Practical Product Component Risk Analysis and Management

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Abstract. The primary aim of purchasing risk management is to improve the profitability of individual products or product systems, at each stage of the product life cycle, through engendering a greater commercial awareness of the underlying cost drivers and risk profiles. This, in turn, should facilitate the development of assigned action plans, resulting in enhanced management control of the identified costs and risks, and a concomitant improvement in productivity.

The rationale for implementing a purchasing risk management can be expressed simply:

a) the primary purchasing risk is that of failing to achieve the material cost target; and,

b) once a product cost model has been established, greater control of the profit margin can be gained through understanding, and reducing, the risk profile of the product.

The presenters will delineate a suggested practical product component risk analysis and management process, starting with an overview of the intended benefits, followed by a description of the principles, and finally an overview of some recommended tools.

The Opportunity. This session is aimed at giving those supply management professionals involved in seeking to either enhance income, or reduce cost, through systematic risk reduction, the background information and tools to support this process.

The suggested approach has been predicated on identified academic studies, complemented by the practical experience of piloting the process in-house within the Alcatel USA business division. Due to the international nature of Alcatel's business, the objective was to define a set of guidelines, rather than a rigid procedure, complemented by a number of practical tools including Bill of Materials (BOM) datasheet analysis, strategic component analysis, product component risk assessment matrices, purchasing risk management checklists and product component risk management action plans.

Specifically, the product component risk management process presented:

(i) proposes classifications for the different types of component risk;
(ii) utilises tools to identify and objectively quantify these different risks; and,
(iii) explores how these quantified risks can be systematically reduced or contained through the deployment of assigned action or risk management plans.

The application of the process should result in an improvement in product profitability, either directly through a reduction in purchasing cost, or indirectly, through the avoidance of the various consequential costs associated with poor risk management such as emergency purchases through brokers, interim product substitution, or lost future income resulting from customer defection.

Objectives. Our objective is to present practical information for supply managers regarding:

(a) an understanding of the different types of product component risk;
(b) a methodology for quantifying, tracking, reducing or containing each type of risk; and,
(c) suggested tools for implementing the risk management process.

(a) **Understanding the Different Types of Component Risk.** Risk can be defined generically as a measure of the likelihood and consequence of a particular occurrence. We have defined product component risk as a measure of the potentiality for a particular component to have a negative impact upon the end product, system or sub-system.

The collective product component risk subcategories identified are the following.

Critical	Long lead-time or limited availability
Key	Strong impact on product costs
Strategic	Strong contribution to product value (performance, differentiation)
Technical	Carries technical risk that may delay component qualification, product design or limit availability

The term “focus parts” refers to components classified as having critical, key, strategic, or technical risks. All other components can therefore be categorised as “non-focus parts”.

(b) Methodology for Quantifying, Tracking and Reducing Each Type of Component Risk. The product component risk management process focuses on design, cost, availability, and manufacturability risks. An enlargement of the process could include legal, quality, and environmental, health and safety impacts. The process is supported empirically by a product material costing activity in order to track the material cost of the equipment/product and the price evolution. Finally, the supply base risk is complementarily managed through a supply management process.

Product component risk management is an ongoing activity throughout the product life cycle from new product introduction to end of life, and should drive all purchasing activities. The process is iterated on a regular basis (quarterly, biannually or annually), depending upon the occurrences of new conditions in the market, technology etc., or on the identified risks attached to a particular product line. The process comprises three main activities:

(i) an identification of the product/system BOM;
(ii) an assessment of component risks; and,
(iii) the development of related action plans.

(i) An Identification of the Product/System BOM. The objective is to first identify the product or system, sub-product or sub-system, and then, to list all the current and future components used to produce it. There are two main methodologies, which should be considered.

- A top-down analysis using a generic model of the product line generated from R&D's standard configurations, and from Marketing's annual demand weighted product sales forecast. The resultant BOM should represent a model of the average product/system.
- A bottom-up analysis using specific product models relating to identified key products/systems based upon R&D and Marketing information. The process may focus on several specific sub-system part number lists covering a range of key equipment/products. These key equipment/products are identified in collaboration with Marketing.

The product component risk management process described below could be based on the results of a combination of the two approaches.

(ii) An Assessment of Individual Component and Weighted Product/System Risks. The objective of a risk level review for a particular product/system line is to decide for which components the risks need to be managed. The product/system BOM models generated above are analysed and the components divided into two broad categories:

- focus items, as described above, for which an individual component risk is evaluated using both quantitative and qualitative metrics as appropriate; and,
- non-focus items, which are not considered to warrant individual risk assessments.

A weighted risk factor can be defined for each product/system by aggregating all of the individually calculated focus component risks.

The definition and risk status of an individual component may evolve throughout the product life cycle and therefore, all components need to be monitored and reassessed at predetermined intervals.

(iii)The Development of Risk Management Action Plans. Having identified the focus components and the weighted product/system risk factor, the objective is either to maintain this weighted risk factor, or seek to systematically reduce this weighted risk factor to an acceptable level within an agreed period of time (the decision is based on a cost benefit analysis of whether the value derived from a planned risk reduction is greater than the costs of achieving that risk reduction). To support this, risk management action plans are drawn up and monitored via regular internal reviews to assess progress, specifically:

- for focus items, a dedicated action plan with direct involvement from an interdepartmental team including Purchasing, R&D, Manufacturing and Marketing; and,
- for non-focus items, an economical call-off solution based on a trade-off between working capital and structure costs.

(c) Suggested Tools for Implementing the Risk Management Process

(i) BOM Datasheet Analysis. At the design stage of the product life cycle for a new product, a proforma BOM spreadsheet can be constructed which identifies each of the intended components. For those components currently used in the manufacture of existing products, the latest negotiated terms and conditions can be inputted into the proforma BOM spreadsheet. For those components not currently used in the manufacture of existing products, forecast terms and conditions can be inputted into the proforma BOM spreadsheet based upon similar products, existing suppliers etc. In order to reduce the time spent constructing the proforma BOM, all existing BOMs need to be updated regularly throughout their product life cycle; perhaps, this could be automated using, for example, an Enterprise Resource Planning (ERP) system.

The proforma BOM spreadsheet can then be manipulated to identify possible key and critical focus components (see above).

Key components have a strong impact upon costs and can be identified by performing a datasheet analysis based upon the total % product material cost that is attributable to the use of a particular component.

Critical components are those that have a long lead time or limited availability and can therefore delay or prevent the production of a particular product. Performing a datasheet analysis based on lead-time information can help to identify them. The component lead-time threshold should be agreed by Purchasing with Sales and Marketing.

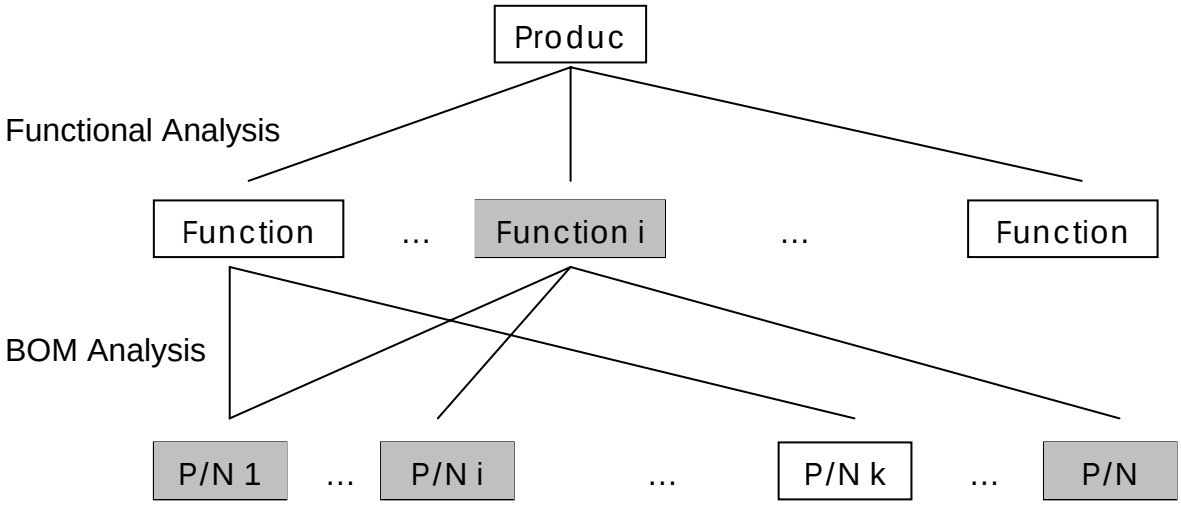
Technical components involve the development or use of new technology in their production, and therefore carry a technical risk that may delay component qualification, product design, or production of the new product. These components can be partially, but not satisfactorily, identified using quantitative datasheet analysis. Instead, Purchasing should liaise with R&D and Manufacturing to determine the technical components, which are likely to be few in number.

(ii) Strategic Component Analysis. Strategic components are those components that either contribute strongly to the product performance or are fundamental to the differentiation of the product in the market place.

These components cannot be identified satisfactorily through quantitative datasheet analysis – instead they need to be identified using a tool such as functionality analysis. The initial input should come from Sales & Marketing who, through market research on their customer base, can identify the key functionalities of the new product that will influence the buying decision, and differentiate it from competitive offerings.

Purchasing, with support from Operations or Manufacturing, can then take this list of key functionalities to analyse, produce a related mini-BOM, and identify the strategic parts that help to deliver these functionalities.

Figure 2 Strategic Analysis



(iii) Product Component Risk Assessment Matrices. Having identified the focus components, risk assessment matrices can be used to derive a weighted, or unweighted, risk factor for each identified focus component; and, a weighted risk factor for the product or system as a whole.

For example, in the case of a strategic component, the properties of the individual component would be compared against the seven suggested criteria included in the strategic components risk assessment matrix and a score determined for each criteria. These scores would then be totalled, and expressed as a percentage of the maximum possible total to determine the relative risk factor.

(iv) Purchasing Risk Management Checklists. In addition to the purchasing risk assessment matrices, purchasing management risk checklists can be used as a complementary tool to assess component and supplier risks at specific stages in the product life cycle; for example, as an input into the business case, at the product design stage and before mass production.

(v) Product Component Risk Management Plans. After scoring all the focus components in a product, the components can then be ranked by individual risk factors to determine the priority for developing risk management plans.

Using weighted averages, the risk profile of the individual product can be calculated and tracked over time to monitor progress in reducing the portfolio risk to a predetermined acceptable level, or maintaining the portfolio risk at the current level, depending upon the results of the cost benefit analysis (this process could be replicated at a commodity family level if the purchasing organisation is predicated upon commodity families rather than products or systems). Targets for risk reduction could be set at the global product or system level and at the individual component/commodity family level. Regular updates on progress should be produced and, if necessary, these could be collated and audited independently.

The development of associated risk management action plans can then help enhance management control through directing resources towards the reduction of risk to an acceptable level for products, systems or components with identified high risk factors.

There are many generic solutions which can be utilised or adapted to reduce/maintain the identified risks associated with both focus and non-focus items: for example, the use of a substitute component with functional compatibility, or a product redesign.

Finally, similar practical product component risk management principles can be applied to products or systems at other stages of the product life cycle through an analysis of the empirical bills of materials.

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