The procurement process

Refining inputs for Kraljic matrix yields objective purchasing portfolios and strategies

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The global sourcing landscape constantly produces new challenges, risks and opportunities, which makes purchasing and supply management increasingly complex. To ensure long-term availability of critical items at competitive costs, organizations require a well-developed purchasing strategy based on a systematic analysis. During the last two decades, most of the attention has focused on developing appropriate purchasing strategies that consider buyer-supplier relationship characteristics, interdependencies, strategy-based planning and product-based classifications. Procurement scholars and practitioners realized that a one-size-fits-all strategy does not exist.

Successful supply management needs to address different purchased items and buyer-supplier relationships with different purchasing strategies because the corresponding issues and challenges may differ significantly. For this reason, procurement experts in corporate practice proposed and implemented numerous purchasing portfolio models to classify items and derive effective purchasing strategies.

For example, Akzo Nobel Decorative Coating, which had €15.70 billion in revenues in 2011 ($20.86 billion), benefited from using a purchasing portfolio approach for procuring raw materials. Hewlett Packard ($127.24 billion in revenues in 2011) successfully implemented a purchasing portfolio approach to identify strategic and noncritical commodities for its daily procurement of nontangible services. Delta Airlines ($35.11 billion in revenues in 2011) used a similar approach for direct and indirect procurement of items. Likewise, DSM, which had €9.19 billion in revenues in 2011 ($12.21 billion), used a portfolio approach on the corporate level of the company, a strategy aimed at synergy and leverage across business units.

The earliest and arguably most prominent of these models was proposed by Peter Kraljic in 1983 in *Harvard Business Review*. The Kraljic portfolio matrix (KPM) works to match external resources provided by suppliers with the internal needs of the buying firm. For practitioners, Kraljic's approach has proved to be an effective tool for discussing, visualizing and illustrating the possibilities of differentiated purchasing and supplier strategies. Arguably, Kraljic's approach represents the most important single diagnostic and prescriptive tool available to purchasing organizations, and the KPM framework facilitates internal coordination and places emphasis on cross-functional teamwork to improve the internal coordination within business units.

However, while the KPM has influenced professional purchasing and received ample support, it has received a fair degree of criticism.

First, selecting the critical dimensions, such as supply risk and profit impact, is challenging, and the factors that determine the dimensions of the KPM are difficult to obtain. Further, giving weights to these dimensions is a difficult task. Positioning of the items in the portfolio matrix by the purchasing managers is subjective and makes the portfolio models imprecise or even arbitrary. The KPM also faces demarcation problems with respect to its dimensions because the commodities are categorized subjectively using dichotomous variables ("low" and "high") for both supply risk and profit impact. KPM does not consider involving suppliers when assigning different purchasing strategies to commodities and does not provide a finer relative classification of commodities inside the matrix. And last, since the commodities a company procures are interrelated and suppliers are not independent, the interdependency and relative distinction between the commodities and suppliers is important when assigning purchasing strategies; however, this is not explained adequately in present texts about KPM.

To address these issues, this article provides a toolkit to help managers place their purchase range in the KPM and provides clues on how they can move items within the model. Specifically, we propose a multiattribute decision making approach that assigns importance weights to different supply risk and profit impact factors. We then employ a multidimensional scaling (MDS) approach that locates the purchased items in the appropriate quadrant of the KPM. A case example of an automotive manufacturer is presented to demonstrate this approach.

Analyzing portfolios: An overview

Portfolio models typically begin by classifying products or buyer-supplier relationships while considering interdependencies among the same. Portfolios are then the basis for strategic planning. In practice, companies develop purchasing portfolios based on formal, documented systems, personal judgment and group meetings. Assigning an appropriate purchasing strategy is an important but complex task because the buyer-supplier relationships are different for different commodities.

Kraljic's initial portfolio model was based on determining the characteristics of the buyer-supplier relationship and assigning proper strategies to commodities. He suggested that all commodities and all buyer-supplier relationships are not to be managed in the same way. The KPM aims to develop different purchasing and supplier strategies by classifying commodities on two dimensions: profit impact and supply risk (low and high).

First, supply risk can be defined broadly using three factors:

1. Market risk: Availability of potential suppliers for the commodities, type of market (monopoly or oligopoly condition) and entry barrier to the market
2. Performance risk: Supplier's quality- and performance-related issues, which can include things like the supplier's access to new technology or the supplier's pace at adopting new technology
3. Complexity risk: Associated problems with standardization of the product or service. Specification of the products or services is critical.

Second, profit impact can be defined as:

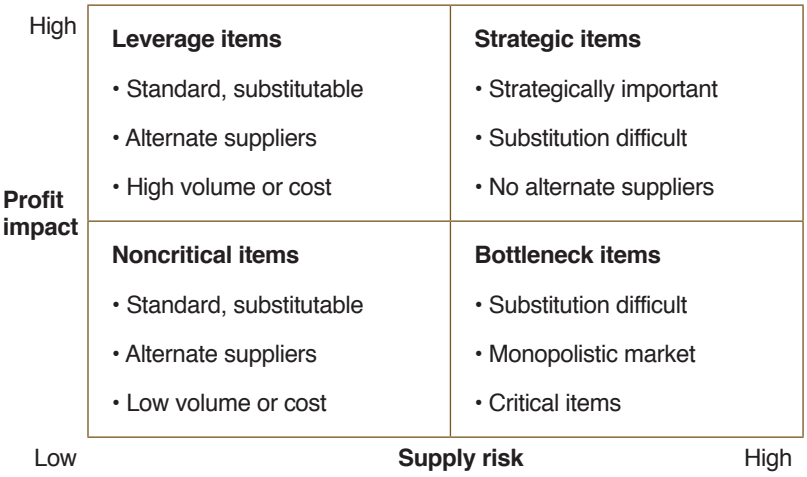
1. Impact on profitability: This factor seeks to address the typical profit yielded on the purchase of each commodity.
2. Importance of purchase: This factor seeks to address the importance or need of the purchase of each commodity.
3. Value of purchase: This addresses the tangible and intangible costs attached to or the value obtained from the purchase of each commodity.

These observations result in a two-by-two matrix that has four categories: bottleneck, noncritical, leverage and strategic commodities, as shown in Figure 1.

Each of the four categories requires a distinctive approach toward suppliers. By plotting the buying strengths against the strengths of the supply market, three basic power positions are identified and associated with three different supplier strategies: balance, exploit and diversify. The general idea of Kraljic's model is to classify the commodities by their preferred procurement strategy. This minimizes the supply risk and makes the most out of buying power to enhance the organization's purchasing performance and yield.

KRALJIC'S PORTFOLIO MATRIX

Figure 1. Each of the four categories of commodities in the KPM requires a different approach to suppliers.



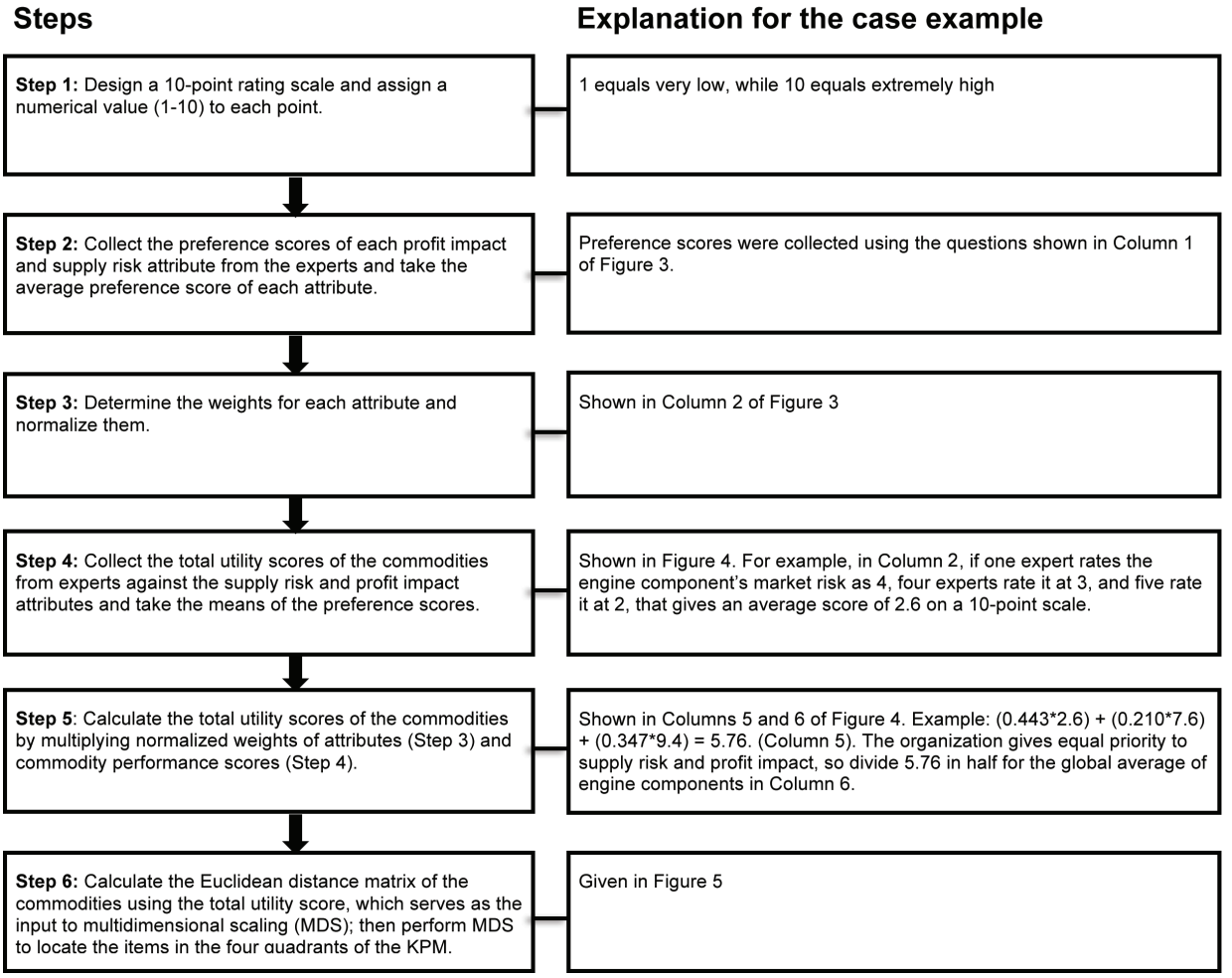
The KPM is arguably the most widely used framework in industry today. For example, comprehensive survey data among Dutch purchasing professionals have verified the credibility of his model. However, since Kraljic proposed his portfolio model, more advanced models have been suggested under various frameworks. For example, considering the interdependency between the buying company and suppliers, transaction-based business relationships depend on the attractiveness of the offer made by both sides. This leads to the second type of approach, tri-partitioning business processes to the product-classification process of industrial projects. The next approach is applying contingency-inspired frameworks to model the relationships among product, internal cooperation and inter-organizational relations.

Then the inter-firm relationship emerged. It considers the transaction cost analysis approach, which is based on asset specificity, frequency of economic exchange and uncertainty associated with the exchange of resources between buyer and supplier as the core dimensions of a transaction. In addition, three sets of relationships – customer (existing and potential), supplier (existing and potential) and indirect (e.g., company, firms, organizations, competitors, suppliers' suppliers and regulatory bodies) – were identified within a network, which recommends that firms should identify organizations that are using each of the three or a combination of the three portfolios of relationships and position the organizations within the portfolio of relationships.

Another suggestion advocated procuring industrial products by following the industrial network portfolio approach. Subsequently, strategic supplier portfolio perspectives considering risks, trade-offs and interdependencies of relationships between the firm and its suppliers were developed. Recently, a stakeholder-based model was designed that considered three organizational elements: policies (P), organization (O) and processes (P). These three "POP" elements help trans-

THE RIGHT FLOW

Figure 2. Procurement experts can use this chart to develop objective ratings for commodities before placing them in the KPM.



late the selected organizational strategy into an appropriate supplier strategy and clarify the idealized mix of suppliers in terms of portfolio archetypes.

The proposed approach

The above-mentioned purchasing portfolio models are based on buyer-supplier relationships and consider interdependency of relationship and strategy-based planning, but using product-based classifications to assign a suitable purchasing strategy has not been addressed properly. The time has come to give managers a simple tool to assess their own purchasing strategies.

The consensus method is based predominantly on a process of discussing and analyzing. Reaching consensus is critical when choosing what weights to assign to the factors and ultimately for positioning commodities in the KPM. Insightful discussions about purchasing issues are considered the most critical part of strategy development with the help of the KPM. The likelihood that experts will have different opinions is quite obvious. Therefore, reaching consensus is a major issue when assigning a commodity in the KPM.

Mapping commodities depends on various factors of supply risk and profit impact. As stated earlier, quite a few of these are qualitative and need to be assessed subjectively by the procurement experts based on their own experience. Such subjective judgment invariably makes the assessment imprecise, sometimes conveying multiplicity of meaning. The imprecise nature can be captured through a conventional ordinal scale to measure them and precisely determine their importance. A 10-point scale can capture high variation in the data. What follows demonstrates the use of such an approach for mapping automotive components in the KPM.

Specifically, the approach proposed by two of the authors, Padhi and Wagner, along with V. Aggarwal in the

March 2012 *Journal of Purchasing & Supply Management,* combines multiattribute decision making and MDS techniques to determine the importance weights of the supply risk and profit impact factors to position the automotive components in the KPM. The approach consists of six steps shown in Figure 2.

Weighing risks and impact

To test the proposed methodology, the researchers applied it to an automotive original equipment manufacturer that procures more than 2,050 different product items and services to carry out its normal operational responsibilities and manufacture cars. Based on this company's total cost of purchases in 2010, 19 items were selected for this analysis. The 19 items account for 80 percent of annual purchase value.

Following steps one through three of the flow chart shown in Figure 2 determines the normalized preference scores of the supply risk and profit impact factors. Ten procurement experts were asked to rate the factors on a 10-point rating scale anchored at one (very low) and 10 (extremely high). Figure 3 provides an overview of the normalized preference scores the 10 experts gave for supply risk and profit impact.

Next, following steps four through five of the flow chart in Figure 2 determines the performance score of the supply risk and profit impact factors for 19 selected automotive components. Ten of the company's procurement experts were asked to rate the items on a 1-to-10 scale on supply risk and profit impact factors. Figure 4 gives the performance scores of a few selected commodities.

With the preference and performance scores of the supply risk and profit impact factors, step six of the flow chart uses MDS to obtain an overall visual positioning of the 19 selected items since the six factors (three each

WHAT'S THE SCORE

Figure 3. The normalized preference scores of 10 procurement experts regarding supply risk and profit impact.

Supply risk	Preference score
How much preference do you give to *market risk* while purchasing products/services for your organization?	44.3%
How much for *performance risk*?	21%
How much for *complexity risk*?	34.7%
Profit impact	**Preference score**
How much preference do you give to *impact on profitability* while purchasing products/services for your organization?	23.5%
How much for *criticality of purchase*?	31.8%
How much for *value/cost of purchase*?	44.7%

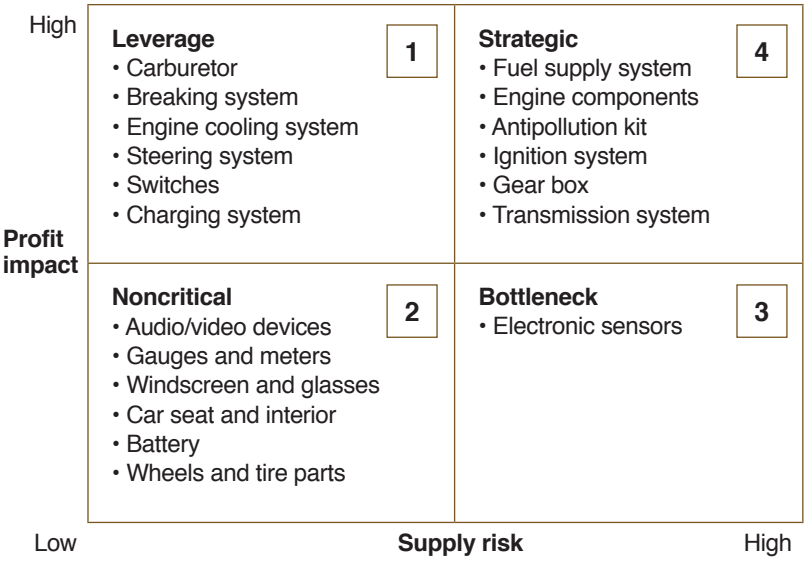
PARTS AND SERVICE

Figure 4: Performance score of selected commodities

How do you rate the item based on supply risk and profit impact criteria on a scale of 1–10?	Average supply risk					Average profit impact				
	Market risk	Performance risk	Complexity risk	Weighted average	**Global average**	Impact on profitability	Criticality of the purchase	Cost/value of purchase	Weighted average	**Global average**
Fuel supply system	2.4	7.8	9.6	5.79	**2.90**	9.8	9.0	9.6	9.46	**4.73**
Engine components	2.6	7.6	9.4	5.76	**2.88**	9.2	9.0	9.2	9.14	**4.57**
Audio/video devices	4.2	2.1	2.1	3.03	**1.50**	2.0	2.6	2	2.18	**1.09**
Gauges and meters	3.2	2.4	2.4	2.75	**1.38**	4.6	3.8	3.8	4.00	**2.00**
Carburetor	1.8	2.0	1.4	1.79	**0.90**	2.0	2.8	3.2	2.79	**1.40**

THE RIGHT QUADRANTS

Figure 5. The proposed process maps automotive items into different quadrants of Kraljic's portfolio matrix.



of supply risk and profit impact) are now classified into two dimensions of the KPM. Next, the Euclidean distance matrix (reflecting the pair-wise perceived preference similarity) of the 19 items is computed based on the two characteristics that will serve as the data input for MDS.

Providing this data as input to MDS (which is implemented in many general purpose statistical software packages, e.g., SPSS, STATA, R), the result reveals an acceptable output at the 0.01 level of significance ($p < 0.01$) in a two-dimensional space. The positioning of the 19 items in a two-dimensional coordinate system of the KPM is shown in Figure 5.

The MDS-output matrix indicates that the 19 items form three distinct clusters in different quadrants. The preference distance among items like fuel supply system, engine components, anti-pollution kit, ignition system, gear box and transmission system, based on the two aspects of evaluation criteria, is very short (i.e., they are very similar). In other words, if one takes "supply risk" and "profit impact" into account together, they are perceived to be the manufacturer's strategic items due to the high supply risk from the supplier side and their high profit impact. Thus, they are positioned in the fourth quadrant of the KPM. However, the decision makers suggested that electronic sensors, while close to the previous items, have a lower profit impact. This shifts that item to the third quadrant, which represents the bottleneck items.

The preference distance among audio/video devices, gauges and meters, windscreen and glasses, car seat and interior, battery and wheels and tire parts, based on the two aspects of evaluation criteria, also is very short (i.e., they are very similar). With low "supply risk" and "profit impact," they are classified as noncritical items and positioned in the second quadrant.

Finally, we are left with the first quadrant of the KPM, which contains items that have a low supply risk and a high profit impact: carburetor, breaking system, engine cooling system, steering system, switches and charging system.

After the matrix was filled, the framework was validated twice: through interviews with the experts and through a questionnaire analysis. Wherever necessary, manual adjustments were made. As mentioned earlier, in-depth discussions on the positions in the matrix are considered the most important phase of the analysis. Strategic discussions provide deeper insights and might lead to consensus-based decisions. The experts and respondents said the Kraljic framework, to a large extent, facilitated these important discussions.

Objectivity over subjectivity

The KPM has gained increasing recognition by purchasing professionals, especially in North America and in Europe. However, historically, positioning commodities in the KPM has been based mainly on the subjective judgments of decision makers. This approach lacks analytical rigor and could lead to erroneous outcomes, which adversely affects purchasing strategies.

The multiattribute decision making approach presented here determines appropriate weights for the supply risk, profit impact factors and performance scores of the commodities. The proposed approach has important managerial significance as it improves upon the quality and confidence of managerial judgment.

The proposed approach's major advantage over subjectively positioning commodities is that it gives a clear snapshot of the commodities to be bought using a particular group of purchasing strategies. Moreover, the proposed approach reduces the dimensions to supply risk and profit impact. It also gives a clear representation of what dimensions are used to map the commodities into the KPM's four quadrants.

Supply risk and profit impact factors are dynamic, so management can investigate any new factors that significantly contribute to both dimensions of the KPM while mapping the commodities using the suggested framework. Involving suppliers in the survey for classifying commodities also can be explored.

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