	<i>0.68</i>	0.48	0.12
Structure	0.03	1	0.28	0.01	0.29
Interactions	<i>0.68</i>	0.28	1	<i>0.62</i>	0.34
Coordination	0.48	0.01	<i>0.62</i>	1	0.39
SQM	0.12	0.29	0.34	0.39	1

**Table XII.**  
Internal correlation  
processes

	Involvement	Ordering	Logistics	Security
Involvement	1	0.28	0.44	<i>0.53</i>
Ordering	0.28	1	<i>0.53</i>	-0.03
Logistics	0.44	<i>0.53</i>	1	0.09
Security	<i>0.53</i>	-0.03	0.09	1

**Table XIII.**  
Internal correlation  
methods and tools

	Information management	e-Procurement
Information management	1	-0.02
e-Procurement	-0.02	1

The results of the regression analysis were further clarified and condensed into six key characteristics of superior performance (Figure 2). Table XVI compares our finding to the studies cited in Section 2 and displays the overlap between the known indicators and our results.

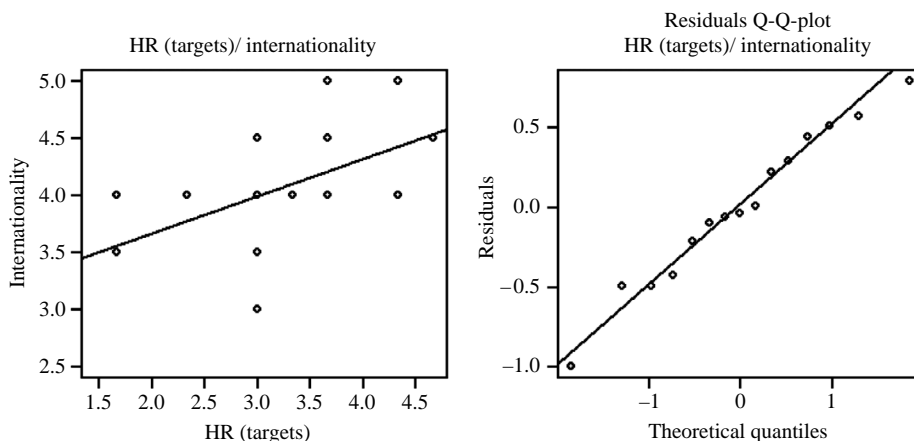
Though some intuitively plausible indicators for best practice identified in earlier studies could not be rediscovered. In particular, we mentioned the coherent formalization of a holistic procurement strategy and the structuring of the supplier portfolio. Concerning the still relative small data basis, these items should be clarified in further studies. Moreover, practical guidelines should be established to put these and further findings into actual procurement day-to-day practice.

	Targets	Education	Training	Internationality
Targets	1	-0.13	0.37	0.52
Education	-0.13	1	0.04	0.12
Training	0.37	0.04	1	0.44
Internationality	0.52	0.12	0.44	1

**Table XIV.**  
Internal correlation HRs

	Supplier portfolio	Supplier selection	Supplier controlling	Supplier development	Supplier integration	SQM
Portfolio	1	0.11	0.57	0.53	0.52	0.05
Selection	0.11	1	0.24	0.05	-0.15	0.24
Controlling	0.57	0.24	1	0.49	0.22	0.11
Development	0.53	0.05	0.49	1	0.63	0.32
Integration	0.52	-0.15	0.22	0.63	1	0.06
SQM	0.05	0.24	0.11	0.32	0.06	1

**Table XV.**  
Internal correlation  
supplier management



**Figure 8.**  
“Internationality”  
against “targets”

**Table XVI.**  
Comparison of our findings with the results provided in Table I

Field of excellence	Indicator (as found in our study)	Comparison with other studies (Table I)
Strategy and cross-company coordination	Hierarchical positioning within the company Cooperation with other units/functions Cross-functional teams	Senior management support for procurement Corporate thinking and cross-functional responsibility
HRs	HR training and development	Highly qualified buyers Procurement personnel must be on face value with other units
Supplier management	Continuous evaluation of the suppliers Supplier integration	Holistic supplier evaluation Supplier value integration and early involvement of key suppliers

**Notes**

1. See Brookshaw and Terziovski (1997) for the importance of procurement with respect to quality management instead of a mere cost perspective.
2. Because of the relative small number of BM partners and the fact that some of them are direct competitors (not to our client's company but among each other), the names of the benchmark partners need to be kept anonymous.
3. See, in particular Hyland and Beckett (2002) for the value of internal BM.
4. Tough, the answer alternatives for closed questions given in the questionnaire were selected with greatest care, often times the situation at the BM partners differed and the BM partners made mental leaps to forthcoming questions or provided additional valuable information.
5. Inter alias, the following sources were used to design the questions in this field: Frehner and Bodmer (2000), Hahn and Kaufmann (2000), Large (2006), Schneider (1990) and Stark (1994).
6. Inter alias, the following sources were used to design the questions in this field: Corey (1978).
7. Inter alias, the following sources were used to design the questions in this field: Boutellier *et al.* (2002), Strache (1991) and Wagner and Weber (2006).
8. Inter alias, the following sources were used to design the questions in this field: Kerkhoff (2006), Nekolar (2002) and Nepelski (2006).
9. Inter alias, the following sources were used to design the questions in this field: Fröhlich-Glantschnig (2005).
10. Inter alias, the following sources were used to design the questions in this field: Ferreras (2007), Hartmann *et al.* (2004), Janker (2004), Schiele (2006), Jahns and Moser (2005) and Jahns and Moser (2006).
11. See, e.g. Hofmann and May (1999) for an introduction into statistical analysis with Excel.
12. R is a language and environment for statistical computing and graphics. It is a GNU project which is similar to the S language and environment that was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S. One of R's strengths is the ease with which well-designed publication-quality plots can be produced. Great care has been taken over the defaults for the minor design choices in graphics (available at: [www.r-project.org/](http://www.r-project.org/)).
13. For references on statistics with R (Becker and Chambers, 1986; Dolic, 2003; Mairdonald and Braun, 2003; Murrell, 2005; Everitt and Hothorn, 2006; Ligges, 2006).

14. LaTeX offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout and bibliographies.
15. 1 was considered as practically no use of the specific lever and 5 as its total exploitation, i.e. the company does not see any way to further increase the use of this lever. The advantage of taking the procurement levers as a basis for further research is, that the degree of application of some of them can be directly gained from procurement data bases and an easy to conduct survey can be established among the buyers on what percentage of their contracts/commodities which lever was used during a specific time interval.
16. It seems that all these changes aimed to enhance the important fields of "integration," "interaction," and "cross-functional teams" to promote/enable procurement success.
17. The application of statistics and regression analysis in business and engineering has a long and fruitful history (Hald, 1952; Dielman, 1996; Czitrom and Spagon, 1997).
18. For an introducing text on linear regression (Fahrmeir *et al.*, 2004, p. 476; Assenmacher, 2003, p. 182; Maindonald and Braun, 2003, p. 107).
19. For an introducing text on correlation analysis (Kleinbaum and Kupper, 1978, p. 71; Sachs, 2002, p. 493).
20. That is to say, language competence, level of qualifications, and level of education.
21. That is to say, employee development and level of satisfaction: existence of training/continuing education plan, promotion of the development potential of employees, measurement of the level of employee satisfaction.

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