CAM-I Blue Book

Resource Consumption Accounting

(RCA) and Marginal Analytics

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Introduction

An exploratory meeting on Resource Consumption Accounting (RCA) as a potential topic for an interest group at CAM-I took place at the Q3/2001 meeting in Jackson Hole, WY. A further validation meeting took place during the Q4/2001 meeting in San Diego, CA. The interest group was officially launched and had its first meeting, Q1/2002 in Charleston, SC with the objective of understanding and communicating the benefits of RCA to CAM-I and its sponsors. To this end the Resource Consumption Accounting Interest Group (RCA IG) delivers this, its second deliverable, in the following pages.

RCA as a comprehensive management accounting approach has the potential to have a significant effect on a wide array of areas within the typical enterprise. In order to demonstrate real and specific value to potential adopters of the approach, the scope of this deliverable had to be defined relatively narrowly. This also allowed the RCA IG to focus on one specific topic and ensure a value added and credible deliverable.

Scope of the Deliverable

The Interest Group decided to peg the scope of the deliverable around decision support and in particular management actions concerned with resources application decisions in an enterprise – this domain is hereafter referred to as marginal analytics. The reasons for limiting the scope to marginal analytics were threefold:

- members within the RCA interest group indicated that current management accounting approaches were not complete when it comes to support for incremental resource application decisions,
- people in practice indicated that there are a number of business decisions not adequately supported by extant management accounting methodologies, and
- the need to demonstrate a sound and consistent treatment of cost behavior as a key element in marginal analytics and effective decision support. Existing management accounting approaches espouse conflicting views on cost behavior. Moreover, some approaches have been inconsistent in reflecting the fixed and variable nature of costs i.e., initially portraying costs as predominantly variable and then later as predominantly fixed.

Deliverable Scope in Perspective

The drawback of limiting scope to one specific aspect of RCA is that the approach will be perceived very narrowly--in this case as primarily a modeling tool. To portray RCA as one-dimensional would do the management accounting discipline's learning, over the last five to six decades, an injustice. Moreover, one might also end up misleading practitioners as to RCA's

comprehensiveness and its integrated nature. The material presented in this deliverable on marginal analytics and RCA must therefore be viewed within the broader capabilities of RCA.

Consider, by way of example, the role planning in RCA plays in providing marginal analytic information. The importance of planning in RCA cannot be over emphasized; in fact, none of what is presented in this deliverable on marginal analytics can be achieved without a rigorous planning regimen. This is because planning in RCA is not a case of using allocated data to impute the future as is typical of snapshot or traditional planning models. Instead in RCA modeling, cause and effect relationships and consumption behavior are used to express recognized realities in enterprise economic dynamics. Reflecting these economic dependencies in an RCA cost model enables the extrapolation of input-output relationships and cost behavior - for predictive purposes. RCA therefore incorporates the two foundational principles of management accounting (i.e., causality and analogy) very early on in its Analytical Cost Plan (ACP).[1] As will be illustrated in this deliverable, the ACP for a cost object in an RCA model contains all of the quantity-based input and output information as well as the cost behavior characteristics to support marginal analytics. Such a quantity-based forward-looking view of enterprise economic activity is indispensable to good marginal analytic information. Marginal analytics is after all about supporting decisions considering changes in the future application of resources.

In RCA, planning is not only the cornerstone of establishing the cost model; planning is also ingrained in a number of other aspects such as alternate uses of the management accounting information and enabling other organizational processes in the enterprise. To put this deliverable's scope in the broader perspective of RCA's comprehensiveness and integrated nature, consider the impacts planning in turn has on the following aspects of the management accounting domain:

- management's processes - the optimization of converting inputs into desired outputs - and doing so in the face of perpetual internal and external change - must be enabled by the management accounting system. A forward-looking enterprises in general and proactive managers in particular, play an indispensable role in achieving optimization. RCA recognizes these realities through its emphasis on accommodating managerial planning, control and analysis processes in a single model,
- control - the calculation of authorized consumption quantities and costs to asses deviations from the plan or target,
- analysis - using standards in understanding deviations,

[1] Van der Merwe, A. 2007. The Management Accounting Philosophy series: Cornerstones for Restoration. *Cost Management.* Sept/Oct Issue. RIA Group. New York, NY.

- management's corrective and adaptive actions - simulating options management is considering in response to change,
- performance management - providing relevant benchmarks to reward for actual results, and
- integration - it is broadly accepted today that integration – both conceptual integration and data and object integration using information systems technology – has to be a basic tenant of the management accounting system. For example, planning cannot effectively be done in a disjointed (conceptual and/or technological) environment. RCA is currently the only management accounting approach capable of satisfying both conceptual and technological integration demands.

The demands that marginal analytics places on a management accounting system – as presented in this deliverable – and how RCA satisfies those demands must be viewed against the much broader background of RCA's comprehensiveness and its integrated nature. To this end appendixes on Planning and Capacity Management are provided. Only within this broader view can the reader fully appreciate the potential of RCA and the benefits it holds to adopters.

Deliverable Content

Given the scope and objective of the deliverable it has been structured as follows:

Chapter 1 – Introduces marginal analytics, presents a formal definition for it and indicates why it is important. This is followed by an overview of the information requirements for effective marginal analytics. These requirements are grouped into two categories: (1) the need to anchor management accounting in operations quantities, and (2) the need to structure management accounting information to enhance its relevance to the decision maker.

Chapter 2 – Presents research that was done into current needs and practices around marginal analytics and the information companies typically provide managers for decision support. The research entailed collecting data through an online survey from 115 companies who responded to solicitations to participate in the survey. Responses were collated and analyzed to gain empirical insight into the methods used to calculate marginal analytic information as well as the use and credibility of the information amongst its providers and users. The survey used in collecting the data can be found in Appendix A.

Chapter 3 – Illustrates how Resource Consumption Accounting addresses the marginal analytic information demands identified in Chapter 1. For each of the demands the RCA modeling approach or data structure, as applicable, is presented and discussed. The Chapter concludes with an illustration of how the RCA principles applicable to marginal analytics provide superior decision support information.

Chapter 4 - Provides detail on a case study (the Onsemi case) undertaken to validate the information provided by RCA to support marginal analytics. Onsemi is a manufacturer of semi-conductor products for a variety of industries. The Onsemi case study entailed the design and construction of an RCA model for one manufacturing plant. RCA information were generated for resource pools, products and multi-dimensional product P&L's.

Chapter 5 – Entails a discussion of the application of RCA principles in the Onsemi case study. Specifically, five resource application decision scenarios were modeled to provide insight into their impacts and to demonstrate RCA's support of marginal analytics. In particular this chapter ties the results back to the marginal analytic and RCA principles and their application in Chapters 1 and 3. The need for the consistent application of RCA principles is clearly highlighted to be able to achieve the desired benefits.

A number of appendixes are also provided.

Appendix A - The online questionnaire used in the research into marginal analytic information and its use.

Appendix B – Glossary of terms for Resource Consumption Accounting introduced in chapters 1 and 3.

Appendix C – Special Topic on the relevance of planning and forecasting for Resource Consumption Accounting. This appendix serves to put the marginal analytic topic of this deliverable in a broader context.

Appendix D – Special Topic on the management of capacity supported by Resource Consumption Accounting.

Chapter 1: Marginal Analytics and The Demands It Places on Management Accounting

Introduction

Management action that introduces change in the enterprise often requires analysis to select the most appropriate decision alternative to implement. In a going concern (i.e., one with deployed resources, current products/services, target markets, and customers) such change has to demonstrate gain over the existing application of resources.

Enterprise strategic objectives provide a framework and overall direction for these managerial actions. For tactical and operational level managers the enterprise's strategic objectives must be broken down into lower level objectives to ensure clear and concise guidance of individual managers' decisions. These lower level objectives must be specific to the areas of responsibility and influence of individual managers and are referred to as managerial objectives.

Managerial Objective: A desired result or outcome of the application of economic goods and services that management chooses to measure, plan, control and/or optimize.

To enable effective causal insights into potential outcomes, individual managerial objectives must further be broken down into their respective outputs and the inputs required to achieve them.

Output: A quantitative measure of a managerial objective.
Input: A unit of resource or resource capability required to achieve a specific managerial objective.

Such a granular input-output view of the larger enterprise's goals and economic flow of goods and services supports the detailed analysis typical of resource application decisions (i.e., marginal analytics). Managers are provided with a clear picture of current resource application dynamics as well as a mechanism for assessing proposed changes in resource application. Moreover, a corresponding monetary view of operations contributes to individual managers making effective contributions to the achievement of enterprise objectives.

Going beyond decision support, the information used in marginal analytics is also important in a number of other areas. For example (1) in gauging how effectively the enterprise is being managed, (2) measuring and rewarding individual managers for their contributions, (3) for planning and measuring enterprise execution, and (4) guiding the whole management team towards goal congruence. Marginal analytics is therefore not only key to the sustained competitiveness and profitability of an enterprise but the information it requires also plays an important role in the larger endeavor of effectively managing an enterprise. Below a formal

definition for marginal analytics is provided before the demands marginal analytics places on the management accounting system are identified and discussed.

Marginal Analytics Defined

In an enterprise, management actions - whether adaptive (changing the company's strategy/plan) or corrective (steps to close the gap to the plan/stay on track) - are required to continuously optimize the conversion of inputs into desired outputs. The analytic domain concerned with the evaluation of the resource application alternatives, which management has in a particular decision scenario, is termed 'marginal analytics'.

Marginal Analytics: The discipline concerned with the evaluation of anticipated change in performance due to resource application decisions.

Cost information provided by the management accounting system is a crucial element of the overall optimization process. In decision making cost information serve as a common denominator to select an optimum alternative from among otherwise incomparable options. In particular, relevant costs feature prominently as information indispensable to the marginal analytics decision-making process.

Relevant Costs: Opportunity costs and/or future net cash flows associated with changes in output and securing the resources required to successfully execute a decision alternatives.

The appropriate costs to consider in decision making vary greatly, for example from:

- throughput costs (when deciding to produce one additional widget), to
- incremental costs (the difference in total cost between two alternatives in a decision), to
- short run variable/proportional costs (when considering the opportunity cost of mutually exclusive uses of resources), to
- attributable costs (for divestment decisions such as a bank outsourcing its information technology function), to
- full costs (for strategic decisions such as a tool manufacturer entering the South American market by establishing a plant in the region).

The dependence of marginal analytics on relevant cost information, which management accounting must provide, dictates that cost information be derived based on the principle of causality. This is because decisions by nature involve inferences about future outcomes based on current causal insights. In order for a management accounting approach to consistently provide causally relevant and accurate information, for the wide range of decision scenarios encountered in practice, the approach must satisfy the following two categories of requirements:

- incorporate key characteristics of an enterprise's economic flow of goods and services in the design of the management accounting system, and
- structure the management information provided to enhance its relevance to individual decision scenarios.

These two categories of requirements are discussed in more detail in the next two sections.

Requirements: Category 1 - Incorporate Key Characteristics of Economic Activity

Management's role is to direct, or at worst, to influence the enterprise's economic activity – the acquisition and consumption of inputs and their conversion into specific outputs - with the aim of achieving stated enterprise strategic objectives in an optimal manner. The management accounting system must serve as the primary enabler in this regard by incorporating the following four characteristics of economic activity in the information it provides:

- an accurate rendering of an enterprise's flow of economic goods and services,
- causality as quantitative and often reciprocal relationships,
- link quantitative flow of goods and services to their monetary implications, and
- provide insight into input-output behaviors - and their respective costs - given the enterprise's existing value chain configuration.

Each of these requirements is discussed in the next section in more detail.

Requirement 1.1: Accurately Depict Enterprise Flow of Economic Goods and Services

There are at least three reasons why the accurate rendering of an enterprise's managed flow of goods and services are important:

- To effectively manage the application of resources (i.e., the how, when, where and how much of resource application). Such a model should assist management in estimating, forecasting, simulating, measuring and analyzing impacts related to one or more variables they want to manipulate or have manipulated in exerting influence on enterprise economic activity.
- The typical enterprise is complex, its operations exposed to the vagaries of uncertainty and subject to both internal and external sources of change making it essential to represent enterprise economic activity in a model that can effectively serve the adaptive and corrective aspects of managements' endeavor.
- The bulk of decisions in an enterprise use existing operations as a baseline. Only with an accurate rendering of the current application of resources can effective incremental analysis for decisions be supported.

Requirement 1.2: Reflect Causality as Quantitative and Reciprocal Relationships

Causality is an overriding principle in management accounting. An accurate model of enterprise economic activity is only possible if the causality principle is consistently satisfied in modeling. Moreover, causality is the basis for all inferences in decision-making and is therefore important in (1) deriving management accounting information and (2) using that information in decision-making.

The proper modeling of causality in management accounting necessitates the distinction between the strong and weak forms of applying the principle. The strong form of causality exists when the consumption relationship can be explicitly quantified e.g., a machine's consumption of electricity when it is used relates directly to the hours the machine is used. In these instances there is a requisite dependency between the output (machine hours) and the input (kilowatt hours). On the other hand, the weak form of causality exists when the input-output relationship cannot be quantified but there is nevertheless an association. For example, a machine is dedicated to making products A and B (two products comprising a product group). What is the relationship of the machine's excess/idle capacity costs to products A and B? The cost of the machine had to be incurred to make products A and B but the relationship between the products produced and the machine's idle time cannot be quantified. To illustrate, consider the addition of product C to the product group, which consumes some of the machine's excess/idle time. Although the machine's idle time decreases, there is no effect on the units of products A and B produced. With the weak form of causality there is no requisite dependency between the output (units of Products A and B produced) and an input (the excess/idle cost of the machine). Nevertheless, there is an association that is important to marginal analytics i.e., in a decision to discontinue the product group the machine's excess/idle capacity cost is clearly an avoidable cost. Reflecting this association for decision support purposes is important. Marginal analytics therefore requires the proper treatment of the principle of causality in management accounting modeling – in both its strong form and its weak form.

The bulk of the relationships in a management accounting model will be of a quantitative nature. The view of causality appropriate to marginal analytics is not money centric as traditionally viewed. Instead for the purposes of marginal analytics monetary (cost) flows only occur as a result of resource quantities or units of resource output consumed. This duality in expressing causal relationships (i.e, quantitative with a subsequent valuation) is an important marginal analytic requirement which flows from requirement 1.1 above.

Another important characteristic of causal relationships is that they are often dependent on the nature resources; resources are the primary determinants of a large number of causal relationships. For example, a human resource function is required because people are employed or, the deployment of large extrusion machines will require a plant maintenance function. Moreover, when deploying a variety of resources, as in the typical enterprise, reciprocal causal

relationships inevitably result. For example, the purchasing department purchases furniture for the HR department and the HR department does payroll processing for purchasing clerks. Causality is therefore not only predominantly quantity-based but it is also reciprocal/simultaneous. Only with such a simultaneous quantity-based approach can all aspects of the model be reconciled and supported by real operational, quantitative data in a retrospective manner without violating the causality principle.

This view of causality and modeling demanded by marginal analytics stands in stark contrast to the traditional practice of taking general ledger dollars (historical financial information) and breaking it back out into a cost model. Even more so, for flawed misallocations of cost that expresses the economic flows of inputs as percentages of dollars.

Requirement 1.3: Valuation of the Quantity-based Model

Marginal analytics requires not only an accurate rendering of the quantitative flow of economic goods and services but also of their monetary/cost values. By integrating value with the quantity-based goods and services model, the effects of resource application decisions on the enterprise bottom line are highlighted. The costs of an enterprise's resources must therefore feature prominently in any attempt to satisfy marginal analytic information demands.

Cost: A monetary measure of (1) consuming a resource or its output to achieve a specific objective, or (2) making a resource or its output available and not using it.

The fact that resources are the source of all costs should be self-evident. Consider the obvious necessity of acquiring resources before they can start providing benefits. Moreover, there can be no outputs before committing funds to acquire at least some resources. With reference to the earlier recognition of simultaneous relationships between resources it is also recognized that valuation has to occur in the same manner.

Requirement 1.4: Input-output Consumption and Cost Behavior

Of the four foundational marginal analytical requirements this one is likely the easiest overlooked. Without a sound view of how the flow of input quantities and their costs behave under varying conditions, marginal analytics is compromised and effective decision support undermined. For example, under an assumption that all costs are fixed, marginal information is non-existent and managers will be hard pressed to glean the impact of changes in any resource application decision on the enterprise's bottom line.

In contrast to many of the commonly held views on input consumption and cost behavior, causality dictates that: in an enterprise's economic model, outputs have clearly definable relationships with the inputs required to produce them (e.g., the production of a ton of bricks requires the consumption of X amount of dirt). Such a level of granularity is of course not

practical for every single consumption relationship. Managers information and decision support needs should be the primary driver of design and implementation decisions in this regard. At least for prominent consumption relationships it should be recognized that: (1) some inputs vary with the level of output produced (i.e., the quantity of resource consumed is proportional to the output level),

Proportional Consumption: Input quantities required to achieve a managerial objective that vary (e.g., according to a linear relationship) with the objective's level of output.

while (2) other inputs do not vary with the level of output produced (i.e., the quantity of resource consumed is fixed in relation to the output level).

Fixed Consumption: Input quantities required to achieve a managerial objective that do not vary with the objective's level of output within the relevant range.

In requirement 1.3 above it was recognized that, in input-output consumption relationships monetary valuation of inputs are always subject to their respective input quantities. This subservience includes the valuation of inputs based on their consumption behavior (i.e., fixed or proportional). For example, an input consumed in a fixed manner will result in all of that inputs' costs becoming a fixed cost. Hence, the determination of whether a particular cost is fixed or proportional is a function of the consumption behavior of its input unit. In this regard, understanding two aspects of the nature of resource cost are crucial in meeting marginal analytic information demands.

First, management accounting must reflect the inherent nature of the cost of the resources in which the enterprise has invested. For example, the inherent operating cost characteristics of a fully automated baggage handling system are quite different from a baggage handling system that relies primarily on manual labor. This inherent cost structure of the deployed resources serves as the foundation for executing strategy and as the point of departure for all valuations. The initial inherent nature of cost (innate cost) of a resource must therefore be reflected correctly if useful decision support information is to be provided.

Innate Cost: A cost associated with a resource that reflects the resource's inherent cost characteristics as dictated by the resource's features (e.g., technology, training, skills).

The second characteristic of cost behavior is the effect on innate costs when an input quantity is consumed in a fixed manner. For example, electricity charged in units of kilowatt-hours - typically a proportional consumption – is consumed by a furnace during a non-productive shift (the furnace is not switched off for reasons of cast metal quality); the cost of all the kilowatt-hours consumed during the non-productive shift becomes a fixed cost to the furnace. Since value is subservient to quantity, the costs associated with an input quantity – consumed in a fixed

manner (the $'s for the kilowatt-hours in the example) - are converted to be consistent with the nature of the consumption relationship of the input quantity i.e., fixed electricity costs in the example.

Converted Cost: An innately proportional cost, which changes to a fixed cost due to the fixed nature of an input consumption relationship.

The following rules apply in cost conversion:

- innately proportional costs become fixed costs when the associated input is consumed in a fixed manner,
- innate costs retain their characteristics when the associated input is consumed in a proportional manner, and
- once a cost has been converted (made fixed) it cannot be changed regardless of subsequent consumption relationships in the cost model.

Requirements: Category 2 - Structure Management Information to Enhance Relevance

Clearly, reams and reams of quantitative and monetary information, no matter how representative of enterprise economic activity, do not qualify as decision relevant information. In this regard, the age old axiom 'different costs for different purposes' is important since optimization decisions span a wide spectrum of potential changes in resource application. Traditional wisdom holds that each decision scenario has sufficiently unique characteristics, which demand scenario specific modeling, information and analysis. Ideally though, the same baseline information should serve to satisfy this diverse range of information requirements, which highlights the need to structure decision support information in order to enhance its relevance to the decision maker. The marginal analytic requirements for structuring decision support information are:

- segment the cost model for only that portion of economic goods and services relevant to the decision at hand,

Cost Model: A logical arrangement of managerial objectives using cost model objects and reflecting operational input and output flows as relationships between cost model objects.

- provide accurate monetary information for all costs categories appropriate to the decision, and
- reflect all causal relationships and their characteristics relevant to the decision.

Each of these requirements is discussed in more detail next.

Requirement 2.1: The Ability to Segment the Cost Model

This requirement is the eternal bane of management accountants; it essentially requires that the cost model be segmented in every conceivable (and inconceivable) manner. While there is obviously no perfect solution, there are a number of guiding principles in establishing a cost model that can be suggested if one considers a manager's perspective on what is needed:

- represent the areas of responsibility of individual managers,
- support individual managers' management processes:
- for optimization processes, e.g., resource management, process management, capacity management, and
- for directive processes, i.e., planning, control, analysis, and adaptive and corrective actions,
- support key organizational decision elements (e.g. critical success factors),
- base cost model definition on the characteristics of economic activity,
- support performance measurement and reward systems,
- balance materiality and accuracy of consumption relationships, and
- provide hierarchies for roll up and summarization of objects.

Establishing objects in the cost model from a manager's perspective goes a long way toward satisfying the segmentation requirement.

Cost Model Object: A component in the cost model used to represent a managerial objective.

It should be noted that certain areas of the cost model will at times be subject to more scrutiny than others. Businesses endure perpetual change, and management is required to focus on different aspects of the business at different times and to varying degrees of intensity. The cost model should therefore not be viewed as static over time but rather as changeable and adaptable to specific management needs.

Requirement 2.2: Causal Relationships and their Characteristics Relevant to Decisions

The requirement of different costs for different purposes recognizes that costs might be considered avoidable for a tactical decision (e.g., electricity when outsourcing a machine), but as incremental for an operational decision (e.g., to manufacture one additional item on the same machine). Decision support information must therefore be transparent enough to be adapted for individual decision scenarios. Transparency of cost information is determined by the following two characteristics of causal relationships:

- the relationship of an original cost item of a resource to the output under consideration in a decision, and

- the nature of the input unit consumed in relation to the output (i.e., does it vary with the level of output).

Each of these factors is discussed in more detail next.

The Relationship of the Original Cost Item – by way of example, assume the output of a converting function requires the services of a particular support function. To provide this support function an original cost is incurred in the support function (e.g., maintenance technician wages). The relationship of this wage cost to the converting function is that of an assigned cost. Distinguishing original and assigned cost relationships are important in decision support because they must be viewed differently for different decisions. For example, the support cost might be an incremental cost in a throughput accounting decision (maintenance hours required for an additional setup when there is no spare plant maintenance capacity) and unavoidable in a decision to outsource the converting function (when the converting function's maintenance hours consumed is less than the total annual hours of one maintenance technician).

The Nature of Input Quantities – on the other hand, also plays a role in the transparency of decision support information. For example, as indicated earlier, an input quantity and its costs must be reflected as fixed if it is incurred regardless of the output level of the consumer. In the furnace example used previously, the fixed electricity costs are unavoidable for any reduction of furnace output, within the relevant range, which management might consider.

Requirement 2.3: Provide Information on All Cost Concepts

A similar dilemma to segmenting the cost model to support any potential decision (highlighted above in requirement 2.1) also applies here when one attempts to provide the appropriate cost information for all foreseeable and any unforeseen decision scenarios. However, the solution here is more elegant than the one for segmentation of the cost model in that the attributable cost concept goes a long way towards solving the problem.

Attributable Cost: Costs of an output that could be eliminated in time, if that output were discontinued and resource consumption and/or provision were reduced accordingly. (Adapted from Shillinglaw)

The attributable cost concept is able to fulfill an overriding role in satisfying the multiple cost concept requirement for the following reasons:

- it is the most complete cost concept based on the principle of causality,
- with attributable cost information in hand it is possible to derive any of the lesser cost concepts, and
- it is impossible to go from a lesser cost concept (e.g., throughput costs) to a more complete cost concept (e.g., long-term proportional costs or attributable cost).

It is important to note that the full-cost concept is unsuitable for this overriding role because (1) the full-cost concept has very limited application in decision support, and (2) the lack of causality in allocating common fixed costs does not allow one to segment out lesser cost concepts from the full cost number after the fact.

Full Costs: Total cost of all inputs consumed and all inputs made available but not used to achieve a managerial objective.

The attributable cost concept enables the derivation of the cost concepts required for effective marginal analytics with the exception of full costs, which can be easily calculated when required due to its arbitrary nature. The first category of requirements identified above (i.e., quantitative causality, accurately reflecting resource costs and resource interrelationships) all combine to satisfy the attributable cost requirement in the resource layer of a management accounting system. Attributable resource cost is not only a key cost concept to support enterprise resource application decisions, it is also necessary for:

- gaining insight into the true cost of capacity, and
- accurately specifying product/service costs, and
- obtaining throughput, contribution, and gross margins.

Conclusion

This concludes the discussion of the demands marginal analytics and its resource application decision support emphasis places on management accounting. Chapter 2 looks at the results from empirical research into current practices in calculating and using management accounting information when making resource application decisions.

Chapter 2: A Survey into Marginal Analytics Practice

Introduction

Understanding the demands marginal analytics place on the management accounting system (discussed in Chapter 1) highlighted the need for insight into at least two aspects of marginal analytics in practice:

- determine whether marginal analytics were important to U.S. managers, and
- assess how good or bad current marginal information, available to managers, are.

An on-line survey was used to collect data for these purposes. Respondents were directed to the survey site through links on electronic newsletters distributed by the AICPA and the IMA as well as solicitation E-mails to members of CAM-I. Respondents had the option to remain anonymous but they could also provide their e-mail addresses to be directed to the results of the survey when it became available. Below the survey details are first discussed before reviewing results of responses to individual questions.

Survey Details

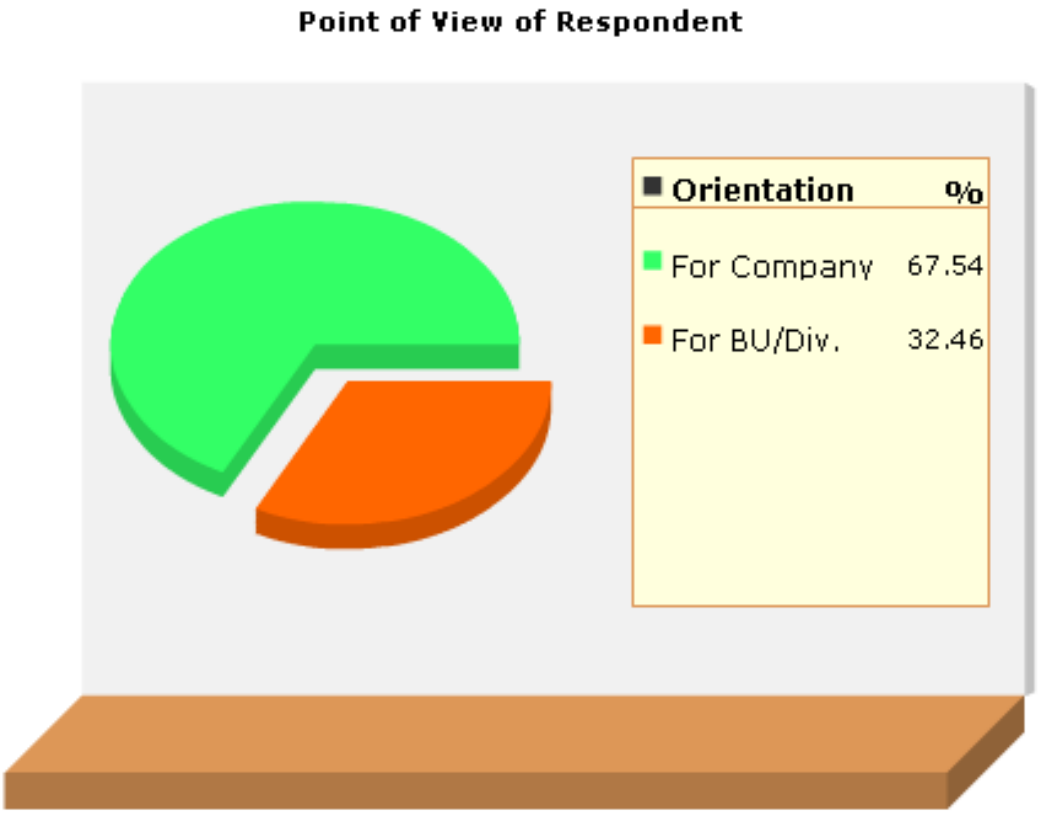
The survey was divided into three sections: (1) respondent's demographics, (2) respondent's current costing methodology, as well as (3) use and perceived values of current information. There were eight, nine, and seven questions in these three sections respectively. The questions used in the survey is presented in Appendix A.

The first section gathered information on characteristics of the respondents and their companies. The second section had nine questions seeking to gain insight into the level of sophistication of the current costing methodology/s used and one question on the manager's point of view about how costs behave. Section three had one question on access to information, two questions about average product/service margins in the company's industry, one question about the importance of accuracy of information to managers, two questions about managers' level of satisfaction with information currently being provided, and one question on manager's attitudes about the cost system.

There were 145 responses to the survey, 111 of these were complete and usable (i.e., not abandoned halfway through and no inconsistencies between responses to dependent or validation questions). The 111 responses may also include multiple responses from the same company. These may include different managers responding for the same company, multiple divisions of the same company, or different managers responding for the same division of the company. Finally, it should be noted that in the graphics provided below a lack of font space has necessitated rounding of numbers.

Section 1: Demographic Information

Exhibit 1:

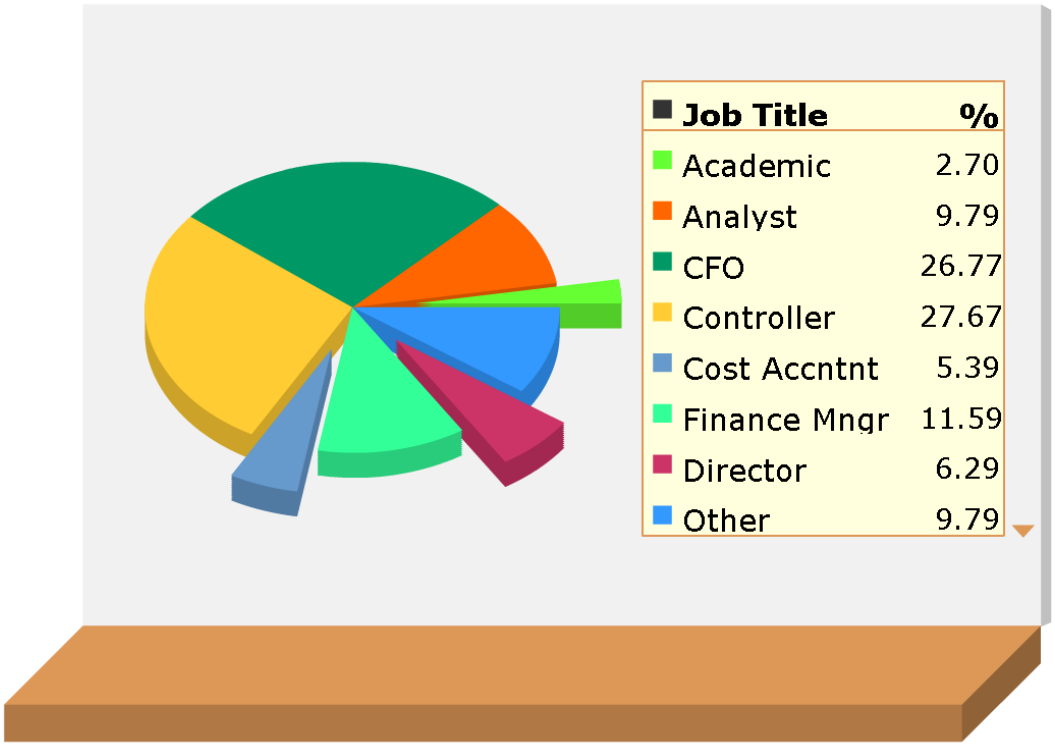


Demographics Question 1: This question asked whether the respondent was answering for their company as a whole or for a business unit/division (see Exhibit 1), 68% of the respondents responded to the survey for their company as a whole and 32% responded to the survey for their business unit/division.

Demographics Question 2: This question asked about the respondent's job title (see Exhibit 2), over 80% of the respondents were in finance and accounting positions (10% -analyst, 27% - CFO, 28% - controller, 5% - cost accountant, 12% finance managers). The rest included management positions, academics and a category for other.

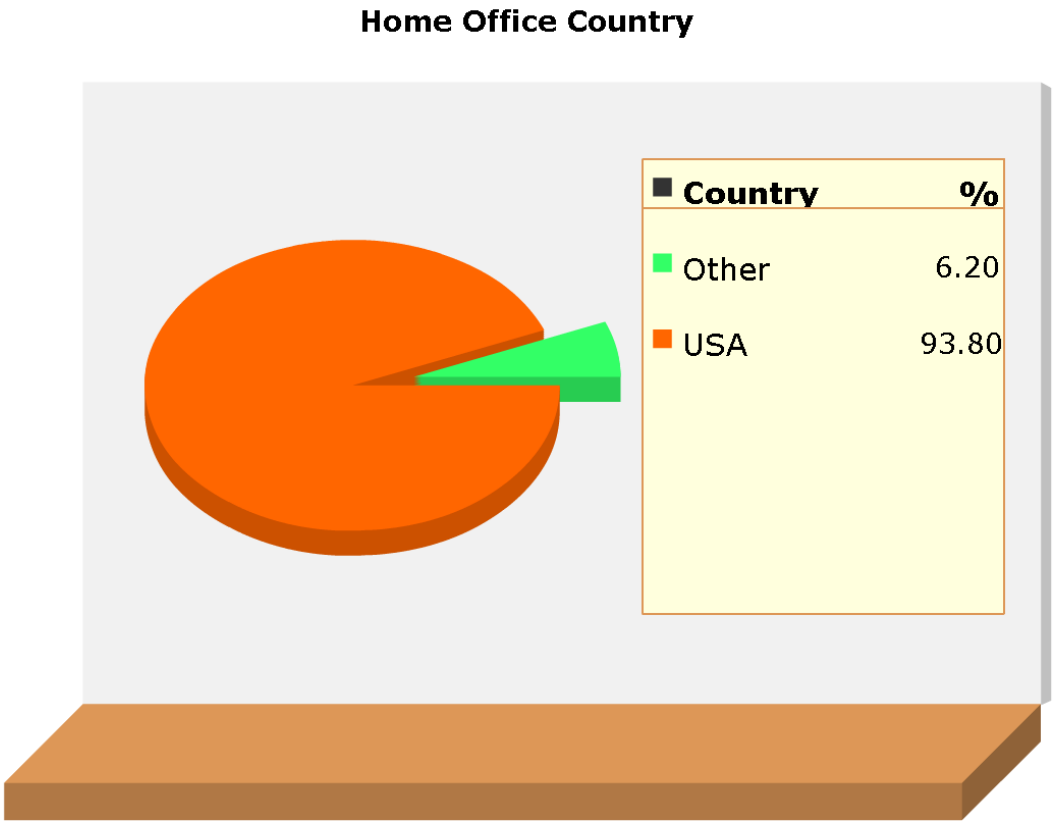
Exhibit 2:

Respondent Job Title



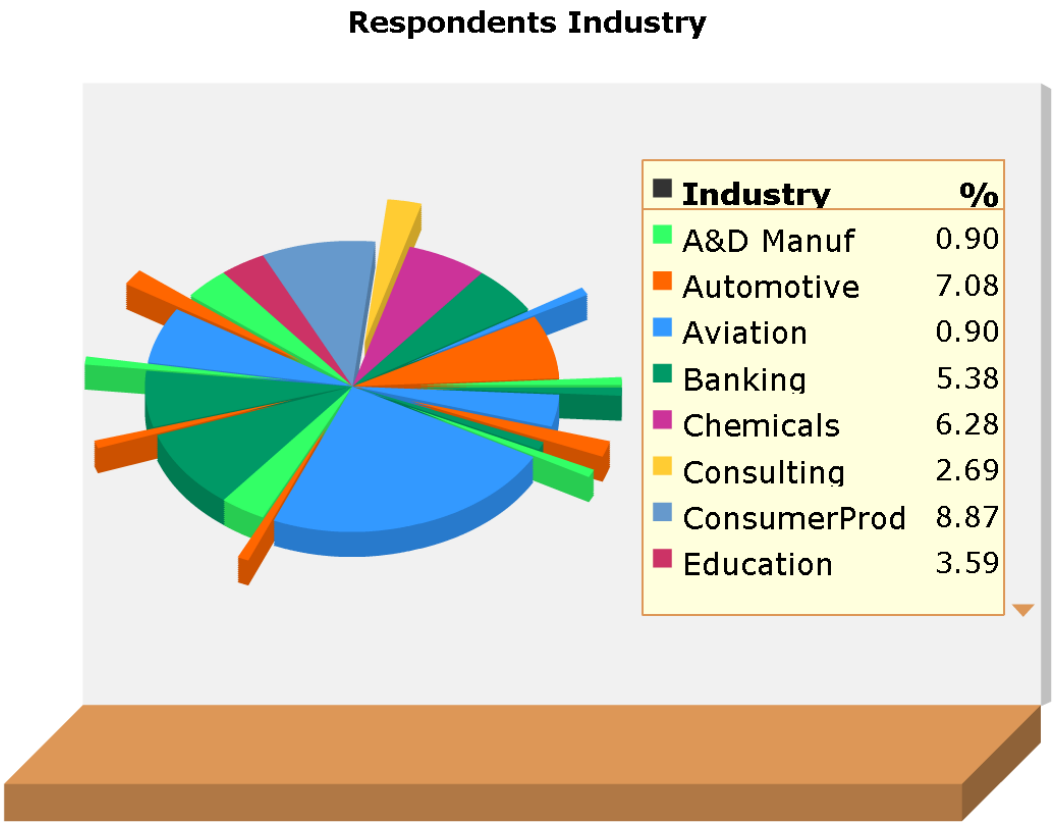
Demographics Question 3: This question asked about the respondent company's country of operation/home office (see Exhibit 3). By far the largest portion, almost 94%, of respondents were U.S. based.

Exhibit 3:



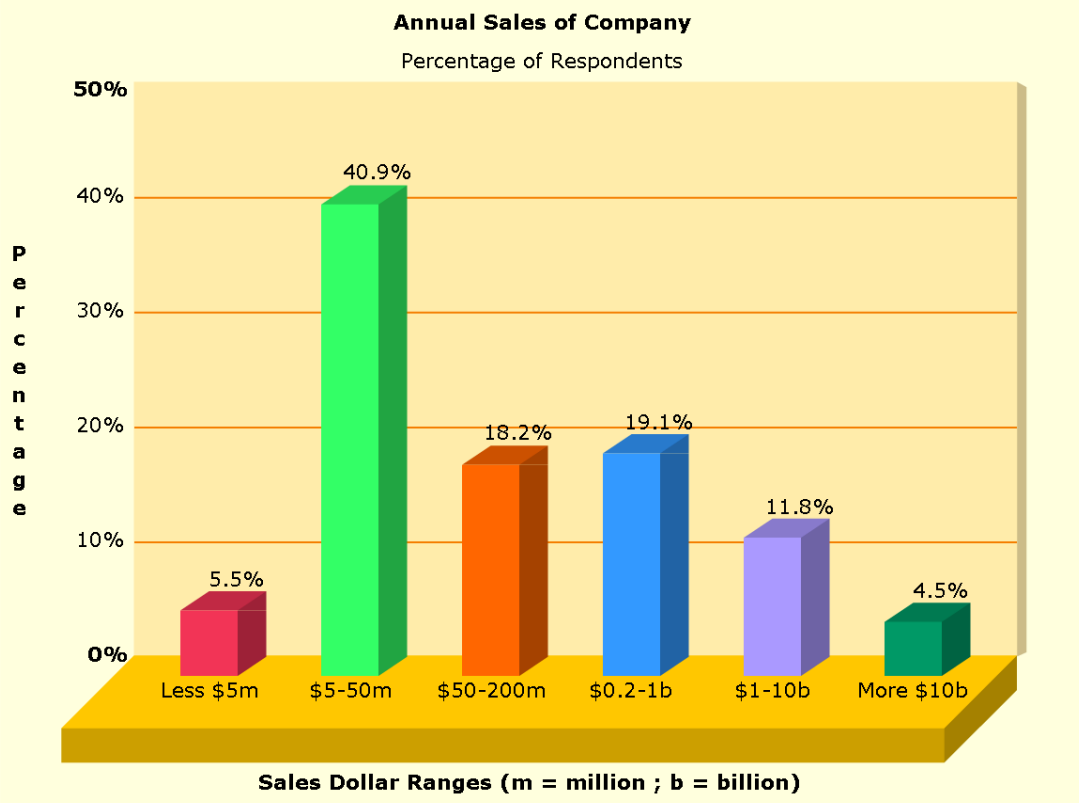
Demographics Question 4: This question involved the industry in which the respondent's company operated (see Exhibit 4). The respondents' companies were in very diverse industries, at least one response was received from each industry category. The five largest industry representations were consumer products – 8.9%, metal and paper – 8.1%, , automotive – 7.1%, medical care - 6.3% and chemical – 6.3%. The category for 'Other' attracted significant responses at 23.2%.

Exhibit 4:



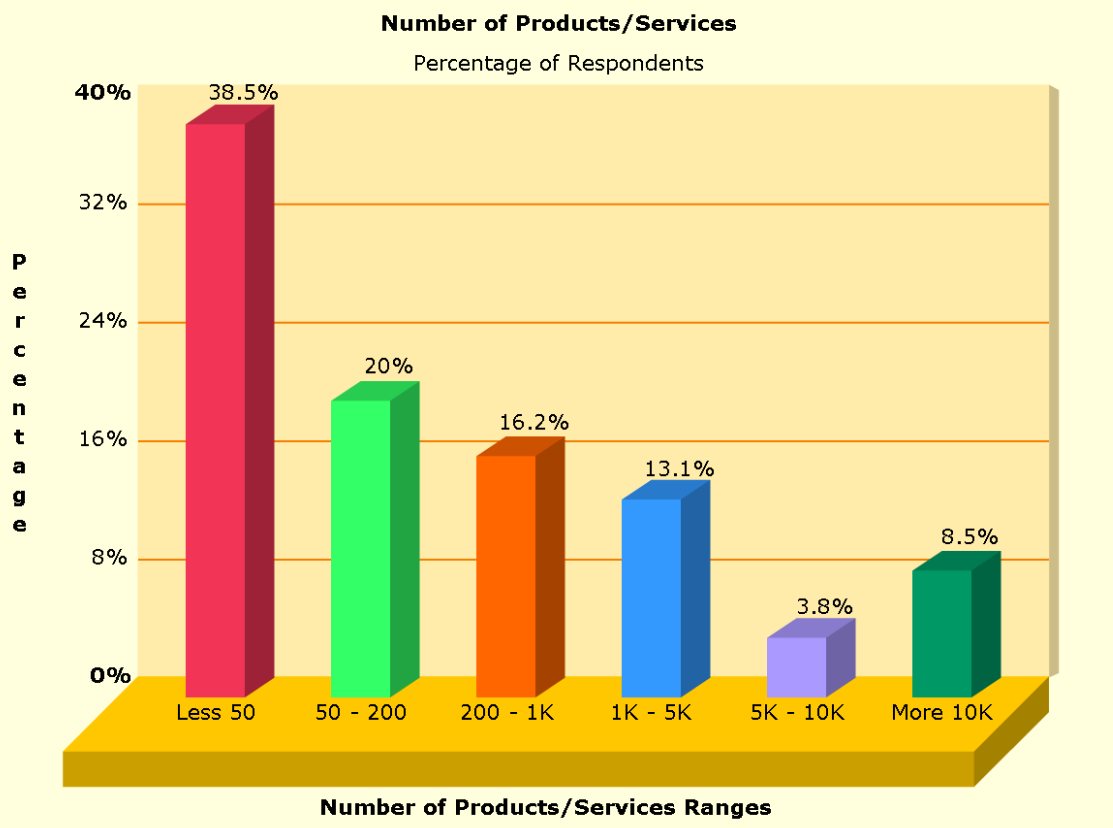
Demographics Question 5: This question was on the respondent company's annual sales (see Exhibit 5). 5.5 percent of the companies had sales of less than $5 million. 40.9% of companies had sales between $5 and $50 million, the largest segment by a considerable margin. These results show that the respondent companies represented all categories of sales size from small to very large.

Exhibit 5:



Demographics Question 6: This question asked how many saleable products/services the respondent's company sold (see Exhibit 6). The majority of the respondents (58.5 %) had 200 products or less. The diversity of products/services for respondent companies in the survey is high.

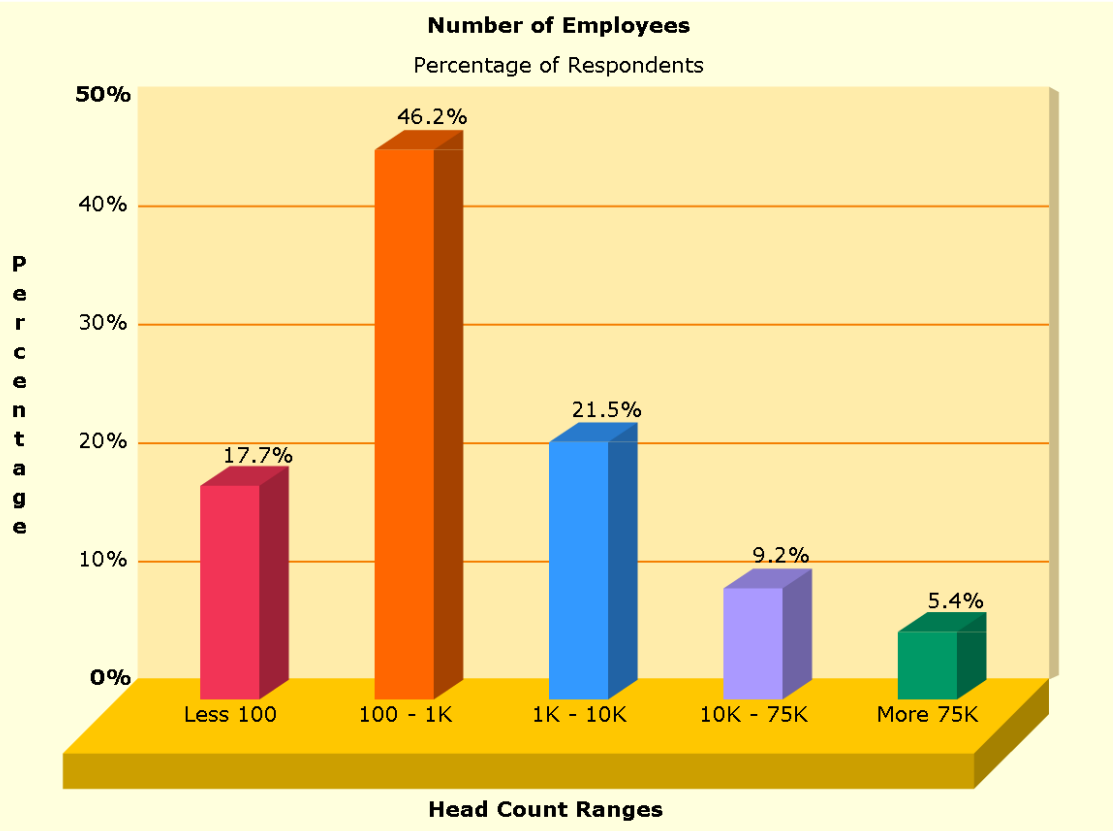
Exhibit 6:



Demographics Question 7: This question asked how many people the company employed (see Exhibit 7). 17.7% of the respondent companies employed less than 100 people. 46.2% of the companies employed between 100 and one thousand people. 21.5% of the companies employed between one thousand and ten thousand people. 9.2% of the companies employed between ten and 25 thousand people. 5.4% of the companies employed more than 25 thousand people.

Therefore more than one-half (63.9% = 17.7% + 46.2%) of the companies had less than 1,000 employees. Also, a few companies (5.4%) had a large number of employees.

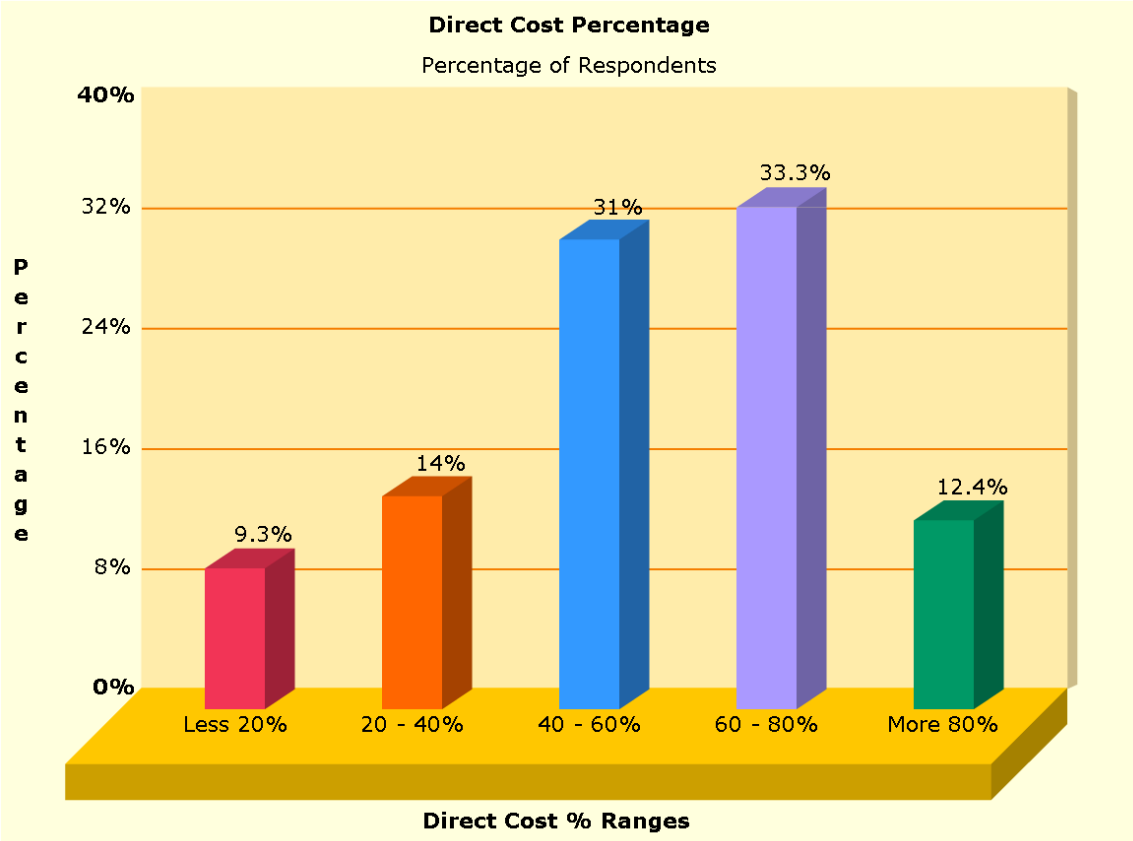
Exhibit 7:



Demographics Question 8: The last demographic question asked about the percentage of product/service costs that is a direct cost (see Exhibit 8). 9.8% of the respondent's companies had less than 20% of their product/service cost as a direct cost. 14% had between 20 and 40% direct cost. 31% had between 40 and 60% direct cost. 32.8% had between 60 and 80% direct cost and 12.4% had more than 80% direct cost.

This question addresses the importance of indirect costs and the assignment of indirect cost to products/services. More then half of the companies (54.3%) indicated that more than 40% of their product/service costs comprise indirect costs. The assignment of indirect cost to products/services is an important issue to almost all of these companies as would be the appropriate treatment of costs in marginal analytics.

Exhibit 8:

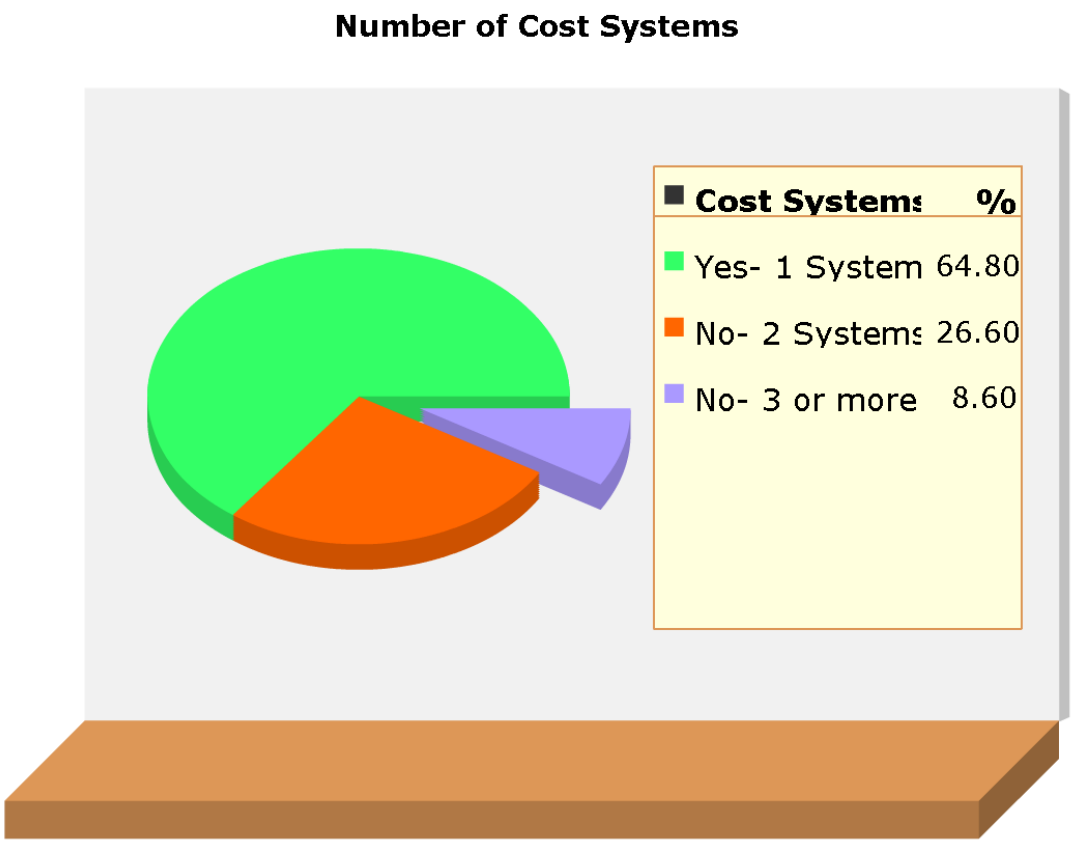


The demographic questions show that the respondent's companies are quite varied in terms of industry, total sales, and number of employees. It is also evident that a large number of the respondents would be considered medium-sized companies. The companies were mainly U.S. companies with a large number of products/services and with large amounts of indirect costs. The individual respondents were mostly employed in finance and accounting but had a wide variety of job titles.

Section 2: Respondent's Current Costing Methodology

Current Costing Question 1: The first current costing methodology question was on whether the same cost system was used for both financial reporting as well as for internal management and decision support (Exhibit 9). 64.8% of the companies used the same system for both purposes. 26.6% of the companies had two cost systems. These companies used one cost system for each purpose. 8.6% of the companies had three or more cost systems.

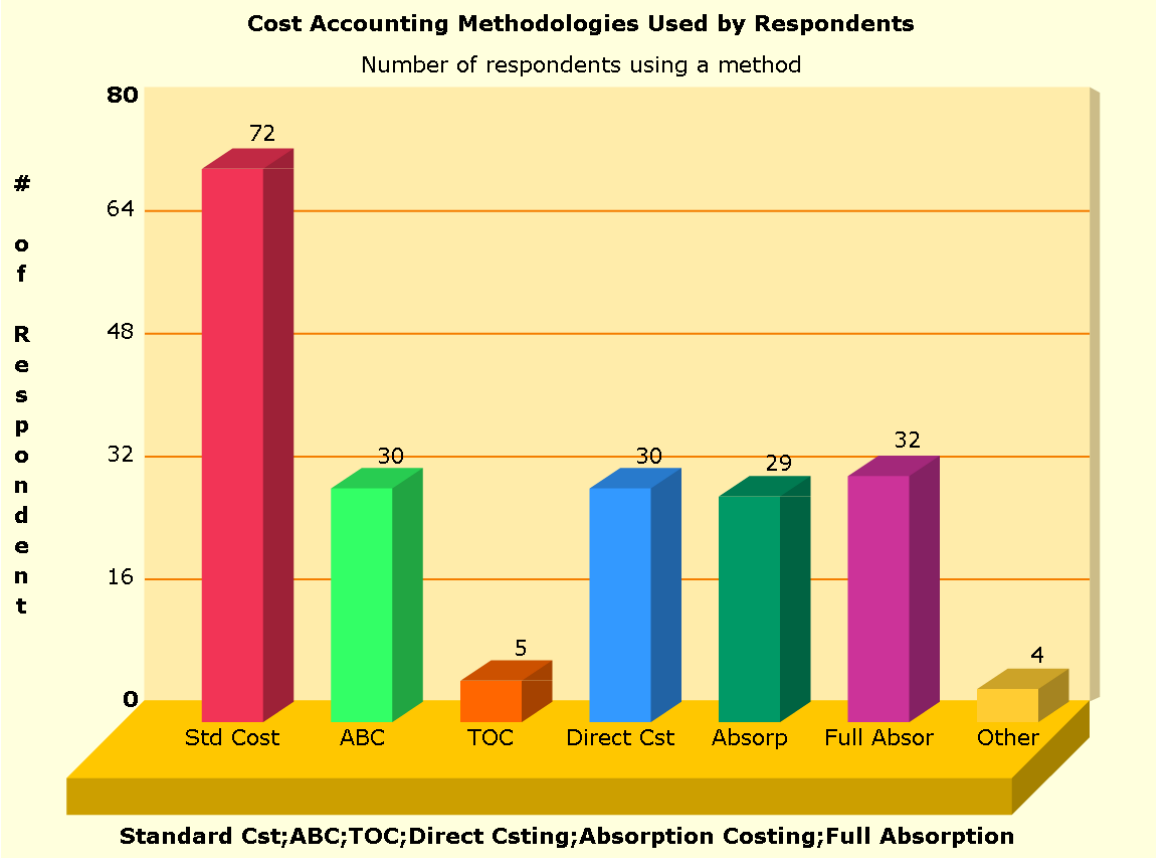
Exhibit 9:



The use of generally accepted accounting principles for external reporting results in information that is unsuitable for decision-making. This includes, for example, assigning selling cost to the period rather than the product and not capitalizing costs such as research and development, which have future benefit. If the same system is used for external reporting and internal decision-making, bookkeeping costs will be low; however the information needed for effective internal decision making and management will be inadequate. Since 64.8% of the companies use the same cost system for both purposes, they do not have the information they need for decision-making and effective management. Moreover, one can expect information needed for effective marginal analytics to also be compromised.

Current Costing Question 2:

Exhibit 10:



The second current costing methodology question was on the company's cost accounting methodology (see Exhibit 10). 72 companies were using standard costing. 30 companies were using ABC. 5 companies were using TOC. The Theory of Constraints (TOC) costing methodology assigns only direct material cost to the product/service. Thirty companies used direct (variable) costing. Twenty-nine companies used absorption costing while 32 used full absorption costing. Absorption costing includes direct material, direct labor, variable overhead, and fixed overhead in the cost of products/services. Companies that practice full absorption assigns these same costs to the product/service plus selling and administrative costs. Four companies used other cost accounting methodologies.

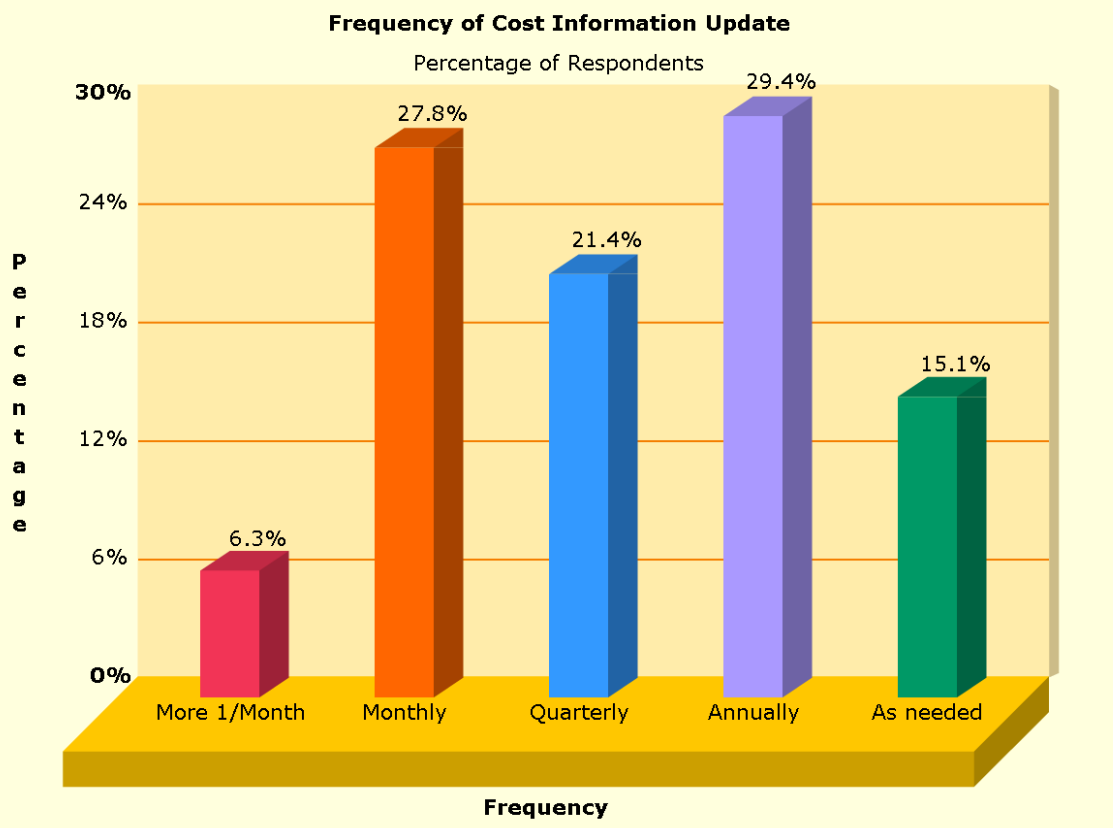
These numbers total more than the numbers of usable surveys (111) because some companies used multiple systems and some systems fall into more than one category. For example, a company might use a standard absorption costing methodology.

The most commonly used cost methodology by far was standard costing. A surprisingly small number of companies (30 or 27%) used ABC. Almost equal numbers of companies used direct (variable) costing (30), absorption costing (29), and full absorption costing (32). Very few companies were using the TOC costing methodology.

Current Costing Question 3: This costing methodology question asked about the frequency with which cost information was updated for the purposes of use of internal management and decision support (see Exhibit 11). Responses indicated that 6.3% of the companies updated more than once a month, 27.8% updated monthly, 21.4% updated quarterly while 29.4% of the companies updated annually. Fifteen percent of the companies updated their cost information as needed.

A surprising number of companies frequently updated cost information as is evident by the 55.5% of the companies that updated their cost information at least quarterly (6.3% + 27.8% + 21.4%). A lot of time and effort is required to update cost information this frequently.

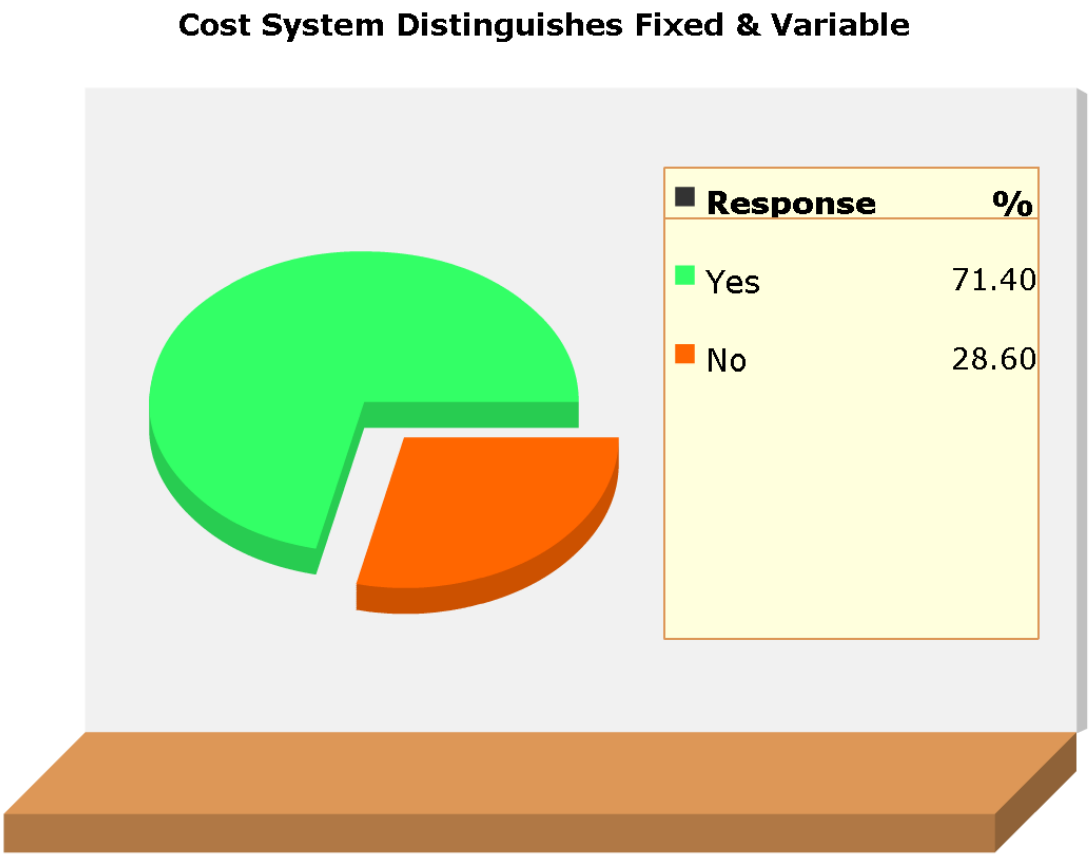
Exhibit 11:



Current Costing Question 4: This costing methodology question asked whether the company's cost methodology distinguished between fixed and variable costs (see Exhibit 12). 71.4% of the companies distinguished between fixed and variable costs while 28.6% did not.

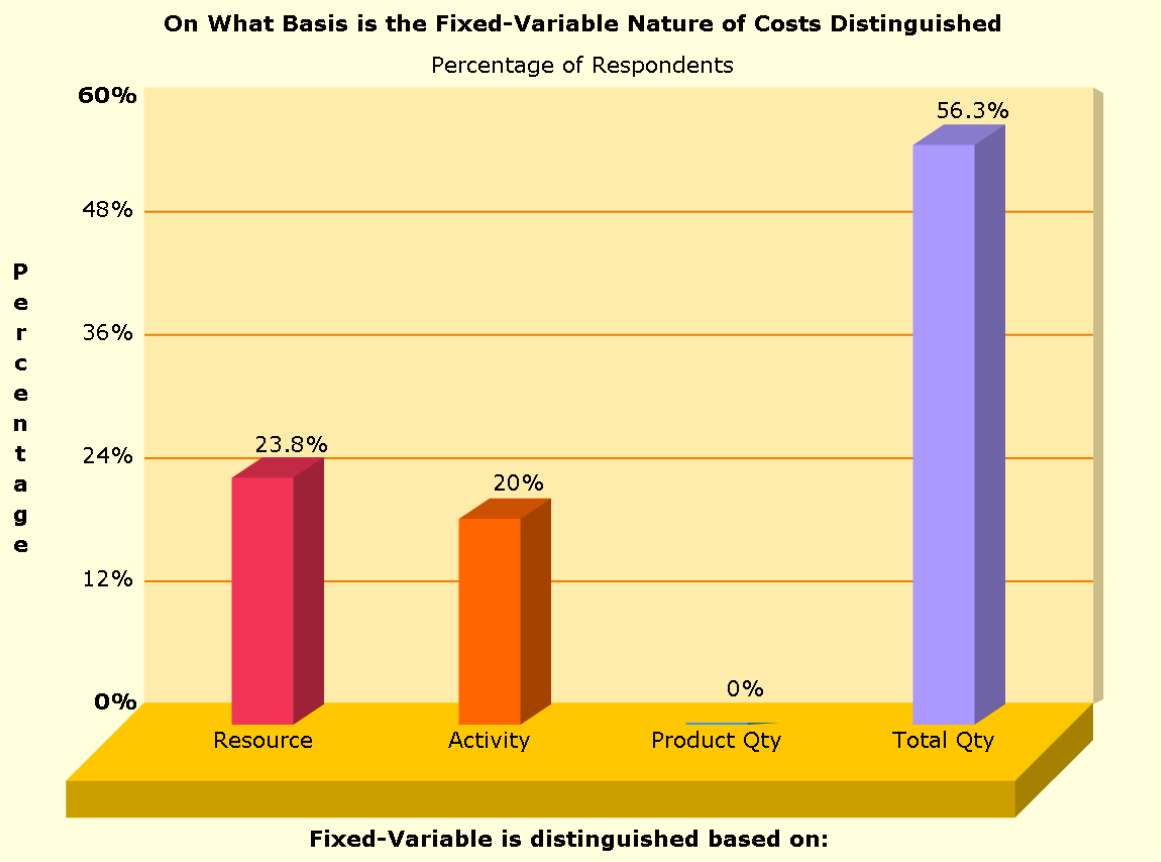
The companies that do not make this distinction are at risk of not having accurate marginal information for most internal decisions. Most internal decisions require variable costs to be separated from fixed costs to estimate costs under various alternatives. The 28.6% response here is also consistent with the full absorption response in current costing question 2. From a marginal analytics perspective the numbers are significant in that nearly 30% of companies have absolutely zero information that could effectively be used in marginal analytics, assuming that those who do make the distinction do so correctly – see question 5 below.

Exhibit 12:



Current Costing Question 5: This cost methodology question asked about the perspective that the companies used in making the distinction between fixed and variable costs (see Exhibit 13). 23.8% of the companies used a resource perspective. 20% of the companies used an activity perspective. No companies used a product quantity perspective and 56.3% used a total quantity perspective.

Exhibit 13:

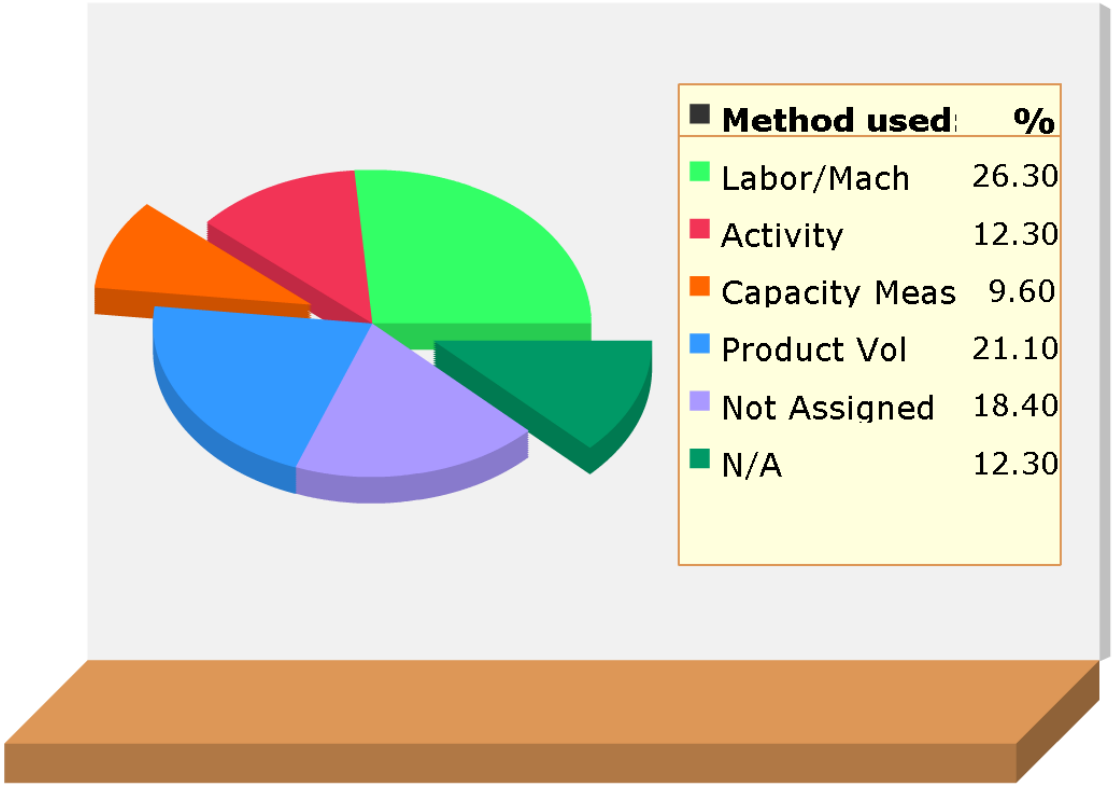


The initial distinction between fixed and variable cost is properly made at the resource level. Nearly 80% (100% - 23.8%) of the companies that do distinguish fixed and variable costs are at risk of not correctly identifying fixed and variable costs. Hence only 15% of total respondents start off from a sound marginal analytic basis with their cost management design. 20% used activities, contrast this with the total number of companies that used ABC (30%) – 50% of total ABC users consider costs on activities fixed, which is probably also indicative of ABC with full absorption. 56.3% used a total quantity perspective, this is in line with traditional standard costing and an indication of just how bad the management information is since it is generally accepted that due to issues such as complexity there is not the implied relationship between total cost and total volume as traditional standard costing assumes.

Current Costing Question 6: This costing methodology question asked how common fixed costs are assigned to products/services (see Exhibit 14). 26.3% of the companies used direct labor or machine hours, 12.3% used activity, 9.6% used a capacity measure, and 21.1% used production volume. 18.40% did not assign common fixed costs while 12.8% of the respondents answered 'not applicable.'

Exhibit 14:

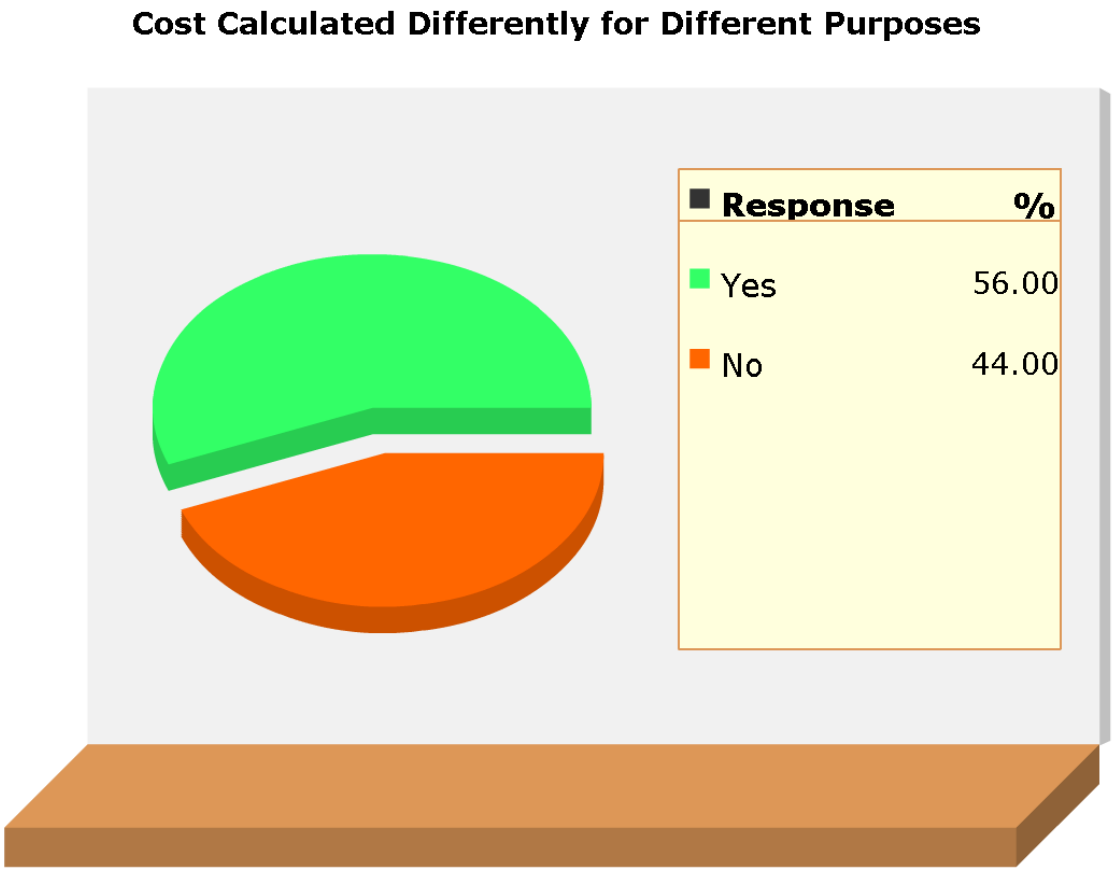
Methods used to Assign Common Fixed Costs



As pointed in Chapter 1 where the weak form of causality was discussed common fixed costs are common to more than one cost object. They can therefore not be assigned with any known accuracy to individual cost objects. Almost 70% of respondents are assigning common fixed costs to products/services- this is inline with the number standard costing users, but this result might be coincidental. Other than regulatory purposes, such as financial reporting or regulated industries, common fixed costs should not be allocated to products/services. If managers use this information to make internal decisions, the decisions could be made incorrectly. For example, cost reduction efforts could be misdirected. It is worth noting that the people (12.8%) that use activities to allocate common fixed costs reiterate the conclusion drawn in current costing question 5, that about 50% of ABC users today still fully absorb.

Current Costing Question 7: This current costing methodology question asked whether the respondent's company calculated the cost of an activity or product/service differently depending on the intended use of the information (see Exhibit 15). 56% said yes and 44% said no.

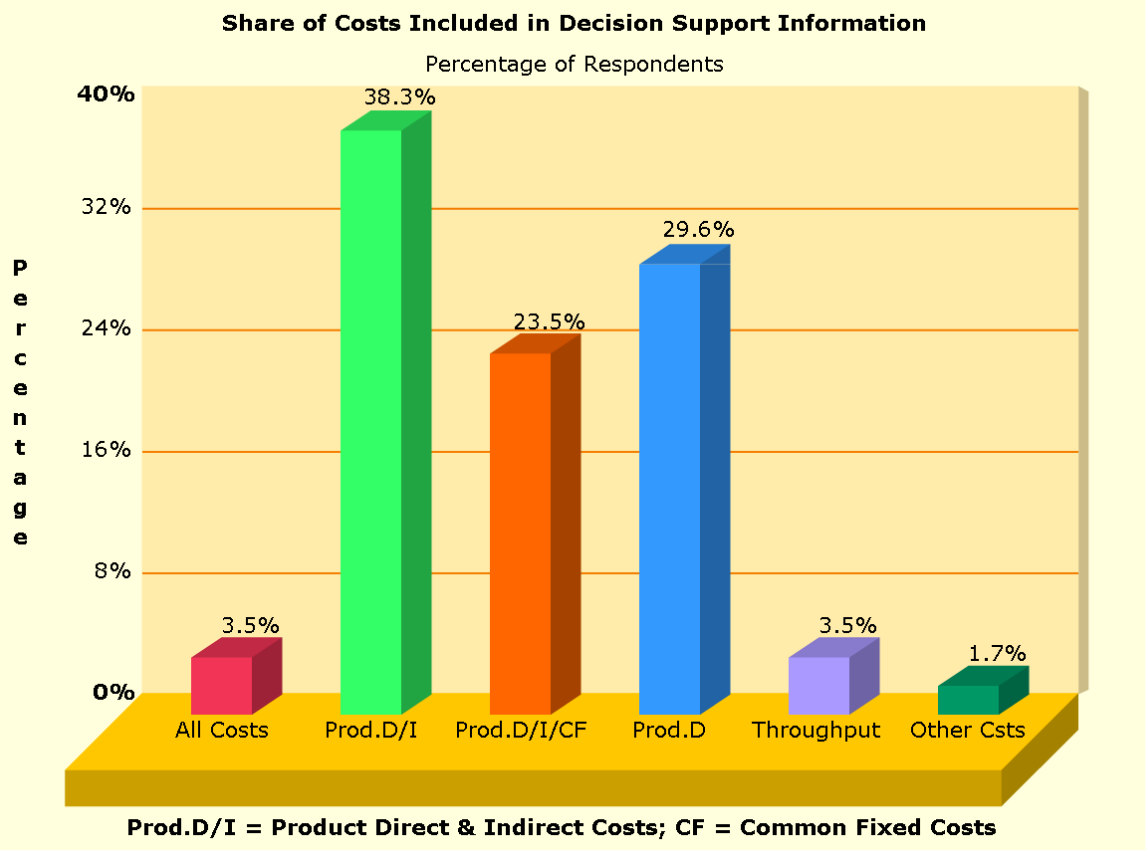
Exhibit 15:



A basic tenet of cost management is to consider different costs for different purposes. For example, an avoidable cost for one decision may be unavoidable for another decision. While 56% of the responses were consistent with this tenet, a surprising number of responses (44%) were inconsistent with this tenet. Companies that do not recognize the need to discriminate with regard to the information to be used for different purposes will have incorrect cost information for some purposes.

Current Costing Question 8: This current costing methodology question asked about which costs were included in cost reduction decisions (see Exhibit 16). Here responses indicated that 3.5% of the respondent's companies included all costs, 38.3% included direct and indirect product costs, 23.5% included direct and indirect product costs as well as common fixed costs, 29.6% included only direct product costs, 3.5% marked throughput (only direct material) and 1.7% indicated other costs.

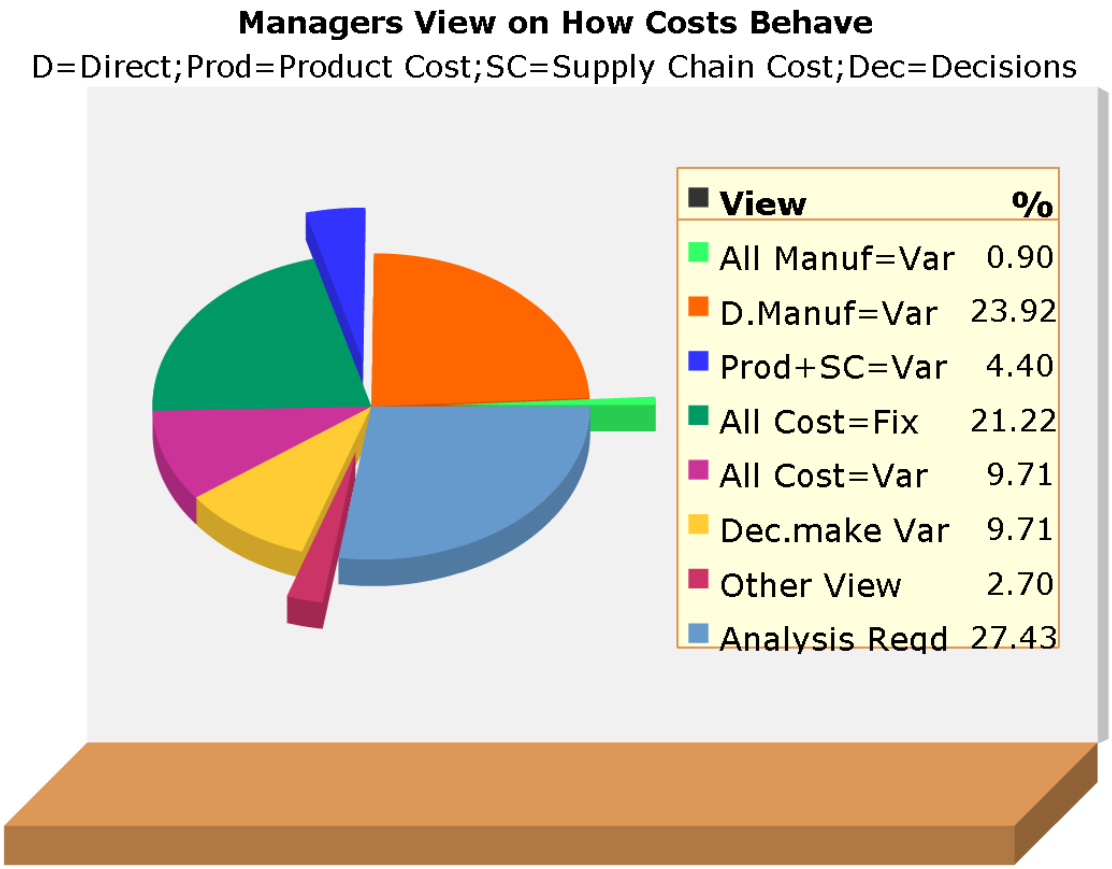
Exhibit 16:



In a cost reduction decision any cost may be decremented. This includes not only direct costs but indirect costs, common fixed costs, selling, and administrative cost. Only 3.5% included all costs as potentially relevant in cost reduction decisions. Accordingly, 96.5% (100% - 3.5%) of the respondent companies were at risk of approaching these decisions with incomplete information.

Current Costing Question 9: The last current costing methodology question asked how managers in the respondent's company thought costs behave (see Exhibit 17): 23.92% thought only direct manufacturing costs were variable, 4.4% thought all product and supply chain costs were variable, 21.22% thought all costs were fixed. Other responses included: 9.71% thought all costs were variable, 9.71% thought the decision made the costs variable, 2.7% had some other view while 27.43% marked analysis required.

Exhibit 17:

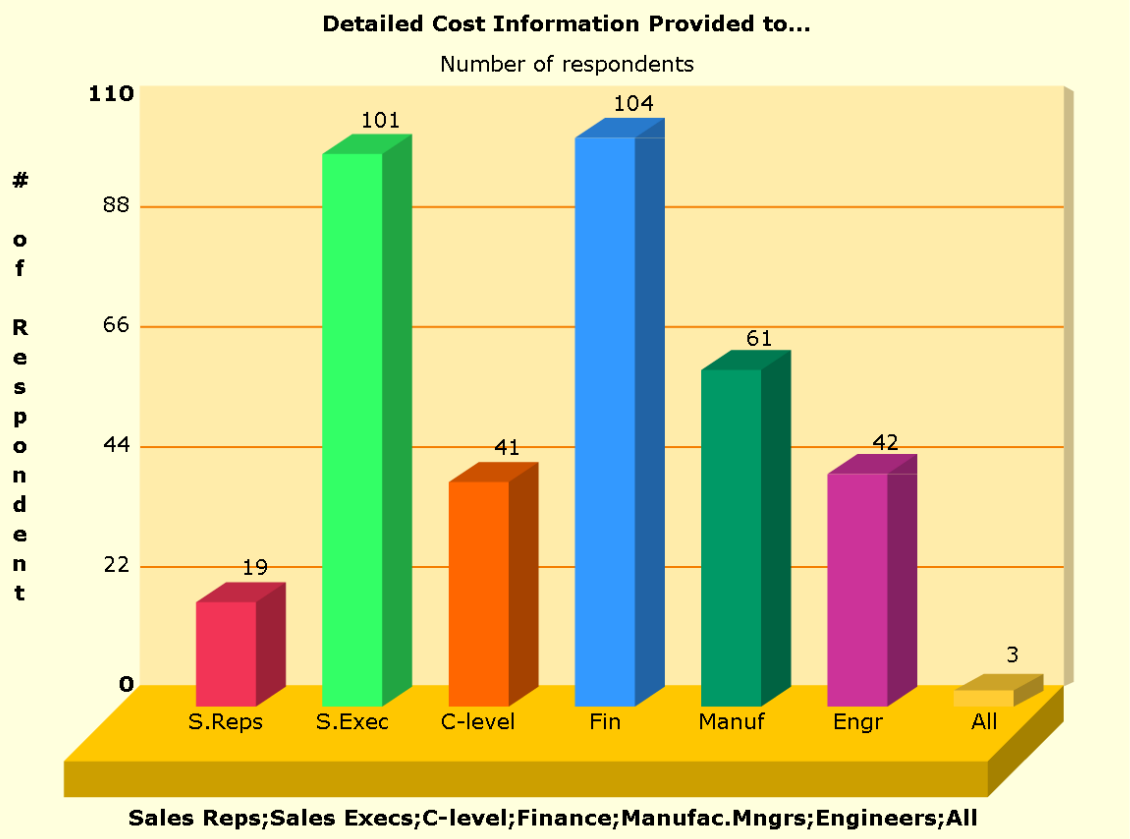


Most disconcerting about this response is the fact that respondents are all over the board. If on top of such a myriad of flawed conceptual thinking about cost behavior managers are also provided with poor/inferior information to make decisions how bad are the decisions they make?

Section 3: Use and Perceived Value of Information Questions

Information Value Question 1:

Exhibit 18:

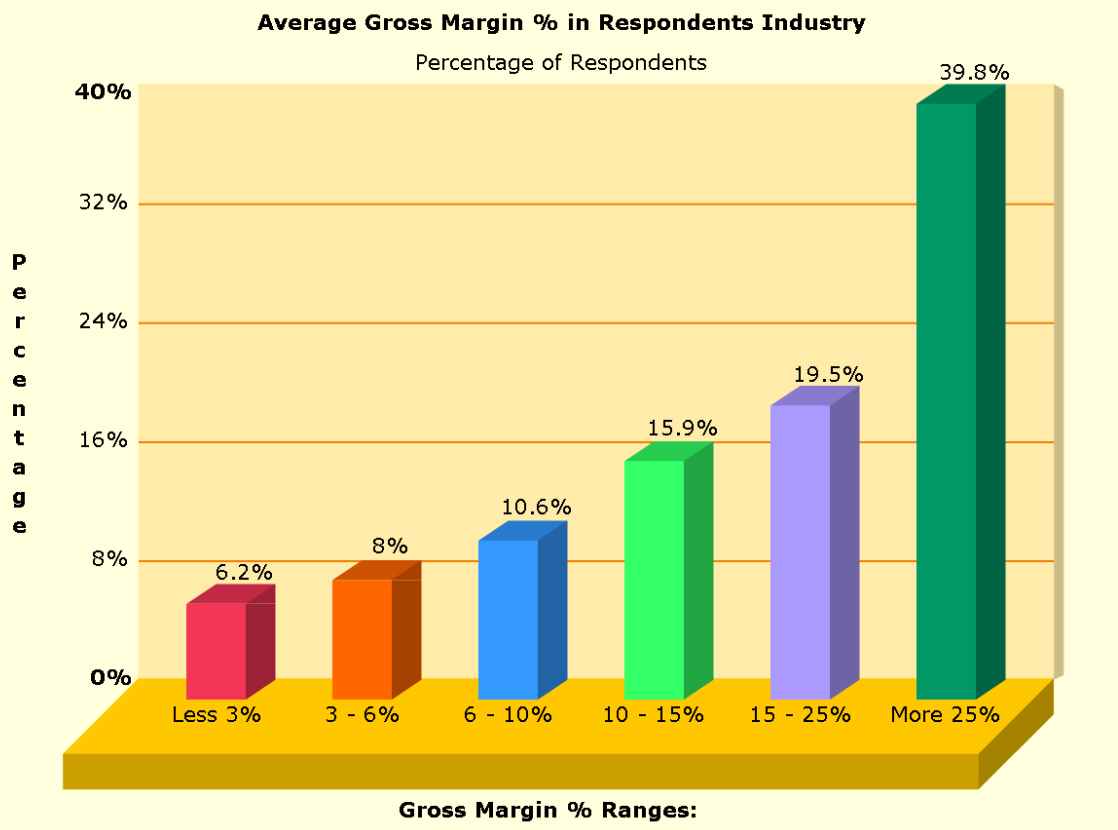


The first use and perceived value of information question was about who had access to detailed product or service cost information (see Exhibit 18). In 19 companies, sales representatives had access to detailed product or service cost information. In 101 companies, sales executives had access to this information. In 41 companies, C-level executives had access to this information. In 104 companies, Finance personnel had access to this information. In 61 companies, manufacturing managers had access to this information. In 42 companies, engineers had access to this information. In 3 companies all of these employees had access to this information. The responses to this question total more than the number of respondent's (111) because some companies allowed access to the information by more than one category of employees.

Some companies did not allow access to this information by a wide variety of categories of employees. It is further insightful that in the companies surveyed, financial people have greater access to this information than sales executives.

Information Value Question 2:

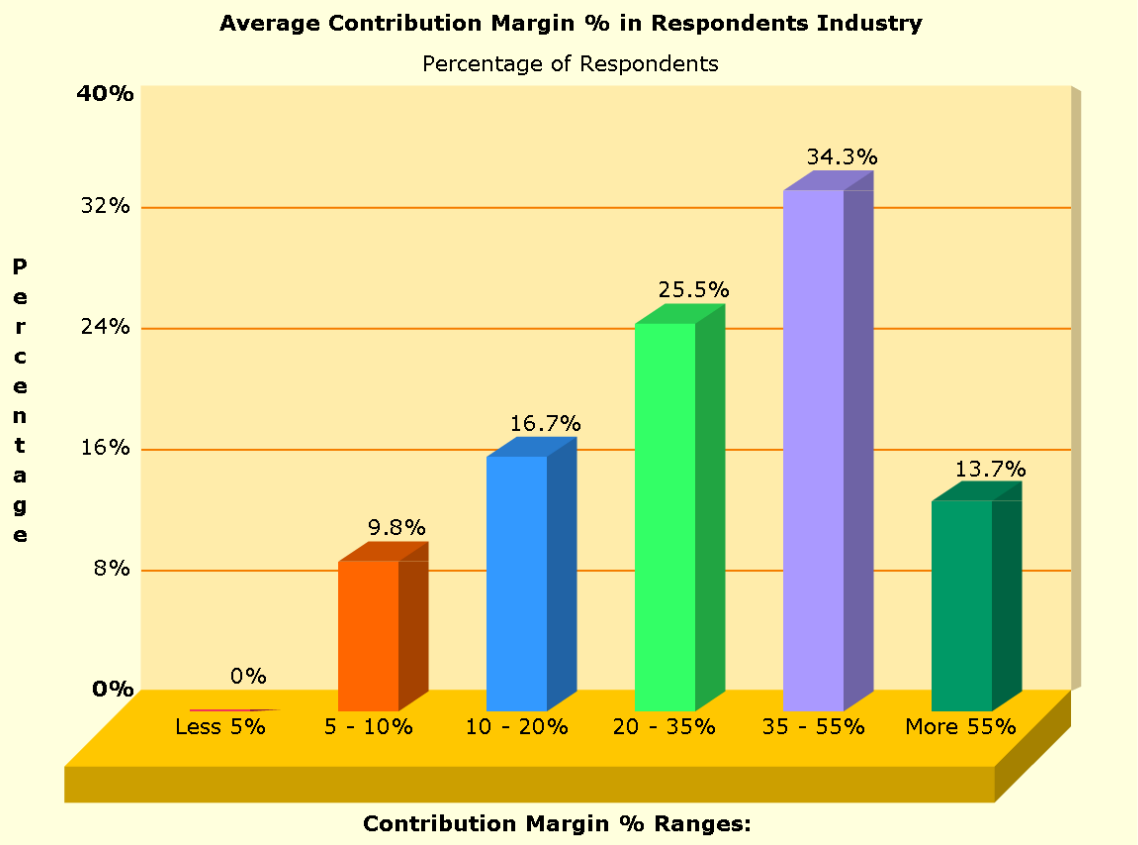
Exhibit 19:



The second use and perceived value of information question asked about the average product/service gross margin percentage in the respondent's company industry (see Exhibit 19). A number of respondents (41%) had gross margins of 15%, or smaller.

Information Value Question 3: This use and perceived value of information question asked about the average product/service contribution margin percentage in the respondent's industry (see Exhibit 20). None of the companies had a contribution margin of less than 5%, However, 9.8% of the companies had a contribution margin between 5 and 10%, 16.7% had a contribution margin between 10 and 20%, 25.5% a contribution margin between 20 and 35%, 34.3% a contribution margin between 35 and 55% and 13.7% a contribution margin of more than 55%.

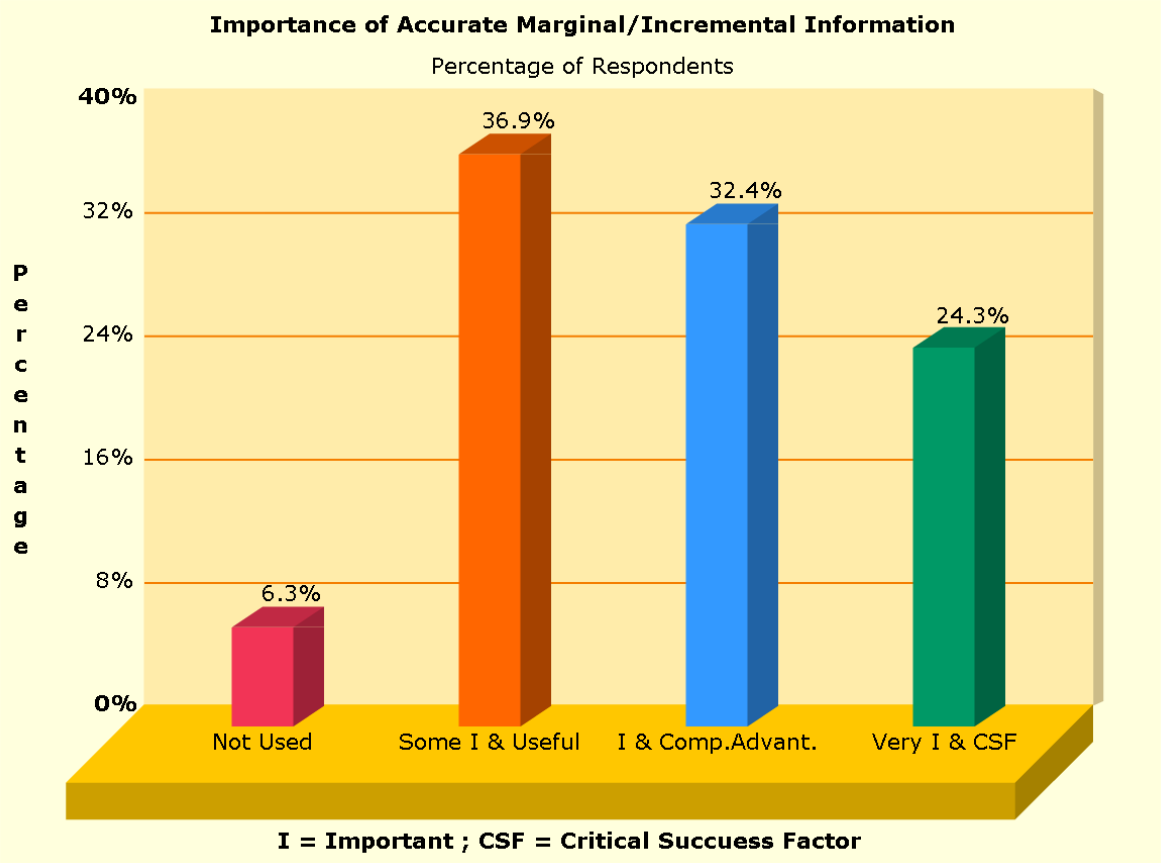
Exhibit 20:



The relatively small shift from contribution margin to gross margin, when compared to overall cost structures in the demographics section (Demographics Question 8), is a clear indication of how incorrectly variable costs are defined and hence how compromised marginal analytic information is. This phenomenon was also observed in other the RCA case studies.

Information Value Question 4:

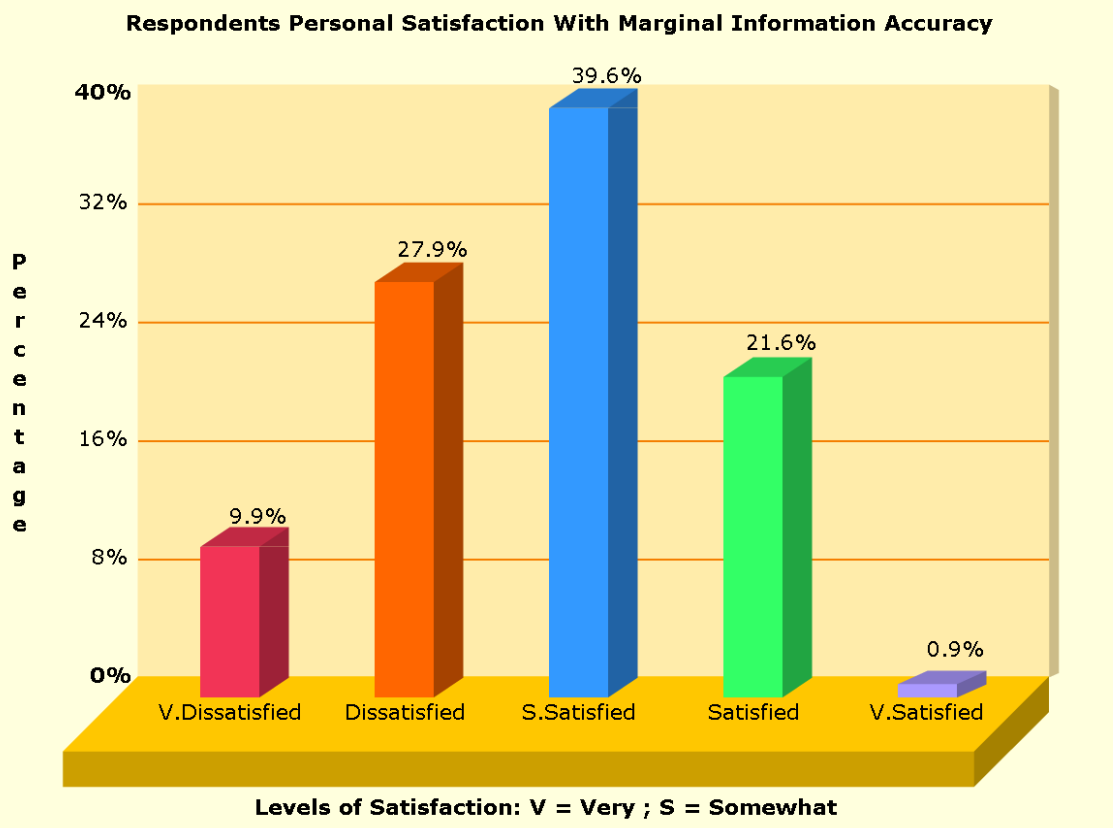
Exhibit 21:



The fourth use and perceived value of information question was about the importance of accurate marginal/incremental cost information to company managers (see Exhibit 21). In this regard 6.3% of the respondent's indicated that marginal information is not used, 36.9% of the respondent's marked somewhat important and useful, 32.4% of the respondent's marked important and competitive advantage and 24.3% indicated very important and a critical success factor. Therefore 93.7% (100-6.3%) of the respondents felt marginal/incremental information was at least important to company managers.

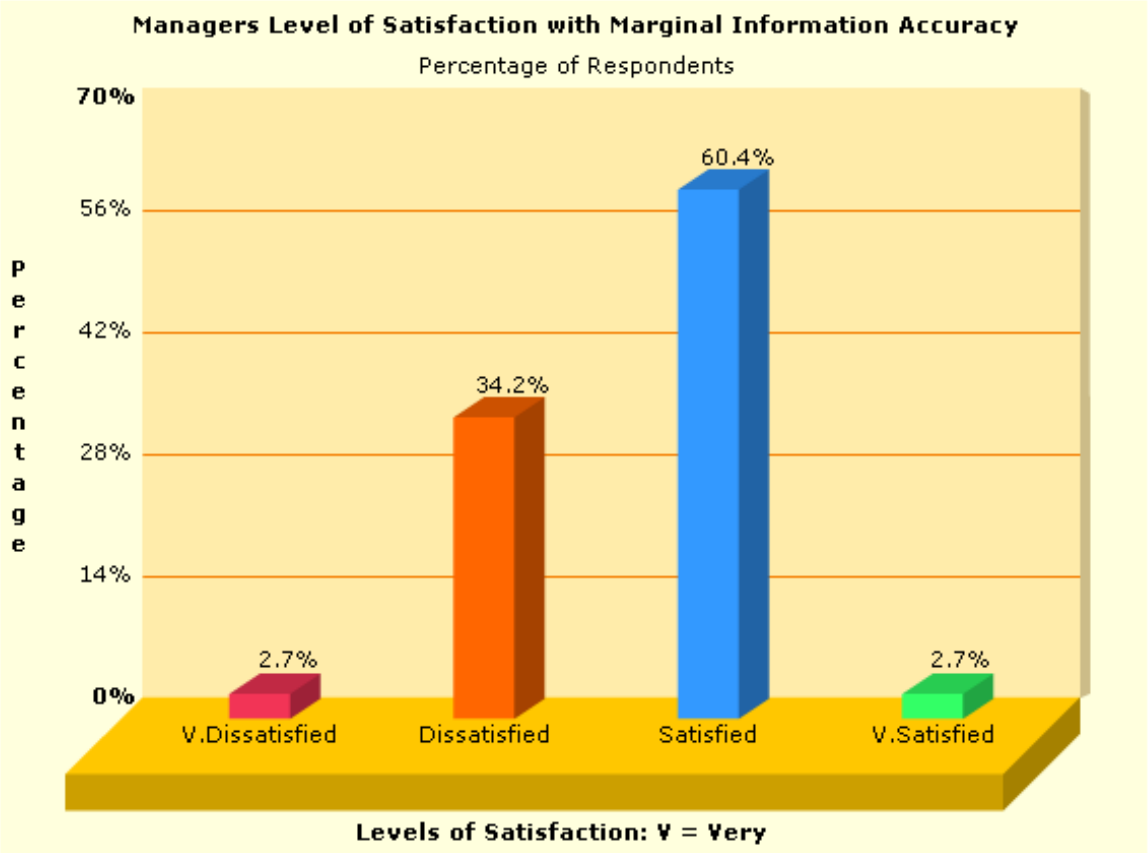
Information Value Question 5: This use and perceived value of information question asked about the personal level of satisfaction with the accuracy of their company's marginal/incremental cost information (see Exhibit 22). Responses indicated that 9.9% of the respondent's were very dissatisfied, 27.9% were dissatisfied, 39.6% were somewhat satisfied, 21.6 were satisfied and 9% were very satisfied. Not surprisingly 37.8% of the respondents (9.9% + 27.9%) were dissatisfied or very dissatisfied with their company's marginal/incremental information. Only 0.9% of the respondent's were very satisfied – compare this to the importance of the information in the previous question. Since the responses to this question is clearly skewed to the dissatisfied side of the scale there is ample room for improvement in companies' marginal/incremental information. It should be noted that one is not looking for a bell curve as indicative of good information, instead a t-distribution heavily weighted to Satisfied and Very Satisfied is what is required.

Exhibit 22:



Information Value Question 6: This use and perceived value of information question asked about engineers', manufacturing/service managers', and sales managers' level of satisfaction with the accuracy of the respondent company's marginal/incremental cost information (see Exhibit 23). Indications were that 2.7% of the respondents marked very dissatisfied, 34.2% of the respondents marked dissatisfied, 60.4% of the respondent's marked satisfied and 2.7% of the respondent's marked very satisfied.

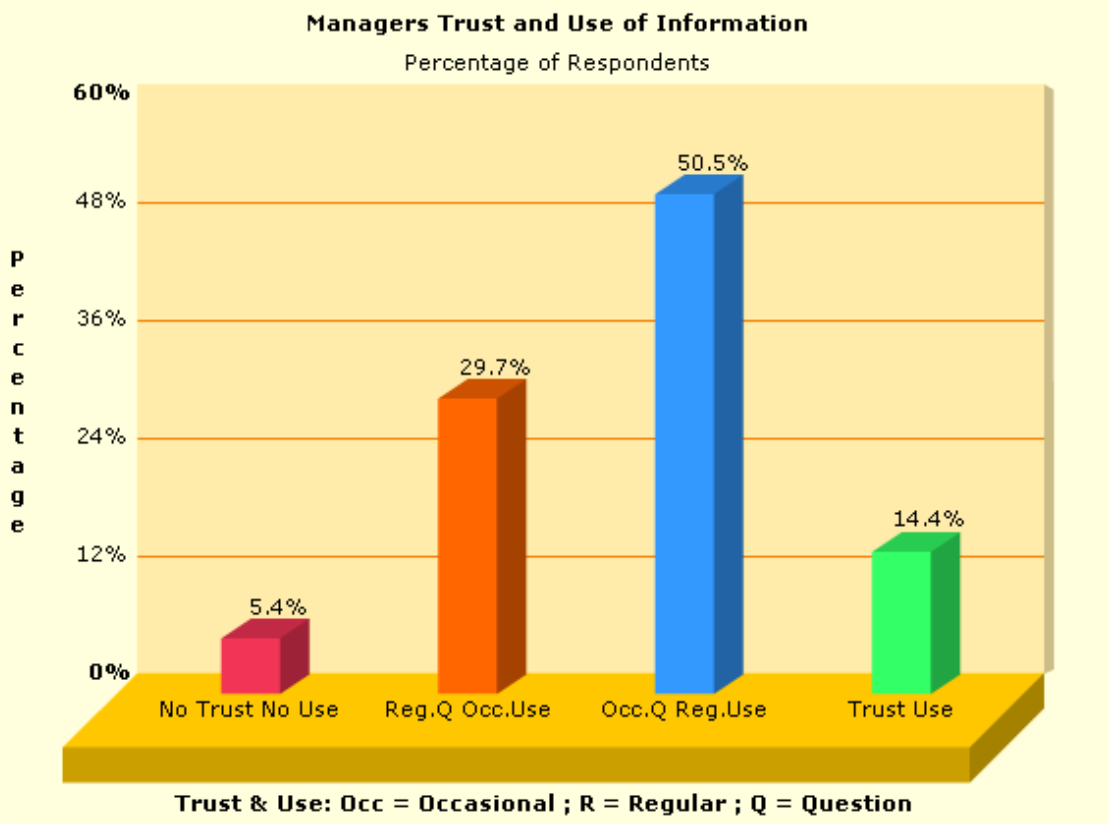
Exhibit 23:



Almost thirty seven percent of the respondents (2.7% + 34.2% = 36.9%) said their company's engineers', manufacturing/service managers', and sales managers' level of satisfaction with the accuracy of marginal/incremental cost information was at least dissatisfied while 2.7% marked very satisfied. Keep in mind that it was primarily financial people who responded to the survey. A point worth noting between this question and the previous one is that finance people indicate a personal level of dissatisfaction much higher than what they infer the level of the managers they serve to be. Is this because the finance people put a more favorable spin on the information to company management?

Information Value Question 7: The last use and perceived value of information question was about managers' in the respondent's company attitudes about the company's cost system in general (see Exhibit 24). Responses indicated that 5.4% of the respondents do no trust or use of the information, 29.7% marked that they regularly question and occasional use the information, 50.5% marked that they occasionally question the information but they regular use it and 14.4% of the respondents marked that they trust and use the information.

Exhibit 24:



Respondents indicated that in 85.6% of cases (100% - 14.4%) managers at least occasionally question their company's cost system. Even though managers recognize their cost information is bad (refer the previous question) it is still regularly or more frequently used by 64.9% and occasionally and more used by 94.6%. There is clearly no other source for monetary management information than that provided by the management accounting system.

Conclusion

The survey showed the presence of a whole host of problems with marginal analytic information in practice for companies. These range from conceptual errors and inconsistencies in

management accounting system design to the views that managers hold with regard to consumption and cost behavior. Moreover, managers don't trust the information they get all the while knowing and admitting that they need good marginal information.

There is clearly a need in management accounting and in management decision support practice for a management accounting approach that will provide accurate and useful marginal analytic information.

Chapter 3: How RCA Addresses Marginal Analytics Requirements

Introduction

This chapter provides insight into how Resource Consumption Accounting (RCA) principles, embodied in the approach's three pillars, are used in cost modeling and the structuring of cost data to provide superior decision support information for resource application decisions. The preeminence of causality in marginal analytics and management accounting justifies a short section on RCA's treatment of the principle. Each RCA pillar is expounded on before details are provided of how the three RCA pillars and related aspects of RCA address the marginal analytic demands on management accounting identified in Chapter 1.

Causality in RCA

Recall from Chapter 1 that management accounting had to accommodate both the strong and the weak forms of causality for the purposes of marginal analytics. How RCA addresses each of these is discussed in this section.

First, with regard to the strong form of causality, as indicated in Chapter 1 it should be based in the quantities of goods and services an enterprise consumes and produces. This requirement forms the basis for RCA's second pillar i.e., the quantity structure or quantity-based approach to cost modeling. This also leads to a definition of causality in RCA that is decidedly void of the traditional value centric emphasis.

> **Causality:** The relation between an input and a managerial objective's output, whose nature is such that the input must be consumed if the objective is to be achieved.

Two aspects of this definition are important. First the use of the words 'must be' indicates the requisite dependency between inputs and outputs identified in Chapter 1. Second, this definition clearly expresses causality as a relation between quantities (inputs and outputs) and not in terms of cost data or dollar amounts. This quantity-based view factors into all three of RCA's pillars as will be shown below.

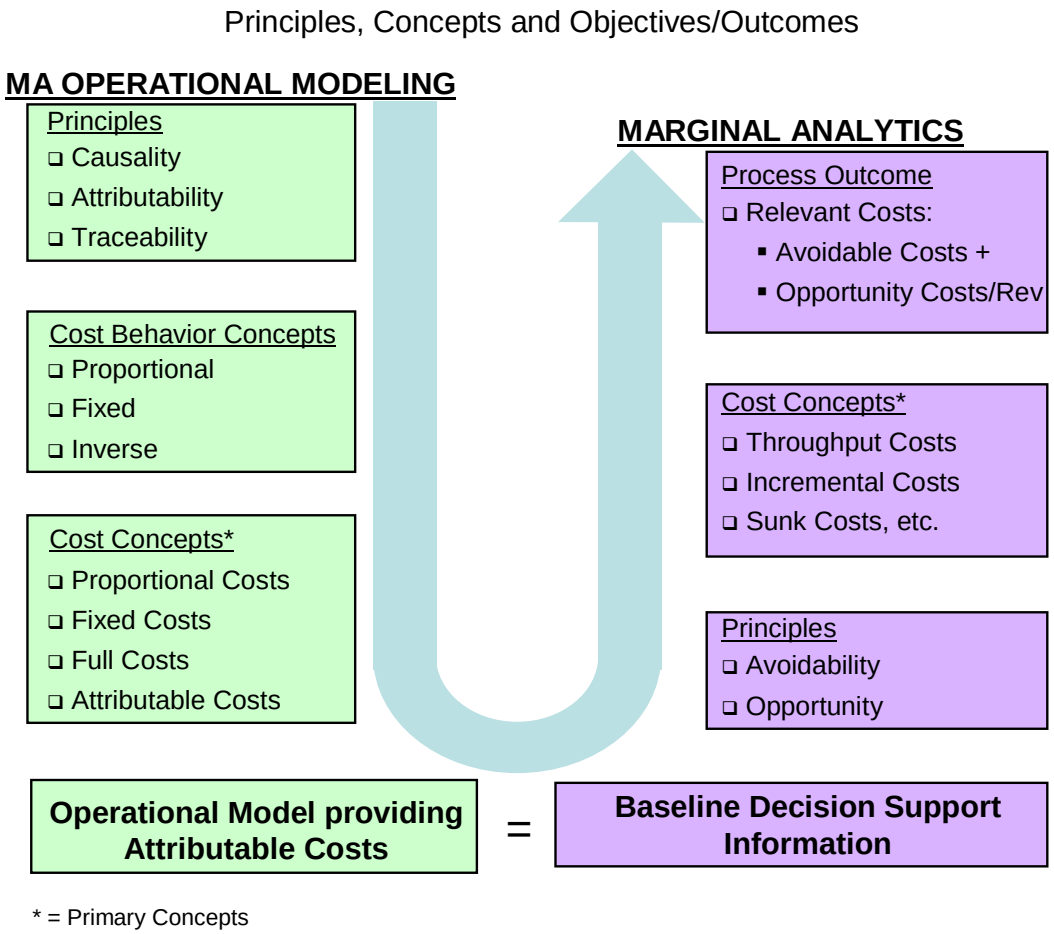
Second, with regard to the weak form of causality, RCA employs the principle of attributability to assign common fixed costs and other costs that cannot be quantitatively associated with lower level outputs. This association occurs at decision relevant levels in RCA's multi-level P&L.

> **Attributability:** The responsiveness of inputs (and hence their costs) to decisions that change the provision and/or consumption of resources. (Adapted from Shillinglaw)

Based on the principle of attributability the excess/idle capacity costs for a product group would be treated as an attributable cost to the particular product group P&L segment. Another example would be for an airline that assigns the costs for the business class lounge in Paris to the P&L segment for Destination: Paris. If the airline decides to no longer fly to Paris the lounge costs are clearly avoidable. At higher levels in the P&L more cost will be attributable until at the highest level (i.e., the operating result for the company) the costs attributed will reflect a fully absorbed number. Examples of typical entity level costs assigned at the operating result level are the office of the President and the Public Relations department.

The cumulative effect of assignments in RCA based on quantitative causality and the principle of attributability is attributable costs. Attributable cost is the primary objective in cost modeling in RCA. The relationship between the various principles that govern cost modeling in RCA, their outcome (attributable costs) and its use in marginal analytics and the principles that apply in the decision making process are graphically illustrated in Figure 3.1

Figure 3.1 RCA Operational Modeling and its support for Marginal Analytics



The Three Pillars of RCA

RCA has claimed from the outset that certain inalienable practices form the basis for the operational modeling in the approach. These have come to be known as RCA's three pillars i.e., essential modeling practices that would void RCA of a core element should any of them be compromised or removed. RCA's three pillars are:

- The view of resources,
- The quantity structure, and
- The view of consumption and cost behavior.

In addition to the three pillars, which summarize RCA's core elements, the approach also incorporates other concepts and practices aimed at superior management accounting practice. Some of these are relevant in addressing the demands of marginal analytics and will be included in the discussion below as appropriate.

Pillar 1: The RCA View of Resources

Resource: A definitive component of an enterprise acquired to generate future benefits.

This definition of a resource is purposely broad to include people, machines, raw materials and cash as well as resources developed by the enterprise internally e.g., a commercial bank's in-house developed mortgage application software program.

Resources feature as a key aspect of RCA and this definition serves as an accurate reflection of RCA's resource view. RCA adds a further distinction by identifying three categories of resources, which are based on:

- the nature of the primary benefit each category of resource provides, and
- the distinctive optimization characteristics for each.

The three categories are functionality resources, services and capacity resources.

Functionality Resource: A resource, with one or more unique attributes, which must be sacrificed to achieve a managerial objective.

Functionality resources are typically entirely consumed/sacrificed in providing benefit. For example, a manufacturer of electric motor armatures requires a raw material that can fulfill the following functions:

- provide a relatively high specific weight to ensure rotational momentum,
- conduct electricity, and
- be easily machined.

A six inch diameter round copper bar provides the functionality required but must be entirely sacrificed to achieve the objective. Functionality resources are often subject to lead times and carrying costs. From a management accounting perspective they can usually be assigned

directly where they are consumed, in this example to the cost model object for 6" electric motor armatures. Functionality resources therefore rarely justify a dedicated resource-related cost model object in the management accounting system.

Service: Resource output to provide benefit for a discrete period or for a particular managerial objective. Service can be provided and consumed internally, and acquired and sold externally.

Services are typically representative of resources (most often capacity resources) a company selects not to invest in but for which it enters into an agreement with a service provider to purchase as needed. Information technology and human resource outsourcing are typical examples. Services are therefore periodically subject to assessments/reevaluations with regard to investment decisions. From a management accounting perspective they can usually be assigned directly where they are consumed. Similar to functionality resources they rarely justify a dedicated resource-related cost model object in the management accounting system.

Capacity Resources: A resource which provides quantifiable output to achieve one or more managerial objectives.

Capacity resources are perpetual in nature and have output potential which might or might not be consumed. Capacity resources are subject to specific management activities seeking to maximize utilization over the life of the resource. They are also subject to repeated investments to increase throughput (upgrading a machine) or improve the quality of their outputs (employee training). Capacity resources often require extensive support such as maintenance for machines and human resource functions for employees. From a management accounting perspective accounting for the cost of capacity and its various components (such as excess/idle capacity) is a complex endeavor and justifies dedicating resource-related cost model objects for capacity resources.

As is evident from the RCA definition, a resource does not equate to a general or sub-ledger account - over the last two decades this has been the prevailing view of what a resource is. In RCA, general ledger accounts represent an administrative system to record expenses, of resources amongst others. In an RCA cost model, the attributes of a resource – e.g., its costs, quantitative measures or qualitative characteristics - are represented by resource elements.

Resource Element: A cost item associated with a resource or a quantitative or qualitative attribute of a resource.

Resource elements are combined in a resource pool to represent one or more physical resources in an RCA cost model.

Resource Pool: A collection of resource elements for one or more homogeneous resources.

In establishing resource pools in RCA, resources must satisfy the following criteria:

- the interchangeability criterion,
- be of a similar technology,
- the responsibility of one manager or team,
- their costs must conform with the homogeneity principle,
- the total cost of the resource(s) must satisfy the materiality test,
- outputs and related inputs are able to be planned,
- actual information (quantities and costs) can be collected or imputed, and
- the resources must not be geographically dispersed.

Note: Practicality sometimes dictates grouping two or more types of resources, particularly when different resources (e.g., a clerk and a desktop computer) form one productive unit and at least one of the resources is a low/insignificant cost item. In the clerk-desktop example the materiality test typically dictates that a separate resource pool for desktop computers is not worth the administrative effort.

In RCA, the resource pool serves as the object of all managerial activity concerning capacity resources. All of the resource elements that define a particular resource and which are required for the various management accounting processing steps (e.g., charging out) and/or management actions (planning, managing utilization, etc.) are contained within the resource pool. To illustrate how the elements of a resource combine in a resource pool, refer to Table 1. The resource pool comprises only one resource, a technician. The resource elements used to define the resource in the cost model include the resource pool description (a qualitative element), the resource's output (a qualitative element), the output quantity (a quantitative element) and three cost elements (monetary elements).

Table 1: Modeling Resources and Resource Elements in RCA

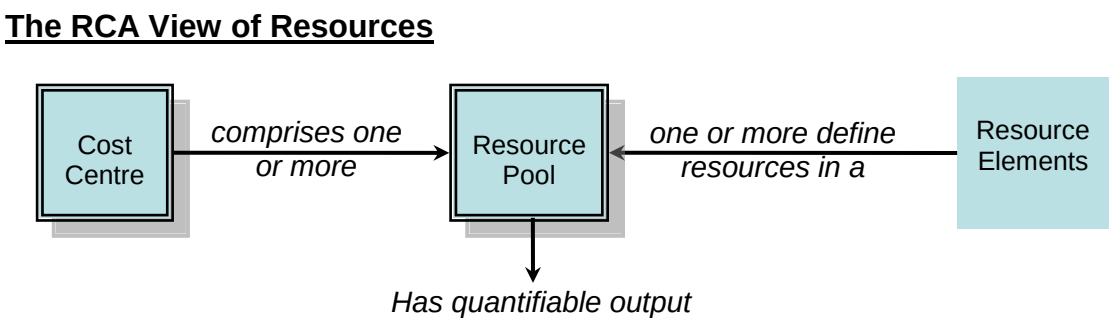
Resource Pool: Technicians	**Output:** Technician Hours **Output Quantity:** 1,800 hours			
Cost Elements:	*Fixed Quantity*	*Prop. Quantity*	*Fixed Cost*	*Prop. Cost*
Wages Productive	-	1,800 Hrs	-	$18,000
Wages – Training	40 Hrs	-	$400	-
Wages – Paid Absence	160 Hrs	-	$1,600	-

Table 1 also shows how RCA uses the resource elements to model the resource's innate costs. The resource's unit is hours (2,000 in total), which are divided into three categories; productive, training and paid absence. Naturally, the productive hours equal the resource pool's output. Notice also that costs follow quantities i.e., the 40 and 160 hours for training and paid

absence, respectively, are fixed and result in associated fixed costs of $400 and $1,600 for the resource pool.

Another resource related cost model object encountered in RCA is the cost centre, which is used for purposes of responsibility accounting. Figure 1 illustrates the relationships between the various concepts that RCA uses in modeling its view of resources. Note, only cost centre and resource pool are cost model objects in an RCA cost model.

Figure 3.2: Resource related Objects and Concepts in RCA



Pillar 2: The Quantity Structure to Model Operations in RCA

In RCA, the requirement to accurately render enterprise operations is addressed by the second pillar - a quantity structure.

Quantity Structure: An RCA cost model defining material causal relationships as quantity-based.

In RCA, cost model objects are defined with quantified output measures, see Table 1 above. Cost model objects also consume quantified inputs resulting in a cost model based on quantity-based relationships. In line with the recognition that cost follows quantity, an RCA cost model is only valued (dollars are attached to the various inputs and outputs) once the quantity structure is complete. As discussed above under the weak form of causality there are always costs for which no causal relationships can be defined in relation to planned or current outputs e.g., excess/idle capacity costs. Moreover, other costs fail the materiality test in this regard e.g., the public relations office. As indicated above, these are dealt with in accordance with the principle of attributability. RCA assigns these common fixed costs en bloc to an actionable level in a multi-dimensional product/service profit and loss statement. In light of the presence of common fixed costs, the quantity structure is not exhaustive i.e., not all costs in an RCA cost model are included in quantitative causal relationships.

Two other characteristics of resources are also addressed by the quantity structure namely:

- resource interrelationships, and

- attributable resource costs.

These resource characteristics feature as key determinants in RCA cost model design. First, resource interrelationships are explicitly reflected among RCA cost model objects in a simultaneous cost model. As part of the effective accommodation of resource interrelationships, RCA allows for not only resource-to-resource consumption relationships but also for resource-to-activity-to-resource relationships in a simultaneous manner. In order to keep original cost items for a resource separate from those inputs consumed from support services, RCA employs the concepts of primary costs and secondary costs.

Primary Costs: Costs for inputs to a managerial objective sourced external to the enterprise; are typically (but not necessarily e.g., depreciation) indicative of cash outflows.

Secondary Cost: Costs for inputs consumed, by a managerial objective, from internal support functions.

Second, an accurate reflection of resource costs and resource interrelationships allow RCA to satisfy the attributable cost requirement. The provision of attributable costs in the resource layer of the cost model also paves the way for the provision of attributable costs on activities, products/services and result segments. Table 2 shows an expanded example of Table 1, which includes details on primary and secondary costs for a resource pool that reflects the resource's attributable costs.

Table 2: Attributable Resource Costs

Resource Pool: Technicians	**Output:** Technician Hours **Output Quantity:** 1,800 hours			
Primary Costs:	*Fixed Quantity*	*Prop. Quantity*	*Fixed Cost*	*Prop. Cost*
Wages Productive	-	1,800 Hrs	-	$18,000
Wages – Training	40 Hrs	-	$400	-
Wages – Paid Absence	160 Hrs	-	$1,600	-
Secondary Costs:	*Fixed Quantity*	*Prop. Quantity*	*Fixed Cost*	*Prop. Cost*
Payroll Processing	12 ea	-	$180	-
Purchase Orders	-	4 ea	$20	$40
Facilities Space	100 SqFt	-	$4,600	-

In addition to the quantity structure, which deals primarily with input-output relationships in goods and services flows, RCA also recognizes management tiers and related cost model objects in modeling. The four generic management tiers in RCA are:

- the resource tier,
- the value chain tier,
- the product/service tier, and
- the result segment tier.

Management tiers facilitate the unique optimization and control aspects of these four areas of an enterprise as well as the recognition and tradeoffs of overall optimization amongst the tiers. Figure 2 provides an overview of the RCA management tiers and some of the cost model objects typically used in each. Tiers and their cost model objects in RCA allow for the effective segmentation of managerial objectives in an RCA cost model as demanded by marginal analytic requirements. It should be noted that tiers and cost objects are company and industry specific e.g., in a construction entity an event management object such as a project with work-breakdown structures and related networks will feature prominently.

Figure 3.3: Management Tiers and Their Cost Model Objects in RCA

Management Tiers and Their Objects

Tier	*Object*	Authorized Cost Report	Authorized Profit Report
Resource Area	Cost Centre	✓	N/A
	Resource Pool	✓	N/A
Value Chain Area	Process	✓	N/A
	Activity	✓	N/A
Product/ Service Area	Make to Stock	✓	N/A
	Make to Order	✓	N/A
	Engineer to Order	N/A [1]	N/A
	Event Management Object	N/A [1]	N/A
	Service Object	✓	N/A
Profitability Area	Market Segment	N/A [2]	✓
	Target Market	N/A [2]	✓

1 - Lot size is typically one, plan-actual reporting is sufficient.

2 - Included in the Authorized Profit Report.

Pillar 3: The Nature of Consumption and Cost Behavior in RCA

The view of the nature of cost is the third of RCA's three pillars. RCA completely breaks with the traditional view of the nature of cost. Instead of the traditional definition of cost variability which relates changes in total costs with changes in total output volume, RCA introduces the concept of responsiveness as the cornerstone of its view on cost behavior.

Responsiveness: A relation reflecting the changes in the amount of input quantities (and hence their costs) that are consumed due to changes in the level of output of a managerial objective.

Note that responsiveness recognizes the relationship between inputs and outputs at the cost model object level as foundational to cost behavior. This is where the break from the traditional view is at its most pronounced; responsiveness in RCA considers cost behavior on every cost model object, including support services, independently, and recognizes a potentially inverse relationship between total cost and total volume. An example of such an inverse relationship is when fewer more complex products are produced at a higher cost. There is therefore no implied linear relationship between total volume and total cost in RCA.

In RCA, the view of resources, the quantity structure and the concept of responsiveness combine to accommodate the innate costs of resources and cost conversion throughout the cost model. As demonstrated above and shown in Table 1, RCA uses a resource's resource elements to reflect innate costs in a resource pool. In the quantity structure, whenever an internal output is consumed, cost conversion rules identified in Chapter 1 are enforced by specific formulae in RCA. (In these formulae upper case 'F' and upper case 'P' represent fixed quantities and proportional quantities respectively and lower case 'f' and lower case 'p' represent fixed cost rates and proportional cost rates respectively.)

In RCA the following formula will result in converted cost:

(1) = (F x p),

the following formula will maintain the innate costs of the supplier as proportional:

(2) = (P x p), and

the following formulae will maintain the innate costs of the supplier as fixed:

(3) = (F x f) and

(4) = (P x f).

The application of these formulae can be illustrated using the secondary consumption relationships in Table 2. Table 3 provides the innate cost rates for each of the secondary services consumed in Table 2 as well as the corresponding formulae that were applied in arriving at the secondary costs in Table 2.

Table 3: An Illustration of Conversion Formulae

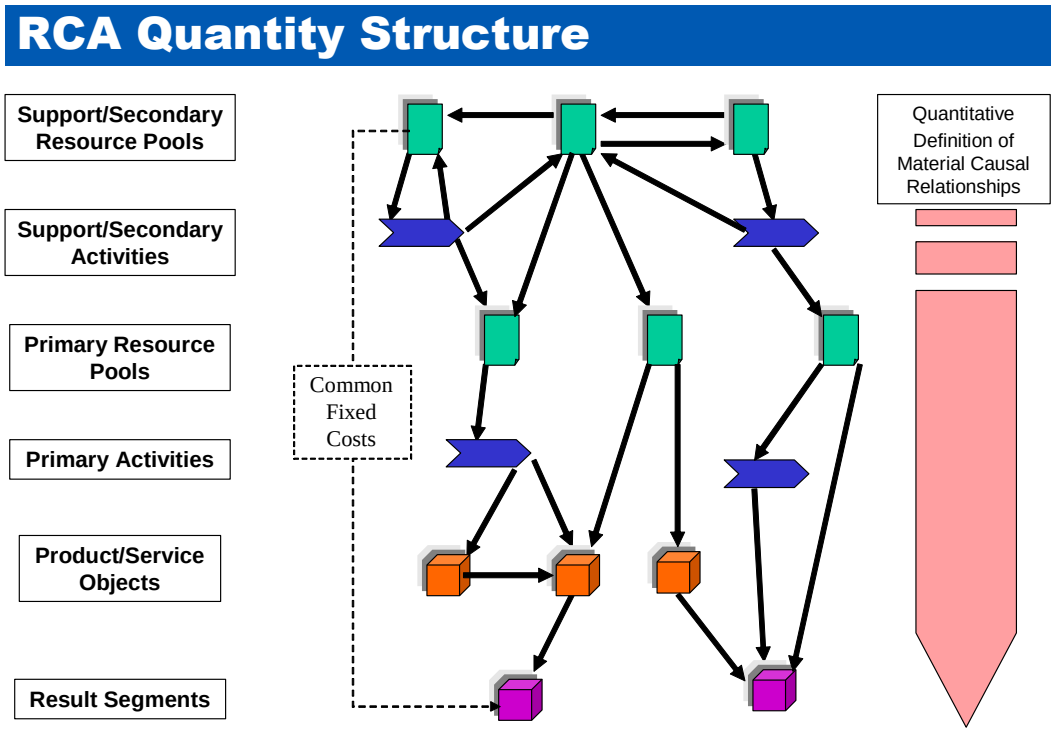
Applying Cost Conversion Formulae in RCA			
Innate Cost Rates for Services (Refer Table 2)		The Formula Applied	
.	Payroll Processing: $5.00 fixed $10.00 proportional	. .	Formula (3) Formula (1)
.	Purchase Orders: $5.00 fixed $10.00 proportional	. .	Formula (4) Formula (2)
.	Facilities Space: $46.00 fixed $0 proportional	. .	Formula (3) N/A

Hence, RCA is able to combine three aspects of management information critical to satisfying marginal analytic requirements around different costs for different purposes into the decision support information it provides. This is achieved by classifying both quantities and costs as primary or secondary as well as fixed or proportional. This means that a single causal relationship, when defined in an RCA cost model, will encompass all three aspects. For example, an input quantity consumed is defined as a secondary quantity consumption, the quantity is further classified as fixed or proportional and the nature of its costs is subjected to the conversion rules as embodied in the formulae above.

With this information a manager can clearly observe the true behavior of costs/dollars as they relate to the input quantities in decisions. The dollars per se are not affected by the decisions, instead it is as quantities are affected that the monetary impact is understood. The primary and secondary classifications further contribute to insights into immediate cash flow impacts (primary costs) and impacts where the evaluation has to be extended to other internal departments/functions or processes (i.e., secondary costs).

This concludes the discussion on the three pillars of RCA. A summary schematic is provided in Figure 3.4 illustrating some of the cost model objects in a typical RCA cost model as well as examples of relationships between objects. The treatment of common fixed costs is also illustrated.

Figure 3.4: Cost Modeling in RCA.



Satisfying Marginal Analytic Requirements

Table 4 provides a summary of the marginal analytic requirements a management accounting system must fulfill as well as a short description of the RCA solution in each instance.

Table 4: Fulfilling Marginal Analytical Demands

Incorporate Foundational Economic Principles			
Requirement		RCA Solution	
1.	Provide an accurate rendering of an enterprise's flow of economic goods and services.	1.	Cost model objects, which represent managerial objectives, with quantified outputs and corresponding inputs.
2.	Accommodate the strong form of causality.	2.	The quantity-based definition of causality in RCA, which is rigorously applied in establishing its quantity structure.
3.	Accommodate the weak form of causality	3.	Use of the principle of attributability to assign common fixed costs and other non-output related costs to decision relevant levels in RCA's multi-level P&L.

4.	Link the quantitative flow of goods and services to their monetary implications.	4.	The integration of resources and their costs by means of resource elements in one cost model object (a resource pool) and reflecting resources' innate costs.
5.	Provide insight into input-output behaviors - and their respective costs	5.	Relate inputs to outputs as either fixed or proportional. Reflecting cost conversion rules in consumption relationships.
Segment Information to Enhance Its Relevance to Decision Makers			
	Requirement		RCA Solution
1.	Segment the cost model for only that portion of economic goods and services relevant to the decision at hand.	1.	Management tiers and their respective cost model objects.
2.	Reflect all causal relationships and their characteristics relevant to the decision e.g., innate costs, converted costs, original and consumed cost items.	2.	Resource elements to reflect a resource's innate and converted costs. Primary and secondary delineate the consumption relationship of original cost items for a cost objective.
3.	Provide accurate monetary information for all relevant cost categories appropriate to the decision.	3.	RCA provides attributable costs on all cost model objects, allowing for the derivation of lesser cost concepts.

Table 5 provides an example of a resource pool with attributable costs followed by an illustration on how this information is used in a resource application decision i.e., an outsourcing scenario. In this example, the plant maintenance resource pool has an output measure of maintenance labor hours and a planned output quantity of 20,000 hours. Expressed as a proportional amount, the primary cost for technician wages is $600,000. Supervisor salaries are planned as fixed (i.e., $48,000). General material cost is planned in fixed and proportional components. The fixed portion (i.e., $855) is for material to maintain equipment in the maintenance workshop. Proportional cost (i.e., $100,000) is for general materials consumed during maintenance tasks. Finally, depreciation for maintenance equipment and tools results in fixed cost of $50,000.

Table 5: RCA Attributable Cost Information for An Outsourcing Decision

Resource Pool: Plant Maintenance		**Output Measure:** Maintenance Labor Hours **Output Quantity:** 20,000 hours			
Primary Costs:				*Fixed $'s*	*Prop. $'s*
Technicians Wages				$ 0	$600,000
Supervisory Salaries				48,000	0
General Material				855	$100,000
Depreciation: Job Shop Equipment				50,000	0
				$98,855	$700,000
Secondary Costs:					
Resource Pool	*Output*	*Fixed Qty*	*Prop.Qty*		
Utilities	Megawatt-hrs	0	200	$0	$30,000
Activity/Process	*Driver*	*Fixed Qty*	*Prop. Qty*		
Benefits Adjust.	# Adjustments	20	0	$1,000	$0
Purchase: Gen. Material	# Purch.Orders	10	200	1,145	4,000
				$2,145	$34,000
			Total Resource Pool Costs:	**$101,000**	**$734,000**
			Unit Cost Rates:	$5.05	$36.70

Secondary costs are separated into those charged directly from other resource pools and those charged through an activity. Utilities (200 Megawatt-hours - MwH's) - are charged directly and result in $30,000 ($150 x 200) proportional secondary costs. The secondary costs charged through activities are for human resources and purchasing. A fixed quantity of 20 units of the HR activity - benefits adjustments - result in secondary fixed costs of $1,000. From procurement, the procure-general-material activity is consumed as partially fixed and partially proportional (i.e. 10 units and 200 units respectively). This results in fixed costs of $1,145 [(10 x $4.50) + (10 x $20) + (200 x $4.50)] and proportional costs of $4,000 (i.e., 200 x $20). The net result is attributable resource costs for the plant maintenance resource pool and an output rate of $41.75 – ($5.05 fixed; $36.70 proportional).

This attributable cost information will be used below to illustrate the following two resource application decisions:

- Outsourcing an entire resource pool.
- Outsourcing a process.

Each of these scenarios is discussed in detail in the following sections.

Supporting a Decision to Outsource a Resource Pool

Consider an example in which an organization has an opportunity to outsource its entire plant maintenance function. An external provider proposes to perform the maintenance services for $40 per hour. At first glance, with an internal rate of $41.75 per maintenance hour, this translates into a potential annual cost reduction of $35,000 [(20,000 hours x $41.75) – (20,000 hours x $40)]. On closer examination of Table 4, however, it appears that some caution is warranted. The primary costs (i.e., fixed and proportional costs equal $798,855) and proportional electricity cost (i.e., $30,000) are avoidable (i.e., total avoidable costs of $828,855). However, for human resources and procurement, excess capacity is the more likely outcome. These functions require further analysis to realize cost reduction. The avoidable costs for the alternative to outsource translate into $41.44 per hour (i.e., $828,855/20,000 hours). A manager may conclude that an immediate cost reduction of $1.44 per hour (i.e., $41.44 – $40) or $28,855 annually is possible. From a cash flow perspective, however, a different picture emerges.

Assume the maintenance equipment was purchased for cash (i.e., there is no long-term loan to settle) and that no buyer can be attracted for the equipment. In this case, cash outflow reduction would be $778,855 (i.e., $828,855 – $50,000) or $38.94 per hour. Compared to the $40 per hour cost of the external provider, all of which will be cash outflow, it is clear that plant maintenance should not be outsourced if the equipment cannot be sold. Conversely, if a buyer can be attracted for the equipment, it would have to be sold for at least the net present value of the increase in cash outflows ($40 - $38.94 per hour) for the contract period – such a period ideally approximating the remaining economic life of the equipment. Knowing how and when resources are actually consumed, when they remain idle, and when they result in avoidable costs and when they can be sold result in significant differences in this decision.

Supporting a Decision to Outsource A Process

Consider also an example in which the preventative maintenance process for a machine, that requires 500 hours of maintenance annually, can be outsourced. The original equipment manufacturer (OEM) proposes to do the work for $31/hour. The OEM provides general materials, but will use the electricity on site. The current annual cost to perform the maintenance is $20,875 (500 hours x $41.75). It would cost $15,500 (500 hours x $31) for the OEM to do the work - a potential cost reduction of $5,375.

The 500-hour (i.e., 0.25 of a person) reduction in labor demand on the internal maintenance function will result in excess capacity unless one technician can be terminated. Two options then exist to address the terminated person’s remaining productive hours i.e., capacity of 1,500 hours/0.75 of a person. The remaining resources can provide the output in regular time but this is not likely to happen and also raises work quality issues. Alternately, the 1,500 hours can be worked as overtime, but 1,500 hours of overtime (paid at 1.5 times regular wage) is more

expensive than keeping the original technician idle 25% of the time - assuming zero fringe benefit costs.

As far as secondary costs are concerned, the following has relevance. First, since the OEM performs the work on-site, proportional electricity cost will not decrease. Second, the number of proportional purchase orders required decreases, but no immediate savings are realized since excess capacity will result in procurement. Unless procurement workforce reduction can be accomplished, which is unlikely given the insignificant effort required to provide purchasing support to the machine in question, the proposal to outsource the preventative maintenance process should not be favorably considered.

Concluding Remarks

Through RCA's incorporation of the strong and weak forms of causality and the embodiment of these principles into its three pillars and various other principles and methods, RCA is able to fully satisfy marginal analytic information requirements. RCA provides levels of accuracy and transparency in decision support information not attainable with other management accounting approaches. In Chapter 4 of this deliverable, the RCA principles and practices are applied in a case study to more specifically illustrate the application of the principles and methods inherent to the approach.

Chapter 4: The On-Semi Case Study

Company Overview

On Semi is a $1.3 bil. manufacturer in the semi-conductor industry and is a leading supplier of both power analog and power discrete components. Onsemi has significant portfolio breath, serving as a supplier to all major manufacturers in the computing, consumer/handheld electronics, automotive and power supply industries. Products for which they supply components include PC's, Set Top boxes, Tivo PVR's, Broadband Gateways, CD/DVD Recorders, MP3 players, hard drives, Cell phones, PDA's, GPS devices, digital cameras, AC/DC adapters for charging, TV's and various automotive computing applications.

In supplying their global devices market On Semi ships more than 2 billion products each month. Onsemi customers include Hewlett-Packard, Lenovo, Intel, Asus, Microsoft, LG, Samsung, Sony, Siemens, Bosch and Delphi. Onsemi can be described as a low-tech hi-tech company and occupies a niche in the market that strives to leverage low cost manufacturing capabilities. The company is headquartered in Phoenix, AZ on a 100 acre site and has 17 manufacturing and design facilities spread across the globe located in North America, the EU, Eastern Europe and Asia.

Wafer FAB Management Accounting at On Semi

The Onsemi Wafer FAB Manufacturing Finance team discovered in Q4/2005 that unit costs at the Zener-Rectifier (ZR) Fab were not based on any rational, systematic methodology. Costs were allocated based on a fixed percentage per product regardless of value. This approach was established in early 2005 and was never reviewed. A new methodology was put in place during Jan 2006 aimed at utilizing Onsemi's current cost system (Manufacturing Finance and Analysis Planning System, or MfgFAPS) to produce information similar to an Activity-based Costing (ABC) system.

In this revised model, the Numerator (Spending) comprises direct departments structured according to the manufacturing process. The manufacturing process is represented by the following manufacturing areas, or cost cells: Diffusion, Photo, Etch, Metal, Backgrind and Probe. Departments have direct expenses assigned to them including depreciation, maintenance, payroll and general materials. Indirect departments (indirect labor, bulk gasses, etc.) are also aligned with cost cells, although there are a few that represent generic factory spending.

The Denominator in the model is activities by manufacturing area, which is used to allocate direct costs using both "Ins-By-Area-By-Product" and "Run Time-By-Area-By-Product". This allows for the allocation of costs to individual products at each stage of the manufacturing process. Indirect costs that are aligned with cost cells are allocated using "Ins-By-Area-By-

Product". Indirect Costs that are generic to the factory are allocated using "Total Ins-By-Product". Despite these changes issues remain with the current model, including:

- Using a single month's costs to flow actuals through the model, this subjects the Business Units (BU's) to big swings in charges,
- There is a distinct lack of insight into the cash flow impact of decisions - BU's are rewarded on fully-absorbed gross margins, which leads to poor cash decisions,
- Under-loaded factories causes inefficient allocation of fixed costs in the full absorption environment, this in turn artificially drives up wafer costs, and
- Pricing and loading optimization decisions are not sufficiently supported by the current model.

The Onsemi RCA Model – An Overview

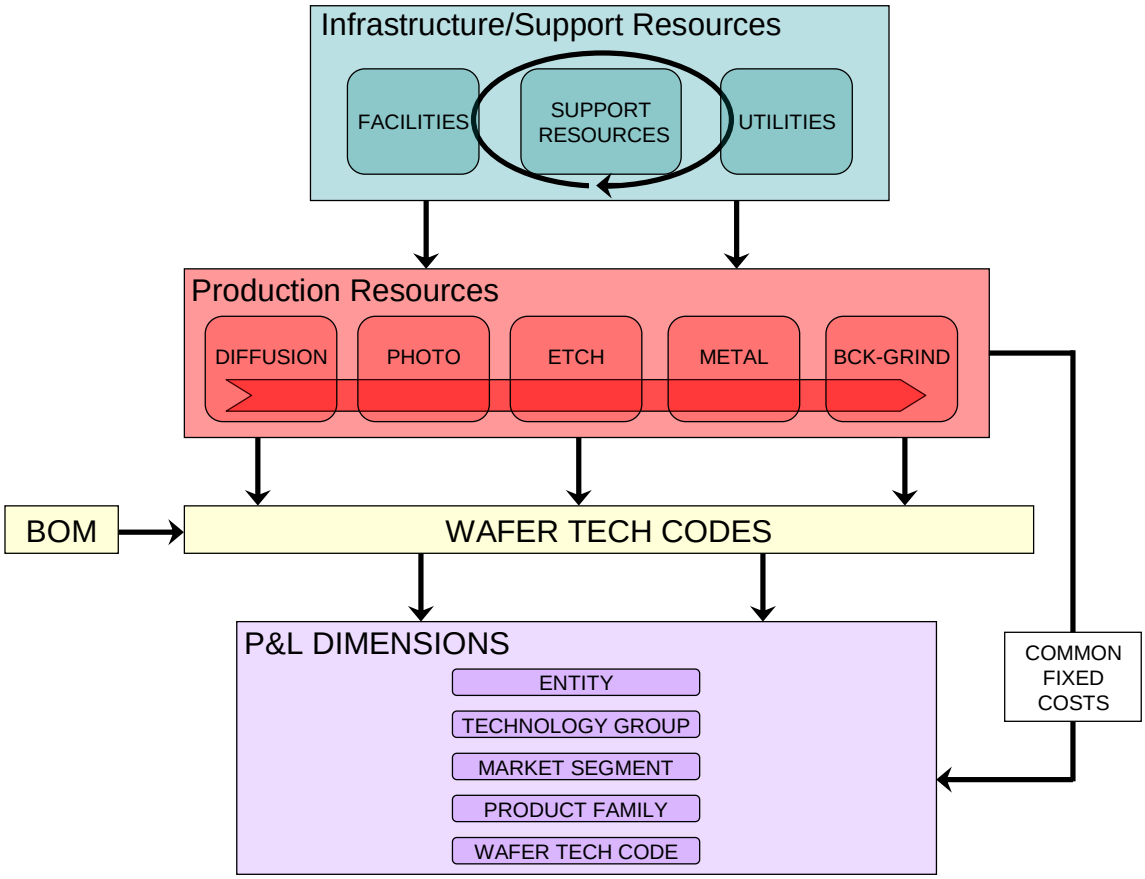
A graphical overview of the Onsemi RCA cost model for a portion of the manufacturing process in one plant at Onsemi is provided in Figure 4.1. As indicated in Figure 4.1 Infrastructure resources where assigned to their consumers, which included other support resources and the production resources. The resultant attributable production resource costs were used in the RCA composite rate calculation as described below. In an effort to reduce case complexity product costing was limited to the wafer tech code level i.e., a grouping of individual generic products more manageable for the purposes of the case study. Production resource pool output was assigned to the various wafer tech codes based on their usage of these resources. Finally, wafer tech code attributable costs are used in the multi-dimensional product profit and loss (P & L) statement. The product P&L provided insight into wafer tech code profitability along the following dimensions: (1) the legal entity they were manufacturer in, (2) the wafer tech code's technology group, (3) predefined market segments described above in the Onsemi introduction, (4) product family, which is a summarization of wafer tech codes and (5) the wafer tech codes themselves. In typical OLAP fashion these five dimensions can be mixed and matched as a manager wanted the profitability information reported. As indicated by the 'Common Fixed Cost' arrow on the right in Figure 4.1 certain common fixed costs (e.g., excess/idle capacity costs) are assigned to the product P & L directly and are not considered product costs (see the detailed discussion below).

Resource Pools

Resource pools for infrastructure and support areas were established with their typical reciprocal relationships. These included resource pools for ground water and the water de-ionizing plant. Resources in the production process were grouped into resource pools based primarily on technology and responsibility. In some cases due to the cost of machines and the oversight nature of direct labor in the production process, direct labor was treated similar to machine overhead cost. Analytical Cost Plans were developed for each resource pool, Figure 4.2

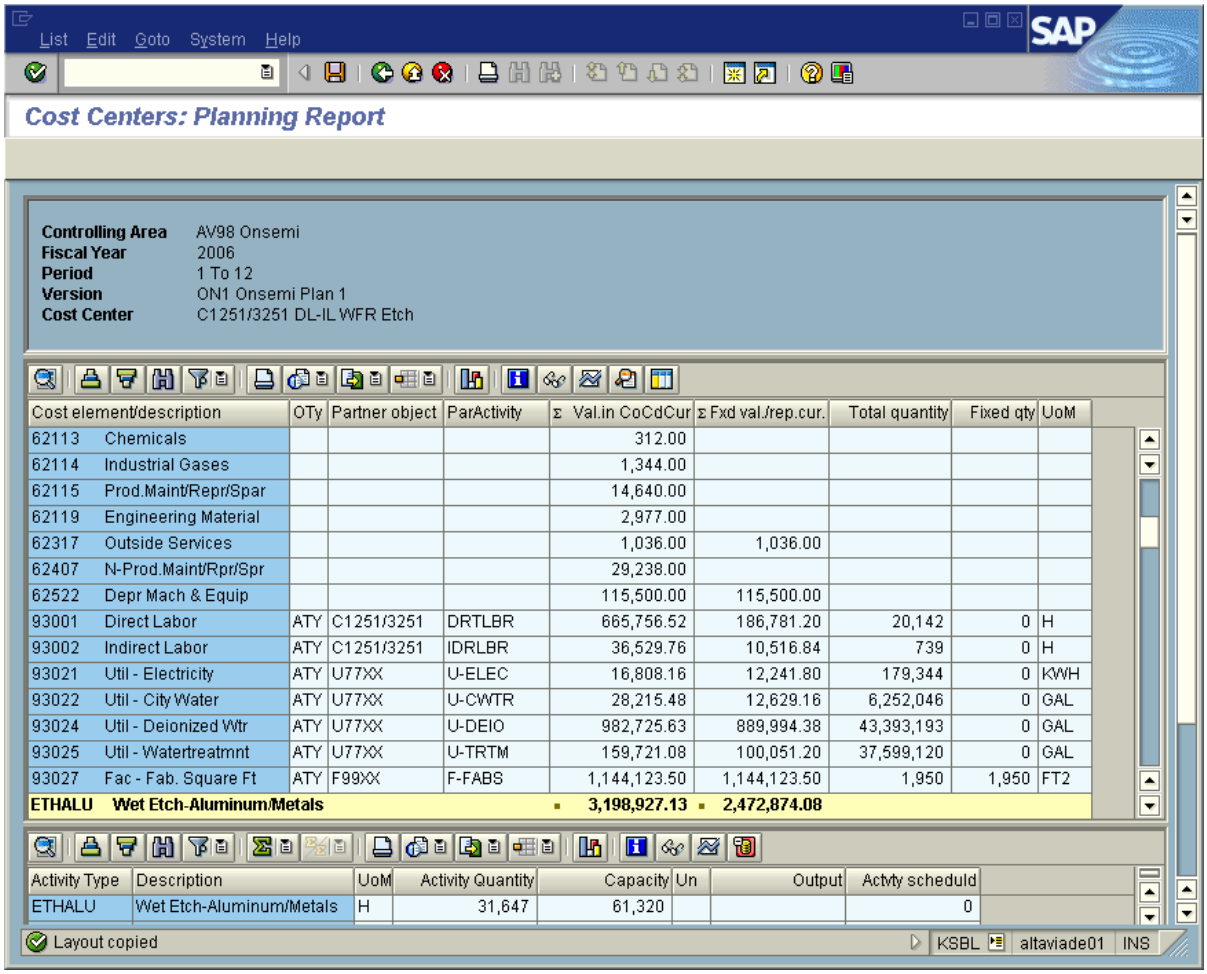
shows an analytical cost plan for an Etch resource pool – the SAP R/3 system was used to construct the RCA model.

Figure 4.1: Onsemi RCA Model Overview



As is evident from Figure 4.2 and in line with marginal analytic requirements to distinguish between cash flow items directly related to a particular output and inputs consumed from other resource pools, inputs were classified as primary or secondary. Note that in the Onsemi RCA model 6-series accounts (cost elements in Figure 4.2) were used for primary costs and 9-series accounts for secondary costs. Input quantities were also divided into their respective fixed and proportional components to reflect the resources' innate costs. The quantity-based nature of the RCA model is reflected by the quantities and unit of measure (UoM) columns on the right in Figure 4.2. The resource pool's planned output and capacity is displayed at the bottom in the 'Activity Quantity' and 'Capacity' fields respectively. It should be noted that SAP uses the designation Activity Type (with Activity for short) to refer to a resource pool, this translation from GPK's 'Bezugsgrosse' has been in use in their software since the mid-1980's and should not be confused with ABC's activity/process.

Figure 4.2: A Resource Pool Analytical Cost Plan



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Cost Centers: Planning Report

Controlling Area	AV98 Onsemi
Fiscal Year	2006
Period	1 To 12
Version	ON1 Onsemi Plan 1
Cost Center	C1251/3251 DL-IL WFR Etch

Cost element/description		OTy	Partner object	ParActivity	Σ Val.in CoCdCur	Σ Fxd val./rep.cur.	Total quantity	Fixed qty	UoM
62113	Chemicals				312.00				
62114	Industrial Gases				1,344.00				
62115	Prod.Maint/Repr/Spar				14,640.00				
62119	Engineering Material				2,977.00				
62317	Outside Services				1,036.00	1,036.00			
62407	N-Prod.Maint/Rpr/Spr				29,238.00				
62522	Depr Mach & Equip				115,500.00	115,500.00			
93001	Direct Labor	ATY	C1251/3251	DRTLBR	665,756.52	186,781.20	20,142	0	H
93002	Indirect Labor	ATY	C1251/3251	IDRLBR	36,529.76	10,516.84	739	0	H
93021	Util - Electricity	ATY	U77XX	U-ELEC	16,808.16	12,241.80	179,344	0	KWH
93022	Util - City Water	ATY	U77XX	U-CWTR	28,215.48	12,629.16	6,252,046	0	GAL
93024	Util - Deionized Wtr	ATY	U77XX	U-DEIO	982,725.63	889,994.38	43,393,193	0	GAL
93025	Util - Watertreatmnt	ATY	U77XX	U-TRTM	159,721.08	100,051.20	37,599,120	0	GAL
93027	Fac - Fab. Square Ft	ATY	F99XX	F-FABS	1,144,123.50	1,144,123.50	1,950	1,950	FT2
ETHALU	**Wet Etch-Aluminum/Metals**				**3,198,927.13**	**2,472,874.08**			

Activity Type	Description	UoM	Activity Quantity	Capacity	Un	Output	Actvty scheduld
ETHALU	Wet Etch-Aluminum/Metals	H	31,647	61,320			0

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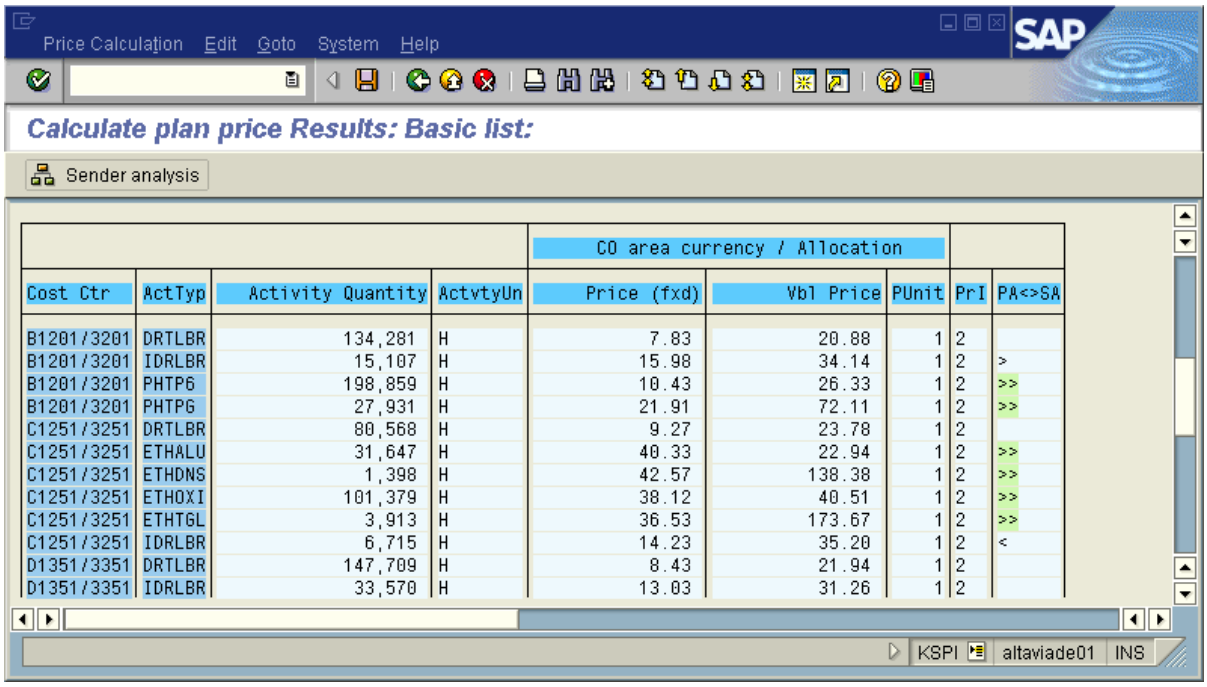
For each resource pool and business process/activity a composite rate was calculated. Resource pool fixed costs were divided by the resource pool's capacity and proportional costs by the resource pool's planned output. The composite rates for a business processes/activity were arrived at by dividing the fixed costs and separately the proportional costs by the planned output of the business process. This distinction in resource pools and business processes rate calculation stems from the fact that resources are the entities containing capacity. There is therefore a need to isolate excess/idle capacity costs on resource pools but no such costs exist on business processes, since they are reflective of utilization/productive output. The result of the Onsemi model output price calculation is shown in Figure 4.3. In an RCA model these rates would normally be used as the standard rates for a defined period of time e.g., one fiscal year.

Figure 4.3: Resource Pool Outputs and Prices/Rates



Wafer Tech Code Costs

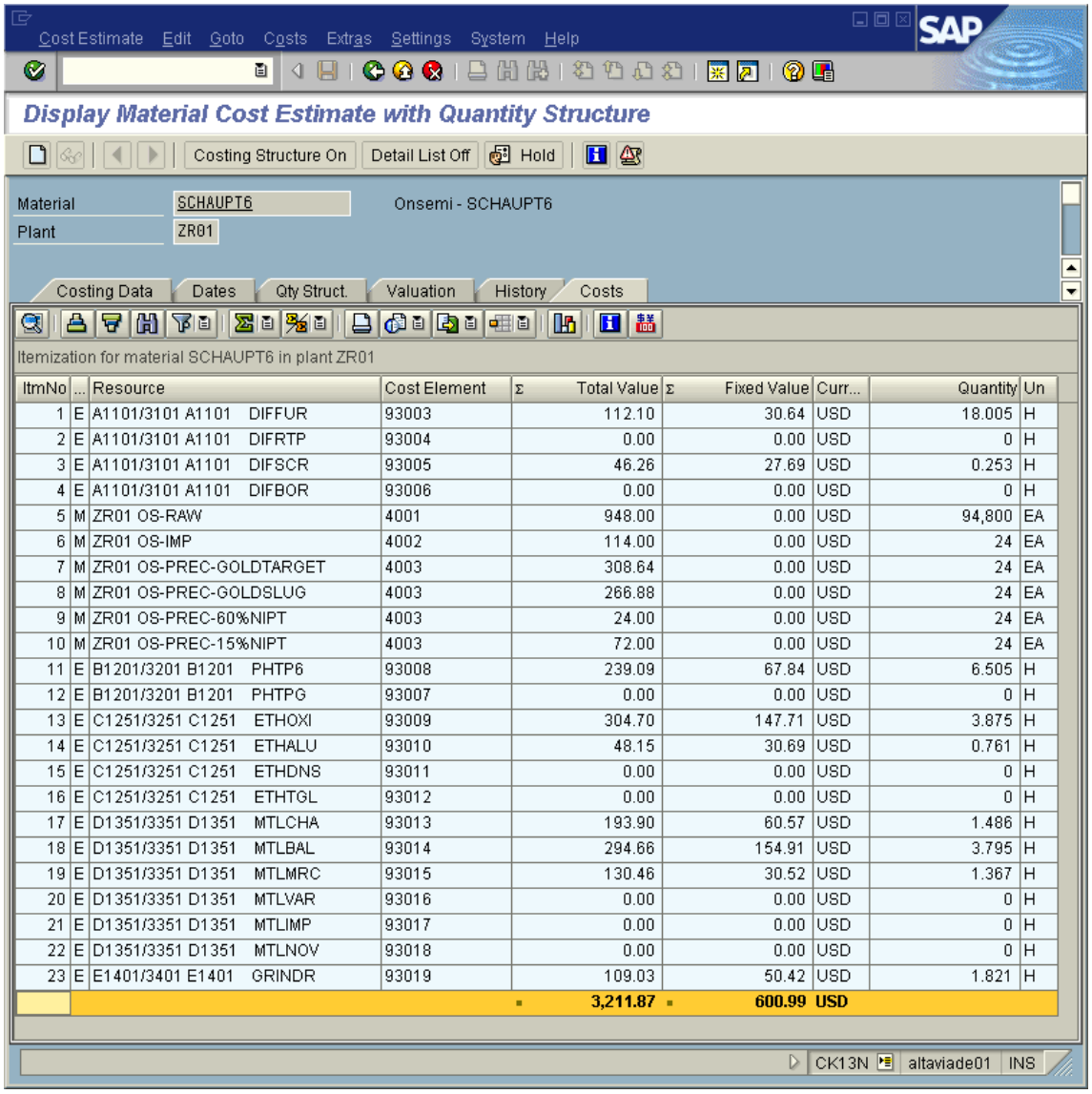
Wafer tech code costs were arrived at by combining a tech code's bill of material costs with the production resources' outputs that each tech code consumes in the manufacturing process. Consistent with marginal analytic requirements the consumed resource costs maintain their innate characteristics if they are consumed in a proportional manner to product volume. Hence, wafer tech code costs reflect the fixed and proportional nature of the resources they consume. Conversely, production resource output consumed in a fixed manner would result in all of that resource's cost becoming fixed costs on the wafer tech code.

An example of a wafer tech code standard cost is shown in Figure 4.4 below. Note the following with regard to the wafer tech code costs as shown:

- material costs were posted against 4-series cost elements,
- production resources consumed (secondary costs) are shown – similar to resource pool costs – against 9-series accounts,
- the quantity based nature of the RCA model is again evident through the quantity and Unit of Measure (Un) columns on the right hand side of Figure 4.4.

Note, the batch size for this wafer tech code and its unit costs are not shown in Figure 4.4 for reasons of confidentiality.

Figure 4.4: Wafer Tech Code Costs



Cost Estimate Edit Goto Costs Extras Settings System Help

Display Material Cost Estimate with Quantity Structure

Costing Structure On | Detail List Off | Hold

Material SCHAUPT6 Onsemi - SCHAUPT6
Plant ZR01

Costing Data | Dates | Qty Struct. | Valuation | History | Costs

Itemization for material SCHAUPT6 in plant ZR01

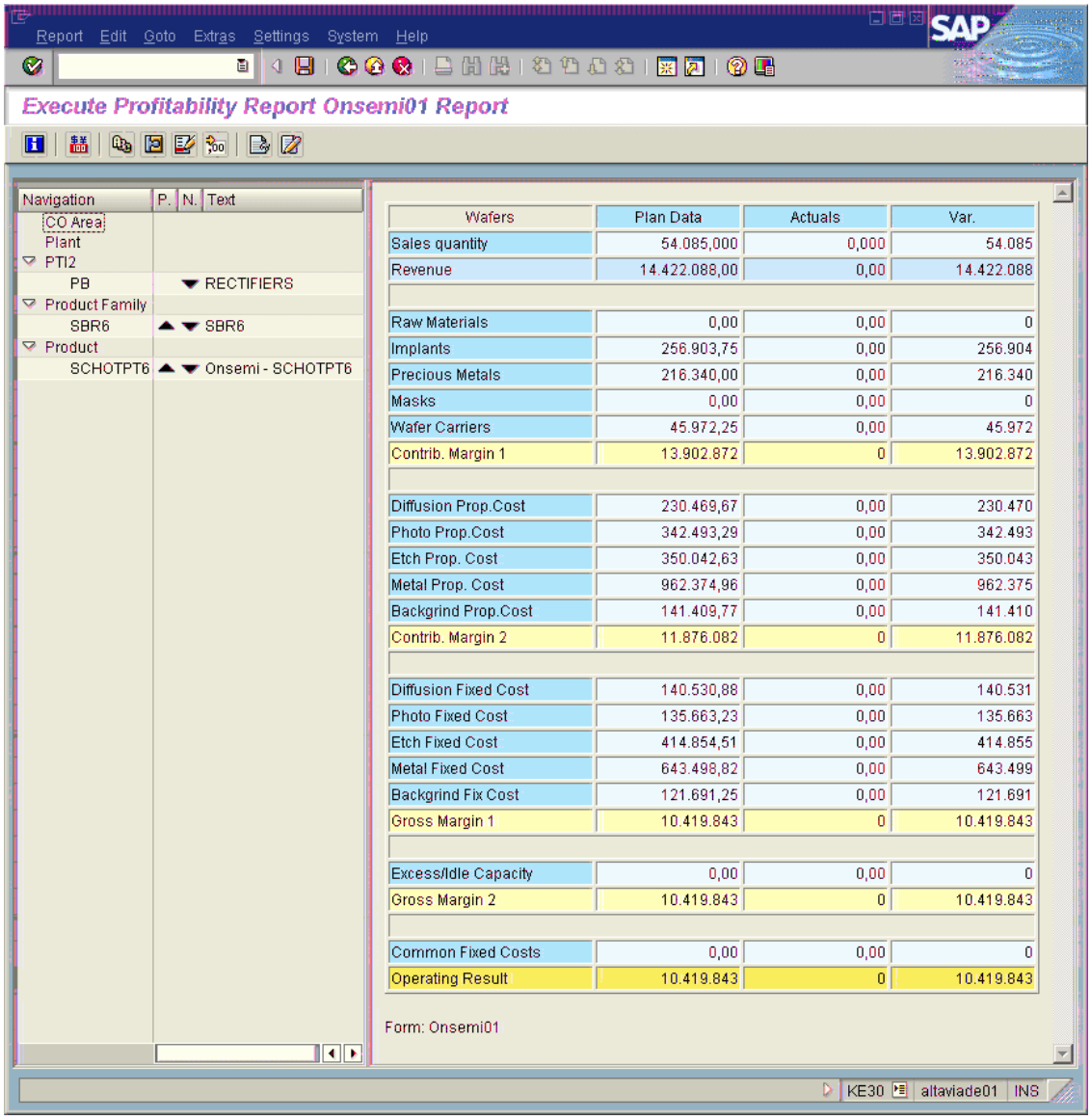
ItmNo	...	Resource	Cost Element	Σ	Total Value	Σ	Fixed Value	Curr...	Quantity	Un
1	E	A1101/3101 A1101 DIFFUR	93003		112.10		30.64	USD	18.005	H
2	E	A1101/3101 A1101 DIFRTP	93004		0.00		0.00	USD	0	H
3	E	A1101/3101 A1101 DIFSCR	93005		46.26		27.69	USD	0.253	H
4	E	A1101/3101 A1101 DIFBOR	93006		0.00		0.00	USD	0	H
5	M	ZR01 OS-RAW	4001		948.00		0.00	USD	94,800	EA
6	M	ZR01 OS-IMP	4002		114.00		0.00	USD	24	EA
7	M	ZR01 OS-PREC-GOLDTARGET	4003		308.64		0.00	USD	24	EA
8	M	ZR01 OS-PREC-GOLDSLUG	4003		266.88		0.00	USD	24	EA
9	M	ZR01 OS-PREC-60%NIPT	4003		24.00		0.00	USD	24	EA
10	M	ZR01 OS-PREC-15%NIPT	4003		72.00		0.00	USD	24	EA
11	E	B1201/3201 B1201 PHTP6	93008		239.09		67.84	USD	6.505	H
12	E	B1201/3201 B1201 PHTPG	93007		0.00		0.00	USD	0	H
13	E	C1251/3251 C1251 ETHOXI	93009		304.70		147.71	USD	3.875	H
14	E	C1251/3251 C1251 ETHALU	93010		48.15		30.69	USD	0.761	H
15	E	C1251/3251 C1251 ETHDNS	93011		0.00		0.00	USD	0	H
16	E	C1251/3251 C1251 ETHTGL	93012		0.00		0.00	USD	0	H
17	E	D1351/3351 D1351 MTLCHA	93013		193.90		60.57	USD	1.486	H
18	E	D1351/3351 D1351 MTLBAL	93014		294.66		154.91	USD	3.795	H
19	E	D1351/3351 D1351 MTLMRC	93015		130.46		30.52	USD	1.367	H
20	E	D1351/3351 D1351 MTLVAR	93016		0.00		0.00	USD	0	H
21	E	D1351/3351 D1351 MTLIMP	93017		0.00		0.00	USD	0	H
22	E	D1351/3351 D1351 MTLNOV	93018		0.00		0.00	USD	0	H
23	E	E1401/3401 E1401 GRINDR	93019		109.03		50.42	USD	1.821	H
					3,211.87		600.99	USD		

CK13N altaviade01 INS

Product P & L's

Wafer tech code costs and sales volumes were used to report on product profitability using the various dimensions or any combination of these dimensions in the product P&L. Figure 4.5 shows an example of such a product P&L view for Onsemi using the dimensions market segment (PTI2) equal to 'Rectifiers', the product family equal to 'SBR6' and the product or wafer tech code equal to 'SCHOTPT6. Note that the report shown in Figure 4.5 shows only planned product profitability information.

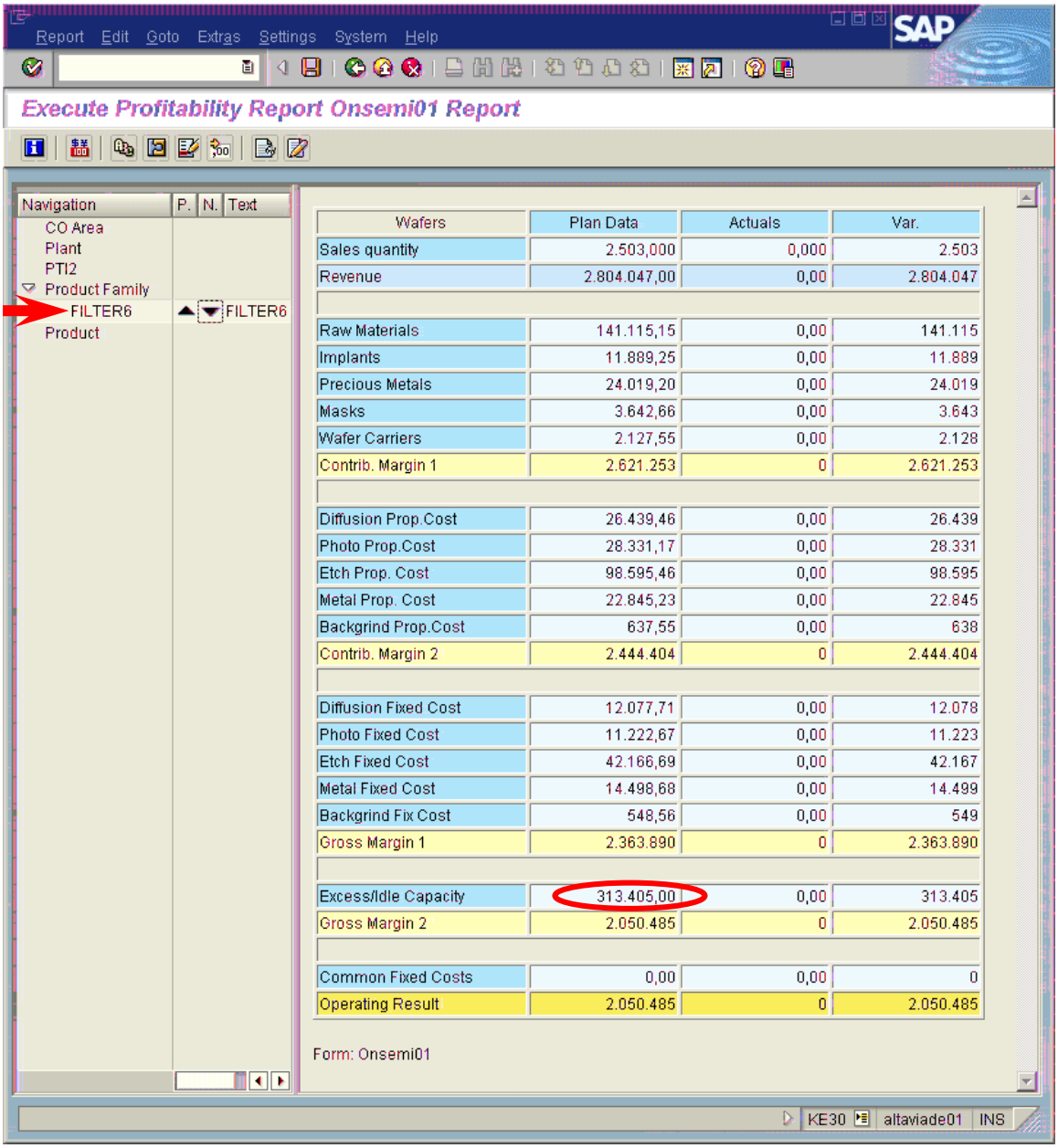
Figure 4.5 An Example of the Multi-Dimensional Product P&L



Typical of an RCA model the product P&L contains multiple margins. Various levels of proportional and fixed costs are added in at different levels as required for analytical purposes and decision making. For example, Contribution Margin 1 is equal to the Theory of Constraints' (TOC) throughput margin (Revenue minus TOC's 'totally variable costs'). For Onsemi 'totally variable costs' equals material costs (i.e., RCA's functionality resources). Contribution Margin 2 reflects a traditional contribution margin where material costs and proportional production resource costs are deducted from revenues. This information is useful for example in opportunity cost decisions when the cost of committing a resource to a particular course of action is required. Gross Margin 1 in turn is reflective of a typical cost of goods sold gross margin and includes material costs and fixed and proportional production resource costs.

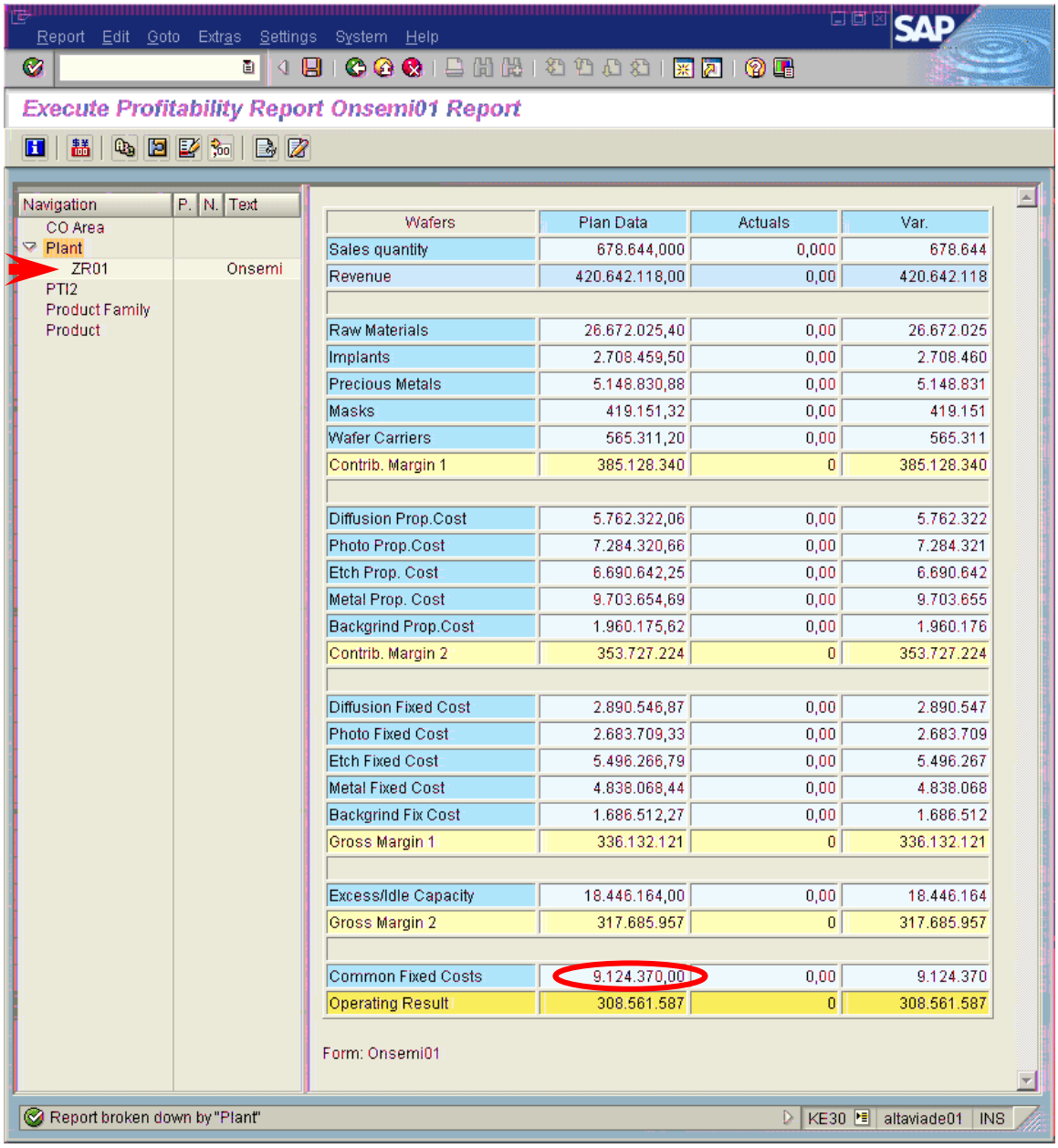
So far all of the desicision support information presented has been assigned using the strong from of causality i.e., a quantitative relationship existed between the output and the input required to produce it. However, as discussed in Chapter 3 there are also instances where the weak from of the causality exists. In these cases the principle of attributability is used to assign costs to a decision relevant level in the P&L. Figure 4.6 shows an example of such an assignment where a machine, dedicated to a particular product family (FILTER6), is not fully utilized. Instead of unitizing the machine's excess/idle capacity costs to the FILTER6 products, these costs are assigned to the product family's result segment (refer the red arrow on the left) in the P&L. The excess/idle line item is highlighted in Figure 4.6 by the red oval.

Figure 4.6 An Example of Excess/Idle Capacity Costs Assigned at the Product Family Level



In a similar manner other common fixed costs would be assigned to decision relevant levels in the product P&L. In this regard certain common fixed costs that would only be relevant when a decision to close a entire plant had to be taken would be assigned at a higher level (e.g., the plant level) in the P&L. The assignment of such over arching common fixed costs is shown in Figure 4.7. The level of assignment in the P&L is again indicated by the red arrow on the right and the corresponding line item is highlighted by a red oval.

Figure 4.7 An Example of Common Fixed Costs Assigned at the Entity Level

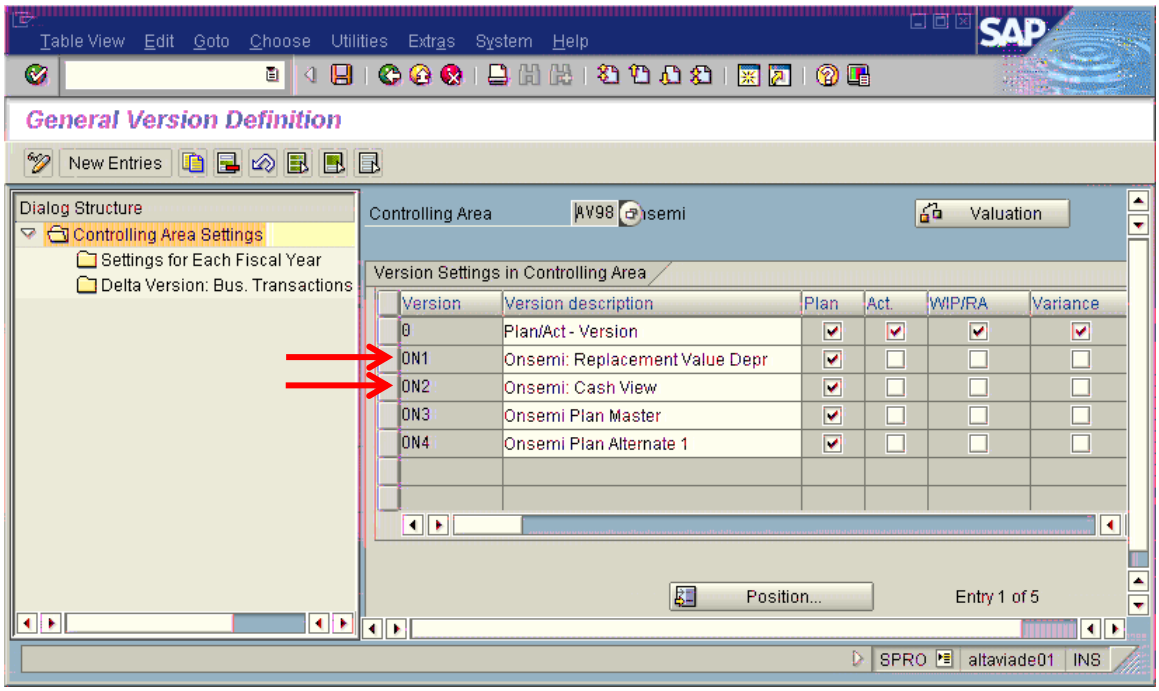


As stated in Chapter 3 RCA's use of the strong and weak forms of causality in cost assignment means that the operating result at the legal entity level will be the only profitability number that will be fully absorbed.

Conclusion

Some of the other requirements that Onsemi had was accommodated through different capabilities that are enabled through the RCA modelling process. One particular requirement was the need for a cash view of operations to better understand the effect of product pricing decisions on the operating result. This had particular significance in the Onsemi case as they operate a large number of very old machines that are fully depreciated. The cash requirement was accommodated by applying a different valuation strategy to RCA underlying quantitative cost model i.e., its quantity structure. Figure 4.8 provides an overview of the various valuation strategies used in the model to value the quantities. The two primary valuation strategies used (i.e., replacement value depreciation and cash) are indicated in Figure 4.8.

Figure 4.8 Different Valuation Strategies Used in the Onsemi RCA Model



Chapter 5: Marginal Analytics Application: Decision Scenarios at On Semi

Introduction

The chapter contains details on the application of marginal analytic principles in decision support at On Semi using RCA information.[2] Five decision scenarios were identified as highly relevant to On Semi, namely:

- assessing the impact of product mix change on capacity,
- supporting a decision to introduce new tools,
- a mutually exclusive resource application decision,
- validating a decision to expand capacity, and
- a decision to produce a batch size smaller than standard

These scenarios were simulated, using the RCA model derived through the on-site case work at On Semi. It should be noted that the five decision scenarios were executed independently i.e., the base line RCA model was reset after every scenario. In practice, and as indicated by assumptions in some of the scenario details, this is not necessarily a realistic approach. It was nevertheless important to demonstrate the fulfillment of various marginal analytic requirements using controlled scenarios. It is possible for the reader to extrapolate more complex (and representative) scenarios by contemplating changes in the assumptions mentioned. Below each of the five scenarios are discussed in more detail under five headings: problem statement, description, data needs, process steps, and outcome.

Scenario 1: Assessing Impact of Product Mix Change on Capacity

Problem Statement - What is the effect of an anticipated product mix change on ZR Plant resource utilization and on its capacity?

Description - Using existing products manufactured in the ZR facility to simulate a stated product mix change to determine the impact on available capacity. In addition, generate a new ZR budget based on the revised product mix.

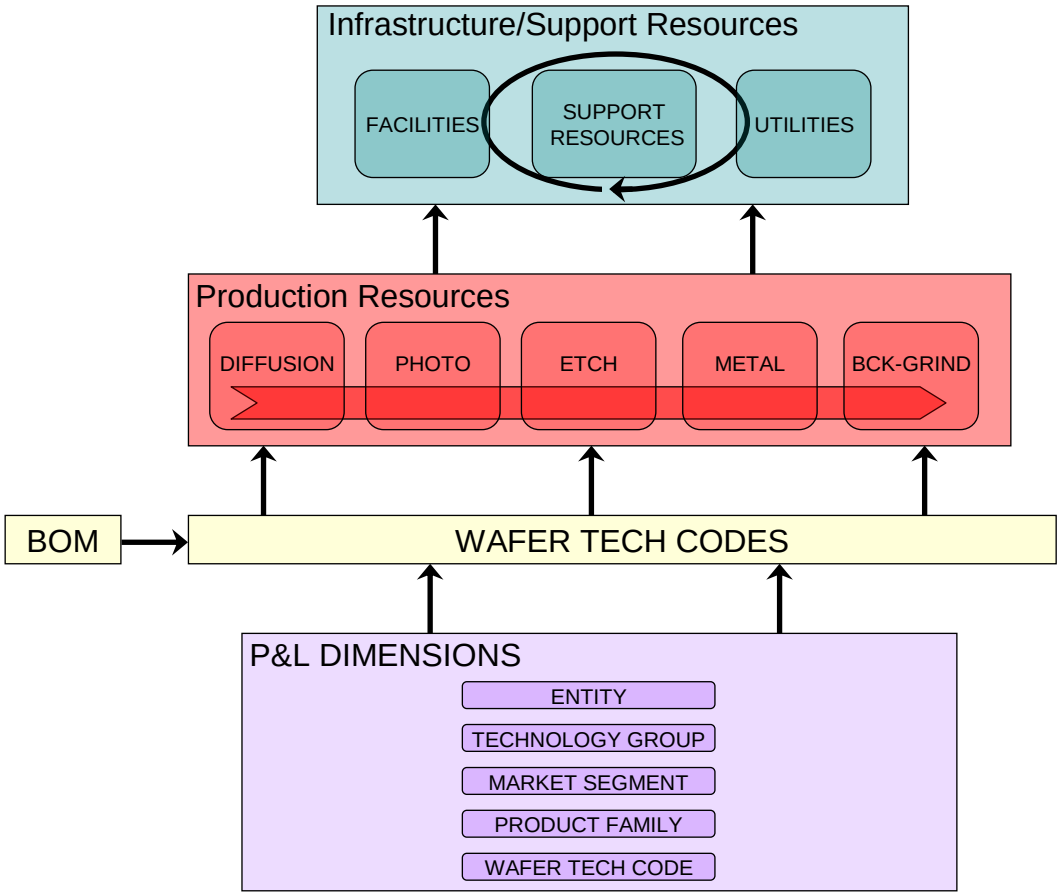
Data Needs – Standard data from the On Semi RCA model that was used in this decision scenario included the bills of materials for all the products, the routings indicating all resource inputs required to produce each product. The standard output rates (fixed and proportional) for all manufacturing resources pools as well as all resource support consumption relationships between the manufacturing resource pools and support resource pools.

[2] For reasons of confidentiality some decision scenario information details, e.g., specific product details, are withheld or changed as are the specific details of the decision scenarios outcomes.

New data that had to be provided to execute the simulation was limited to planned product volumes as per the anticipated product mix. It was assumed that product prices would not be affected by the change in volumes.

Processing Steps – The simulation entailed changing the product sales plan in the Profitability Analysis module and then back-flushing the new demand numbers through the cost model. The back-flushing process is graphically illustrated in Figure 5.1.

Figure 5.1: Backflushing the RCA Model: A Product Mix Change Simulation



For the sake of simplifying the modeling of this scenario the inventory and production plans were assumed not to have any impact on the level of effort actually demanded from production resource pools i.e., increases in volume could not be satisfied out of existing inventory. Because this simulation used every aspect of the cost model to arrive at the decision scenario outcome all of the marginal analytic aspects typical of an RCA model mentioned in Chapter 3 featured in the process. This included the quantity-based relationships between each object, the fixed and proportional input definitions on products and resource pools for inputs as well as these inputs' primary and secondary classifications.

New product demand numbers were converted into production resource pool output demand which resulted into: (1) new levels of primary cost inputs to produce the revised product

mix , and (2) secondary demand quantities which were converted into their respective primary and secondary input requirements. These were passed on the respective support resource pools in a simultaneous manner where required. In every individual relationship the back-flush process also takes into consideration the specific fixed and proportional quantity-based relationship.

Once new output demand on resource pools, and the corresponding inputs, were determined a new plan (in dollars), required to meet the revised sales mix, could be generated. This financial view of the revised scenario was then be rolled up into the P&L to provide a complete view of the bottom line impact of the scenario.

The appropriate cost concepts used were the attributable cost concept and the full cost concept. The attributable cost concept applied to the recalculated inputs of all the objects in the model given the new demand. The full cost concept only applied to the entity level P&L once the new budget was generated and all common fixed costs for the new scenario were assigned to their requisite levels in the P&L.

Decision Outcome – the scenario demonstrated that a key production resource would exceed its available capacity under the revised mix scenario and the scenario was therefore not feasible unless an investment was first made to expand the capacity of the resource in question.

Scenario 2: Evaluate the Introduction of New Tools

Problem Statement - Should new tools be purchased at the ZR facility to improve productivity and output?

Description - The intent of this scenario was that new tools would not drive incremental capacity, but instead would make existing capacity more efficient. It also would reduce inputs required for the existing tools due to their age e.g., maintenance costs due to unplanned outages. For this scenario planned production volume for the fiscal year under consideration would remain unchanged. The intent was not to do a fully-fledged net present value investment decision in new equipment, rather the need existed for a preliminary assessment of potential operational efficiency gains that would serve as the primary motivation for such an investment decision.

Data Needs – Standard data from the On Semi RCA model used in this decision scenario included the bills of materials for the products that used the tools to be replaced as well as their routings containing all resource inputs required to produce each product. The standard output rates (fixed and proportional) for all unaffected manufacturing resources pools as well as all resource support consumption relationships between the manufacturing resource pools and support resource pools.

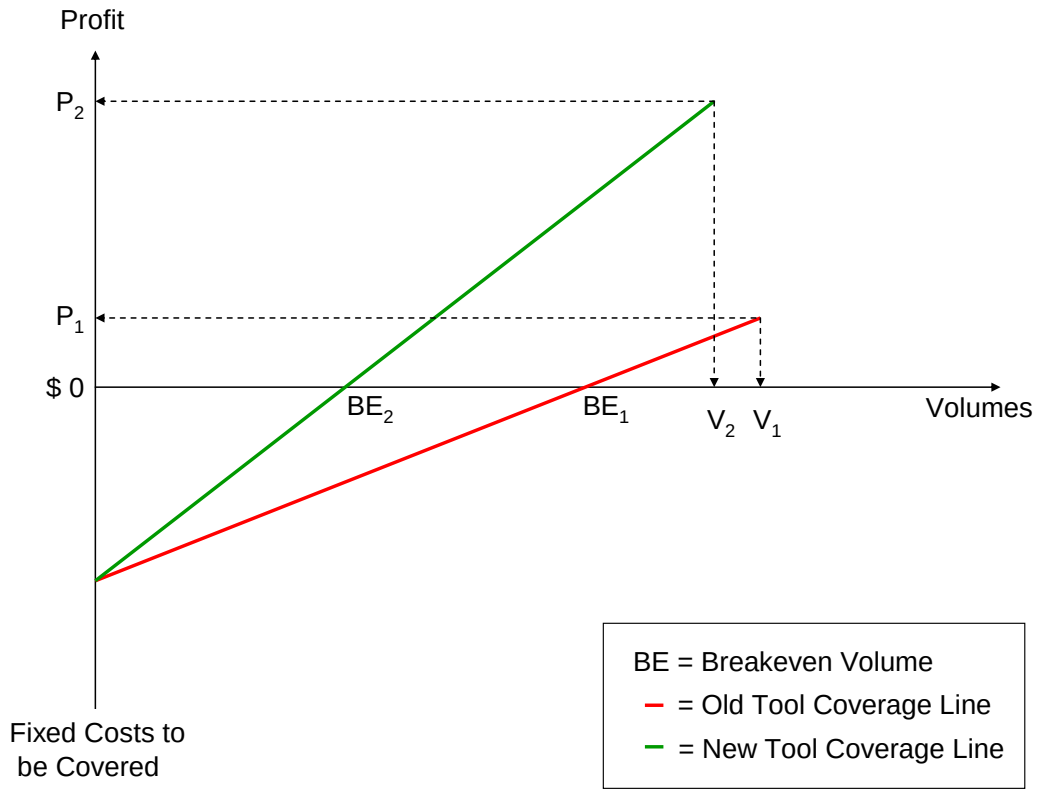
New data that had to be provided to execute the scenario included an analytical cost plan for the new equipment with all of the requisite primary and secondary consumption details. This also included its replacement value depreciation and the costs of spares and maintenance. Run

rates for the new tool, revisions to the manufacturing process steps – as reflected in the product routings - and standard times.

Processing Steps – The first step was to establish the new resource pool and enter the analytical cost plan for the new tool. This included an estimate of its output and capacity – as in the rest of the model theoretical capacity was used. This was followed by the resource pool price calculation and subsequently establishing new standard costs for all the products manufactured on the new tool. Finally a new planned P&L was generated for the fiscal period to demonstrate the effect the new tool would have on the profitability of individual products.

Cost concepts used were the attributable cost concept and the proportional cost concept. Attributable cost applied to the costs of the new tool, the costs of products manufactured on the new tool and the assignment of attributable costs to relevant P&L levels. Proportional cost was important since it was estimated that it would reflect the biggest gain from the introduction of the new tool due to lower energy and maintenance costs. Since replacement value was used (pre and post the scenario) negligible difference was expected in the fixed costs rates.

Figure 5.2: The Effects of Changing Proportional Costs [3]



Decision Outcome – confirmed the reduction in the new proportional resource pool rate and expected stability of its fixed cost rate. This meant that products' contributions margins

[3] Christopher, W. 1974. *The Achieving Enterprise.* AMACOM. A Division of American Management Associations. New York, NY. p. 161.

increased accordingly. Although a volume or mix simulation was not included in this scenario the leveraging effect the investment would have was clearly demonstrated - refer Figure 5.2. If the new tool is purchased products will cover their fixed costs at a lower breakeven volume – compare BE1 to BE2. Moreover, the change in the proportional cost line gradient (a lower proportional unit cost for the new tool) can easily offset reduction in volumes and still result in higher profits – compare V1 and P1 to V2 and P2. Coupled with larger volumes the increase in profitability will far outstrip the reduction in proportional costs achieved with the new tool. The initiation of investment decision, the capital budgeting process and the accompanying net present value analysis should therefore be pursued.

Scenario 3: A Mutually Exclusive Resource Application Decision

Problem Statement - What would it cost ZR to manufacture a new product and discontinue an existing product (due to capacity constraints). What should ZR management's recommendation be to Sales in this regard?

Description - The sales department approaches ZR with a proposal for a new product to be marketed and sold in an existing target market. Incremental costs downstream of production are therefore considered minimal. The sales department estimates an annual sales volume of 5,000,000 units for the new Tech Code at a sales price of $0.11.

Data Needs – Standard data from the On Semi RCA model used in this decision scenario included the bills of materials of the Tech Code to be discontinued as well as the routings indicating all resource inputs required. The standard output rates (fixed and proportional) for all manufacturing resources pools used to manufacture the new Tech Code were also used. In this scenario there were no changes to any of the resource pools or support services.

New data that had to be provided to execute the simulation comprised of the quantity structure of the new Tech Code. Because the products were similar the quantity structures of the outgoing Tech Code were changed to represent those of the new Tech Code.

Processing Steps – The first step was to generate the standard product cost for the new Tech Code. This calculation used the standard resource pool rates without any changes. A new planned P&L for the fiscal period was not generated for this decision scenario since the decision could be made using the unit costs of the two Tech Codes in question i.e. the downstream costs for the two products were assumed to be similar.

The appropriate cost concepts used were the attributable cost concept, the opportunity cost concept and the proportional cost concept. Attributable costs applied to the recalculated product standard cost. The opportunity cost concept was used to evaluate the decision to discontinue the old Tech Code for the sake of making and selling the new Tech Code i.e., a mutually exclusive resource application decision. Each product's proportional costs would serve

as a proxy for their respective opportunity costs i.e., to give an indication of the resources committed to each of the alternatives.

Decision Outcome – The volume of the two Tech Codes are similar and the price of the new Tech Code is 5% higher than the old Tech Code. However, the proportional cost of the new Tech Code is 15% higher than that of the old Tech Code. Essentially, significant more resources must be committed to manufacture the new Tech Code, which results in a product with more functionality. Without consideration for other qualitative factors the 10% difference in contribution margin between the two alternatives (the opportunity cost) does not justify the switch from the old Tech Code to the new Tech Code. The recommendation to the sales force would be to increase the price of the new Tech Code, possibly based on differentiating it from the old Tech Code based on its functionality.

Scenario 4: Validating A Decision to Expand Capacity

Problem Statement - Evaporation ovens are currently a bottle neck in the production process, what will the effects on product cost and capacity in the plant be should an additional oven be installed?

Description - For a given sales mix (the planned sales mix) simulate the effect on manufacturing capacity both up stream and down stream if an additional oven were to be installed in the ZR facility. Similar to Scenario 2 this analysis is intended to serve as an input into an investment decision.

Data Needs – To keep the scenario simple the existing oven resource pool information was augmented. Standard data from the On Semi RCA model used in this decision scenario included the planned product volumes, resource pool outputs and standard output rates (fixed and proportional) for the oven resource pools as well as all affected resource support consumption relationships between the oven resource pools and support resource pools.

New data that had to be provided to execute the scenario included a revised analytical cost plan for the oven resource pool with all of the requisite primary and secondary consumption details amended. This also included its replacement value depreciation and the costs of spares and maintenance for the new oven. Run rates for the new oven were assumed to be the same as the existing ovens as were processing times.

Processing Steps – The first step was to change the analytical cost plan for the existing oven resource pool. This included changing both the output and capacity – theoretical capacity was used – and all the primary and secondary inputs. This was followed by the resource pool output price calculation. A new planned P&L for the fiscal period was not generated for this scenario since it was understood that the new unused capacity would merely increase the assigned common fixed costs to the entity level in the P&L. The scenario here required a back-flush, similar to Scenario 1, to demonstrate the effect of the additional oven on available capacity.

The appropriate cost concepts used were the attributable cost concept, the fixed cost concept and the proportional cost concept. Attributable cost applied to the recalculated inputs of the oven resource pool. The fixed and proportional cost concepts were important in this scenario since it was expected that these should not change and hence that product costs would be unaffected. This rational was based on the fact that the use of replacement value depreciation and capacity as the denominator would result in no product cost increases even with the addition of an oven. Similarly, a proportionate extrapolation of the proportional inputs for the additional oven was not expected to have any effect on the resource pool's proportional rate either.

Decision Outcome – the resource pool price calculation confirmed that only negligible changes resulted in the rates of the oven resource pool. The back-flush confirmed that the oven resource pool was no longer the bottleneck in the ZR facility. It was also possible, through and analysis of the resource supply and demand information to determine which resource would be the next constraint should the existing planned product mix be increased proportionally.

Scenario 5: A Decision to Produce A Batch Size Smaller Than Standard

Problem Statement – The Sales Department approaches ZR production with a request for a specific Tech Code to be produced in a batch size smaller than standard lot size for a specific customer order. What does it cost to fulfill the order and what should the selling price be?

Description – An existing Tech Code with a bill of material, production process steps and standard lot size of 24 is produced at a smaller lot size (8 units) for a special order. Assume that the resource that must be committed to this order do not have an alternate opportunity available.

Data Needs – Standard data from the On Semi RCA model used in this decision scenario included the bills of materials for the product in question, its routings indicating all resource inputs required. The standard output rates (fixed and proportional) for all manufacturing resources pools used to manufacture the product. New data that had to be provided to simulate the decision scenario was limited to new lot size.

Processing Steps – The first step was to generate the standard product cost for the Tech Code using a lot size of 8. This calculation used the standard resource pool rates without any changes. A new planned P&L was not generated for this decision scenario since this was a one-time order with no repeated effect on the P&L and the decision could be made using the revised product cost estimate.

The appropriate cost concepts used were the attributable cost concept and the proportional cost concept. Attributable cost applied to the recalculated product standard cost. It served to give an indication of the overall profitability of the order. Proportional cost was used to evaluate the ultimate feasibility of the order i.e., the income from the order could not be less than its proportional cost. The proportional cost concept would also serve to indicate the contribution

to fixed cost in case the order's income was less than its attributable cost but more than its proportional cost.

Decision Outcome – The scenario indicated that the gross margin of the product would decrease by 63% due to the smaller lot size. The income from the order still exceeded its attributable cost. The order's proportional cost was not different from the number expected based on the lot size. The recommendation would therefore be to fulfill the order at the products normal price if price elasticity does not allow for charging of a higher price. The assumption that the resources could not be applied elsewhere meant the opportunity cost concept were not relevant in this scenario

Conclusion

This concludes the discussion on RCA and its application in marginal analytics. As is evident from Chapter 3 the RCA approach to operational and cost modeling is accomplished with an uncompromising focus on effective decision support. In particular, the foundation is the principle of causality and the objective is decision support for a broad range of decisions. Moreover, RCA also recognizes the need to support managerial processes vital to the success of organizations.

A key managerial process is planning. As alluded to in the introduction of this deliverable planning is a cornerstone of the RCA solution. Planning in an organization strives to provide insight into and anticipate potential operational outcomes. Add to this the requirement for proactive optimization, investing in resources that support strategic objectives and mining of market segments to their full potential and the need for a comprehensive management accounting approach as the foundation to all aspects of planning is clear. Appendix C to this deliverable provides more insight into the various aspects of planning and RCA's role in each. More importantly however, this appendix should serve to provide the reader with an understanding of the importance of RCA's planning emphasis in marginal analytics. In RCA decision support is not considered something that happens in isolation or only in reaction to some business event (although the reality is that this is sometimes the case) instead decision support is considered an integral part of a proactive stance that begins in planning. Hence, the need in RCA for extensive marginal analytic support in an organization's planning process and the reason, in turn, why in RCA planning serves as the basis for marginal analytics.

Performance measurement is an integral part of managing any entity and management accounting invariably plays a roll in this process. Marginal analytics is a manager's vehicle to changing outputs effectively and to increases in enterprise performance. A brief mention of performance measurement is therefore warranted. In short, because of RCA's operations focus and integration into the value chain it is able to support a wide range of levels of detail and a

variety of measurement models. Performance measurement is briefly touched on in each of appendixes C and D as it relates to planning and capacity management respectively.

Central to the fulfillment of marginal analytic requirements is RCA's treatment of fixed costs. Appendix D, to this deliverable, provides more insight into RCA's treatment of capacity related costs. In particular, the concept of attributable cost and the capacity level that is used as the denominator in output rate calculations are crucial components of RCA's ability to support marginal analytics. The rational and advantages of the RCA approach to assigning, in particular, capacity provision cost are discussed in Appendix D.

RCA with its roots in resources and their cost characteristics and its emphasis on attributable cost principles provides a fundamentally different cost information basis than other management accounting approaches. This baseline is highly suitable for effective support of managerial processes, decision-making and enterprise optimization. In decision support RCA is able to provide insight into relevant costs whether the manager is considering small or large changes in output. Moreover, because all cost assignments are governed by the principle of causality (whether in its strong or weak forms), RCA is able to effectively comply with the requirement: different costs for different purposes.

Appendix A: Survey on Marginal Analytics

Purpose of the Survey

This survey is being conducted to gauge the importance of marginal analytics in industry as well as the methods used to calculate marginal information. To this end the survey gathers information on three topics:

- the importance of marginal analytics/incremental cost analysis,
- how information used in marginal analytics is arrived at, and
- how the information provided is used.

Results of this survey will be provided gratis to respondents within four weeks of completion of the survey.

Definition of Marginal Analytics: Marginal analytics entail the use of marginal cost information in making incremental decisions on pricing, investments, operating costs, etc. and are usually limited in scope. Incremental or marginal decisions typically place a premium on knowing the detailed characteristics of which costs will change and how they will change as a result of a decision.

The Survey

This survey is divided into three sections: (1) Respondent Demographic Information, (2) Respondent's Current Costing Methodology and (3) The Perceived Value of Marginal Cost Information.

1. Respondent Demographic Information:

1.1. Are you responding to this survey for your company as a whole or for a segment (e.g., division, business unit), with which you are directly associated? (Radio buttons – select 1.)

1.1.a. For my company as a whole.

1.1.b. For a division, business unit, etc.

(Note: Subsequent questions in this survey will use the term "company" to apply to the unit for which you are responding, whether a company or a segment of a company.)

Question Purpose: Nil, user mind set establishment.

1.2. What is your job title? (Drop down list.)

Question Purpose: Overall comparative purposes based on job perspective.

1.3. What is your company's primary country of operation/home office location? (Drop down list.)

Question Purpose: Overall comparative purposes based on country.

1.4. Which industry does your company compete in? (Drop down list.)

Question Purpose: Overall comparative purposes between industries.

1.5. What is the amount of your company's annual sales? (Radio buttons – select 1.)

1.5.a. Less than $5 million.

1.5.b. Between 5 and $50 million.

1.5.c. Between 50 and $200 million.

1.5.d. Between 200 and $1 billion.

1.5.e. Between 1 billion - $10 billion.

1.5.f. More than $10 billion.

Question Purpose: Overall comparative purposes according to size.

1.6. How many different saleable products/services does your company offer in the market? (Radio buttons – select1.)

1.6.a. Less than 50 products/services.

1.6.b. Between 50 and 200 products/services.

1.6.c. Between 200 and 1,000 products/services.

1.6.d. Between 1,000 and 5,000 products/services.

1.6.e. Between 5,000 and 10,000 products/services.

1.6.f. More than 10,000 products/services.

Question Purpose: Overall comparative purposes based on # of products.

1.7. How many people does your company employ? (Radio buttons – select 1.)

1.7.a. Less than 100 people.

1.7.b. Between 100 and 1,000 people.

1.7.c. Between 1,000 and 10,000 people.

1.7.d. Between 10,000 and 75,000 people.

1.7.e. More than 75,000 people.

Question Purpose: Overall comparative purposes based on # of employees.

1.8. What percentage of your product/service cost is a direct cost? (Radio buttons – select 1.)

1.8.a. Less than 20%.

1.8.b. Between 20 and 40%.

1.8.c. Between 40 and 60%.

1.8.d. Between 60 and 80%.

1.8.e. More than 80%.

Question Purpose: Overall comparative purposes based on % of direct cost.

2. Respondent's Current Costing Methodology

2.1. Does your company use cost information from the same cost system for external financial reporting and for internal management and decision support? (Radio buttons – select 1.)

2.1.a. Yes, a single system is used for both.

2.1.b. No, two systems are used.

2.1.c. No, more than 2 systems are used.

(Note: From this point onward – if you indicated 2 or more systems – reply to questions for your primary system used for internal management and decision support.)

Question Purpose: Overall comparative purposes based on systems approach. Also to ensure user mindset is correct.

2.2. Your company's cost accounting methodology is based on which of the following? (Check boxes, select all that apply.)

2.2.a. Standard Costing.

2.2.b. Activity-based Costing (ABC).

2.2.c. Theory of Constraints (TOC).

2.2.d. Direct Costing.

2.2.e. Absorption costing.

2.2.f. Full-absorption costing.

2.2.g. Other, briefly explain:_____

Question Purpose: Overall comparative purposes based on the approach adopted as well as product costing strategy used. Full Absorption should also give an indication of varying product costs due to changes in output volumes.

2.3. How frequently do you calculate/update cost information used for internal management and decision support? (Radio buttons – select 1.)

2.3.a. Annually.

2.3.b. Quarterly.

2.3.c. Monthly.

2.3.d. More than once a month.

2.3.e. When needed.

Question Purpose: Overall comparative purposes based on frequency of model update. Make a case for real-time information. Expect some ABC'ers to indicate periods longer than a month. Indicative of how up to date information is.

2.4. Does your costing methodology distinguish between fixed and variable cost? (Radio buttons – select 1.)

2.4.a. Yes.

2.4.b. No.

2.4.c. Don't Know.

Question Purpose: Overall comparative purposes based on response, in particular responses to section 3 of the survey. A 'Don't know' response and 'No' responses will route the respondent to question 2.9, skipping 2.5 thru 2.8.

2.5. Which one of the following best describes the philosophy of your costing methodology in making the distinction between a fixed and a variable cost? (Radio button – select 1.)

2.5.a. Based on whether the cost varies with total volume.

2.5.b. Based on whether the cost assigned to a specific product, vary with the volume produced for that product.

2.5.c. Based on the type of activity (unit, batch or sustaining) the cost is assigned to.

2.5.d. Whether a cost is fixed or variable is determined by the resources deployed.

2.5.e. Some other basis, briefly explain:_____.

Question Purpose: Anything but (d) is a dead giveaway that marginal information is poor. Responses 'a' and 'b' should trap all standard costing users, 'c' all ABC users and 'd' would likely be TOC'ers and those that hold that decisions make cost variable.

2.6. Which method do you use to assign <u>common fixed costs</u> to products/services? (Radio buttons – select 1.) Note: Common fixed costs are defined as fixed costs that are not traceable (directly or indirectly) to saleable products and services e.g., the CEO's remuneration.

2.6.a. Product/service volume measures including sales volume.

2.6.b. Capacity measures (e.g., theoretical, practical or planned).

2.6.c. Input cost measures such as direct labor or machine cost.

2.6.d. Activities.

2.6.e. Common fixed costs are not assigned to products.

2.6.f. Other methods of cost allocation, please explain:_____

Question Purpose: Get a feel for the degree to which product cost are distorted due to arbitrary cost allocations.

2.7. Does your company's cost methodology calculate the cost of a particular activity or product/service differently depending upon the intended use of the information e.g., when used for inventory valuation vs. a make-buy decision vs. as an input into pricing? (Radio buttons – select 1.)

2.7.a. Yes.

2.7.b. No.

Question Purpose: If answers up to this point were wrong, and the response here is 'Yes', it indicates a recognition of information issues and a lot of manual rework whenever decisions need to be taken. Conversely a 'No' response would mean decision support information is woefully inadequate. If the answers to all prior questions were right, 'Yes' would be a bit of a surprise and 'No' would be consistent.

2.8. When estimating the cost for an activity or product/service that is the subject of a cost reduction decision what costs are included to support the analysis? (Radio buttons – select1.)

2.8.a. Only throughput costs.

2.8.b. A proportionate share of all company costs.

2.8.c. Only costs caused directly by the product or activity.

2.8.d. Costs caused directly or indirectly by the product or activity.

2.8.e. Costs caused directly or indirectly by the product or activity as well as proportionate share of common fixed costs.

2.8.f. Some other definition of relevant cost.

Question Purpose: Will provide an indication of how complete information is and in particular whether attributable cost on the object of a decision is a consideration.

2.9. Which of the following best describes managers in your company's philosophy on how costs behave? (Select the most appropriate option.)

2.9.a. Most all costs are fixed.

2.9.b. Most all costs are variable.

2.9.c. Decisions make costs variable.

2.9.d. Direct manufacturing/service costs are variable.

2.9.e. All manufacturing/service costs are variable.

2.9.f. All product/service costs – including up and down stream supply chain costs – are variable.

2.9.g. Special analyses are conducted to evaluate the impact on costs.

2.9.h. Another view, Explain _____

Question Purpose: Inconsistency with 2.5 should point to a likely 3.7d response. In light of the options provided 'g' is the most appropriate response.

3. Use and Perceived Value of Information:

3.1. Which of the following employees in your company have access to detailed product or service cost information? Select all that apply. (Check boxes - mark all that apply.)

3.1.a. All sales/field representatives.

3.1.b. Sales managers.

3.1.c. Sales executives.

3.1.d. Product design engineers.

3.1.e. Service\manufacturing managers.

3.1.f. Finance and Cost accounting.

3.1.g. C-level Executives

3.1.h. All other employees.

Question Purpose: How widespread is the use of information (right or wrong) within the company.

3.2. What is the average product/service gross margin in your industry? (Radio buttons – select 1.)

3.2.a. Less than 3%

3.2.b. Between 3 and 6%

3.2.c. Between 6 and 10%

3.2.d. Between 10 and 15%

3.2.e. Between 15 and 25%

3.2.f. More than 25%

Question Purpose: From this one will be able to gauge the margin of error that is available to spread fixed costs around.

3.3. What is the average product/service contribution margin in your industry? (Radio buttons – select 1.)

3.3.a. Less than 5%

3.3.b. Between 5 and 10%

3.3.c. Between 10 and 20%

3.3.d. Between 20 and 35%

3.3.e. Between 35 and 55%

3.3.f. More than 55%

Question Purpose: The difference between 3.2 and 3.3 should give an indication of the amount of fixed cost around. Might also be worthwhile doing cross industry analysis on this split, combined with 1.5 and 1.8.

3.4. How important is accurate marginal cost information to managers within your company? (Radio buttons – select 1.)

3.4.a. Very important - a critical success factor.

3.4.b. Important – a competitive advantage.

3.4.c. Somewhat important – useful.

3.4.d. Irrelevant – never used and never will use.

Question Purpose: Companies with lower margins in 3.2 and 3.3 should score either 'a' or 'b' here.

3.5. What is your personal level of satisfaction with the accuracy of your company's marginal cost information? (Radio buttons – select 1.)

3.5.a. Very dissatisfied.

3.5.b. Dissatisfied.

3.5.c. Somewhat satisfied.

3.5.d. Satisfied.

3.5.e. Very satisfied.

Question Purpose: Validity check.

3.6. What is your perception of how satisfied your company's engineers, manufacturing/service managers, and sales managers are with the accuracy of your company's marginal cost information? (Radio buttons – select 1.)

3.6.a. Very satisfied.

3.6.b. Satisfied.

3.6.c. Dissatisfied.

3.6.d. Very dissatisfied.

Question Purpose: Should be consistent with 3.4.

3.7. Which of the following statements best reflect managers in your company's attitudes towards the cost system in general? (Radio buttons – select 1.)

3.7.a. They trust the accuracy of the information provided and use it frequently.

3.7.b. They occasionally question the accuracy of information, but use it on a regular basis for decision support.

3.7.c. They often question the accuracy of the information and occasionally use it for decision support.

3.7.d. They do not believe the information is accurate, nor do they use it for decision support.

Question Purpose: Determining how widely and extensively the information is used.

Please provide your email address here if you want to be notified directly when results of the survey becomes available. Note if you responded to this survey via a link through the AICPA electronic newsletter or that of the IMA, notice of the availability of survey results will be published in these news letters.

Appendix B: Glossary of Terms

Term	Definition
Activity	Segmentation of work that provides analytical insight into the output of a resource.
Attributability	The responsiveness of inputs (and hence their costs) to decisions that change the provision and/or consumption of resources.
Attributable Costs	Costs of an output that could be eliminated in time, if that output were discontinued and resource consumption and/or provision were reduced accordingly.
Avoidability	A charactrisitc of an input that allows for the input (and hence its costs) to be eliminated.
Avoidable Costs	Costs incurred for an objective that will no longer be incurred if the need for that objective is eliminated. (Adapted from Schillinglaw)
Capacity Provision Cost	Cost incurred to enable the company to meet and respond to current demands for goods or services. (Shillinglaw)
Capacity Resource	A resource which provides quantifiable output to achieve one or more managerial objectives.
Capacity Usage Cost	Total cost of proportional inputs consumed in generating a capacity resource's output.
Causality	The relation between an input and a managerial objective's output, whose nature is such that the input must be consumed if the objective is to be achieved.
Converted Cost	An innately proportional cost which changes to a fixed cost due to the fixed nature of an input consumption relationship.
Cost Model	A logical arrangement of managerial objectives using cost model objects and reflecting operational input and output flows as relationships between cost model objects.
Cost Model Object	A component in the cost model used to represent a managerial objective.
Cost	A monetary measure of • consuming a resource or its output to achieve a specific objective, or • making a resource or its output available and not using it.

Term	Definition
Fixed Consumption	Input quantities required to achieve a managerial objective, which do not vary with the objective's level of output within the relevant range.
Fixed Costs	Total costs of fixed input units of an objective plus the fix costs of the proportional input units of an objective.
Fixed Cost Rate	Total costs of fixed input units of an objective divided by its capacity plus the fixed costs of the proportional input units of an objective divided by its output.
Full Cost	Total cost of all inputs consumed and all inputs made available but not consumed to achieve a managerial objective.
Functionality Resource	A resource, with one or more unique attributes, which must be sacrificed to achieve a managerial objective.
Innate Cost	A cost associated with a resource and which reflects its inherent cost characteristics as dictated by the resource's features (e.g., technology, training, skills).
Input	A unit of resource or resource capability required to achieve a specific managerial objective.
Managerial Objective	A desired result or outcome of the application of economic goods and services that management chooses to measure, plan, control and/or optimize.
Marginal Analytics	The discipline concerned with the evaluation of anticipated change in performance due to resource application decisions.
Operational Model	Result of the operational modelling process as basis for supporting decisions.
Opportunity	The availability of alternate resource application options.
Opportunity Cost	The net cash flow that will be lost if the resources in question are diverted from their best alternative use. (Shillinglaw)
Output	A quantitative measure of a managerial objective.
Primary Costs	Costs for inputs to a managerial objective sourced external to the enterprise; are typically (but not necessarily e.g., depreciation) indicative of cash outflows.

Term	Definition
Proportional Costs	Proportional consumption of inputs times their proportional cost rate.
Proportional Consumption	Input quantities required to achieve a managerial objective, which vary (e.g., according to a linear relationship) with the objective's level of output.
Proportional Cost Rate	Proportional costs of proportional input units of an objective divided by its output.
Quantity Structure	An RCA model defining material causal relationships as quantity-based.
Relevant Costs	The opportunity costs and/or future net cash flows associated with changes in output and securing the resources required to successfully execute a decision alternative.
Resource	A definitive component of an enterprise acquired to generate future benefits.
Resource Element	A cost item associated with a resource or a quantitative or qualitative attribute of a resource.
Resource Pool	A collection of resource elements for one or more homogeneous resources.
Responsiveness	A relation reflecting the changes in the amount of input quantities (and hence their costs) that are consumed due to changes in the level of output of a managerial objective.
Secondary Costs	Costs for inputs consumed, by a managerial objective, from internal support functions.
Service	Resource output to provide benefit for a discrete period or for a particular managerial objective. Service can be provided and consumed internally, and acquired and sold externally.
Tracebility	An attribute of an unit of input that permits it to be identified in its entirety with a specific objective's output on the basis of verifiable transactions records. (Adapted from Shillinglaw)
Tracable Costs	Total cost of all traceable inputs on a managerial objective.
Total Cost Rate	Proportional cost rate plus the fixed cost rate.

Appendix C: Special Topics – The Role of RCA in Planning

Introduction

As indicated in the introduction of this deliverable planning is an essential component of any RCA initiative. Apart from the planning details evident in the modeling discussion in Chapters 3 and 4 this Appendix is intended to provide insight into the broader place and scope of RCA in organizational planning.

Planning is an essential management process. Strategic objectives are defined by senior management and translated into executable and measurable tactical and operational plans - which allow the organizational units within the enterprise to execute towards those objectives. Without detailed plans an enterprise has an overall strategic direction but its activities are without specific orientation - like a journey with a destination, but no itinerary how to get there.

Planning includes financial and non-financial aspects. This article focuses on the place of quantitative planning of resources and outputs and their financial outcome within the broader strategic and tactical planning processes. Financial planning is a discipline with widely shared agreement on its necessity but rare satisfaction in its practical execution. The main areas of criticism (the "ills" of the planning process) are[4]:

- It is defined in terms of general ledger monetary values only vs. activities, processes and resources consumed which are the "levers" that must be used to guide and refine the plan.
- Tend to be focused on the macro organization structure that does not provide the driver detail necessary to make the "best" choices around resource optimization, products, customers and distribution channels.
- Based on what each functional group spent in the prior period, plus adjustments as opposed to setting budgets and targets driven by competitive benchmarks and an "unconstrained, aspirational" mindset.
- Too time consuming, requires many iterations and are very costly.
- Influenced by political gaming and limited buy-in or acceptance of results, often because the strategy, tactics and goals are not adequately connected from work room to board room.
- Performed once every year as an "event" as opposed to continual planning and refinement driven by rolling outlooks and "directional" levels of detail.
- Tends to be very "in year" focused vs. a multi-year view, which optimizes strategic and financial goals.

Some of the items in the list can be addressed by an approach like Resource Consumption

[4] Steve Hansen - Closed Loop - p.270

Accounting (RCA) others like political gaming will depend on the organization and can be present regardless of the management accounting approach used. The goal of this paper is to analyze aspects of, and highlight challenges associated with planning and discuss related benefits that RCA provides. The reader will gain a better understanding of planning in RCA and how an enterprise can dramatically improve its Planning and Control processes by using it.

Resource Consumption Accounting

RCA is a 'made in the US' management accounting approach and is based on Grenzplankostenrechnung (GPK) – a German management accounting approach - and also includes aspects of Activity-based Costing (ABC). RCA integrates the "best" characteristics of ABC (activity driver and a process view of costs) with GPK aspects (e.g., resource analysis, fixed vs. proportional cost, accurate marginal information). Key aspects of RCA important in planning are:

- Comprehensive view of resources
- Quantity-based cost model
- Unambiguous view of cost behavior
- Multi-level marginal P&L view
- Integrated Planning Framework

Most of these aspects of RCA are discussed in detail in Chapter 3 and will here only be touched on to highlight their role in planning.

Comprehensive view of resources

Foundational to RCA is its view of resources. Resources like equipment, material or employees enable the delivery and planning of products and services (outputs). Resources are the primary source of costs and provide managers insight into capacity, planned utilization and the expected efficiency of the conversion process.

In its cost model and for planning RCA distinguishes between resource pools and resource elements. Resource elements are the building blocks for resource modeling in RCA and can be monetary (like costs incurred for salaries) or quantitative (like square footage occupied for rent) in nature. During the planning process resource elements for homogenous resources are grouped into resource pools, which have planned output rates each with fixed and proportional cost components. Resource pools are used for the valuation of outputs consumed by other resource pools, used in products and services valuation, or directly transferred to P&L result segments. For an overview of planned and actual cost flows in RCA refer Figure 3.3 in the main deliverable.

Quantity-based cost model

RCA expresses causal relationships in quantities as opposed to dollar values. For example, electricity consumption is expressed in KwH's and personnel output is expressed in labor hours. In RCA value follows quantity. In planning the cost of consumption is derived from the consumed quantities multiplied by their planned output (cost) rates.

The quantity-based model of enterprise operations allows managers to simulate input price changes independently from internal improvements in efficiency. It allows for the planning and assessment of efficiency independent of market driven price fluctuations e.g., the PPI (Production Price Index) or CPI (Consumer Price Index). Managers can also obtain predictive results that combine both improvements in consumption factors and expected input price changes.

Unambiguous view of consumption and cost behavior

The RCA view of the nature of consumption and cost behavior is unambiguously tied to the enterprise's strategic plan and management's task of achieving it while utilizing the invested resource base. The cost characteristics of resources, expressed in the terms fixed and proportional, are used to reflect operational cost behavior. 'Proportional' expresses the dynamic relationship of certain input quantities (and their costs) in relation to the output measure of the consuming cost object. Refer Chapter 3 for a more detailed discussion of this practice in RCA. In planning RCA correlates required inputs with outputs in an enterprise, to provide a consistent view on consumption and cost behavior. It also maintains the integrity of the nature of cost through consumption relationships, enhancing analysis and decision support by its concepts of innate costs and converted costs.

Multi-level marginal P&L view

RCA supports the separation of SG&A and direct and indirect (unit) costs in planning to provide more transparent profitability planning and decision support. Expenses representing direct (unit) cost for products and services sold, flow into the P&L as cost of goods sold. Other indirect costs are assigned to the P&L result segments at causal and decision relevant levels such as product or service line, customer or region. Managers have the ability to plan multiple (contribution) margins based on these direct and different levels of indirect cost assignment. In this regard refer the discussion in Chapter 3 on RCA's treatment of the strong and weak forms of causality.

These four aspects of RCA establish a logical framework of enterprise operations (also referred to as RCA's Integrated Planning Framework) that allows for the planning, measurement, analysis, decision support and performance assessment so the enterprise can manage and direct its economic activity to achieve the envisioned financial results.

Integrated Planning Framework

One key to a successful planning process is to build a model that effectively connects the strategic plan and goals to the more quantitative operational plans and local goals. There are four basic building blocks involved in RCA's Integrated Planning Framework that forms the foundation for such an integration of quantities and their values:

- Establish resource-pool-level unit standard for inputs
- Establish resource output consumption unit standards with consumers (e.g., products/services and result segments)
- Determine resource output demand
- Convert resource output demand into monetary equivalents

In RCA the planned valuation of resource usage in financial terms is based on this quantitative structure to ensure ultimate validity and to bridge the gap between planned enterprise economic activity (the flow of goods and services) and strategic objectives.

Planning

Planning involves setting multi-year strategic and tactical goals for an enterprise. The larger plan is the basis for the acquisition of resources necessary to achieve those goals, creates standards for subsequent evaluation of progress and achievement of goals, and serves as the foundation for incentive and reward systems. In this regard RCA's integrated planning framework can also be used for simulations and easy transition from old to new standards e.g., when input prices change. This is an important aspect of an enterprise's ability to react to market opportunities or market challenges quickly and decisively.

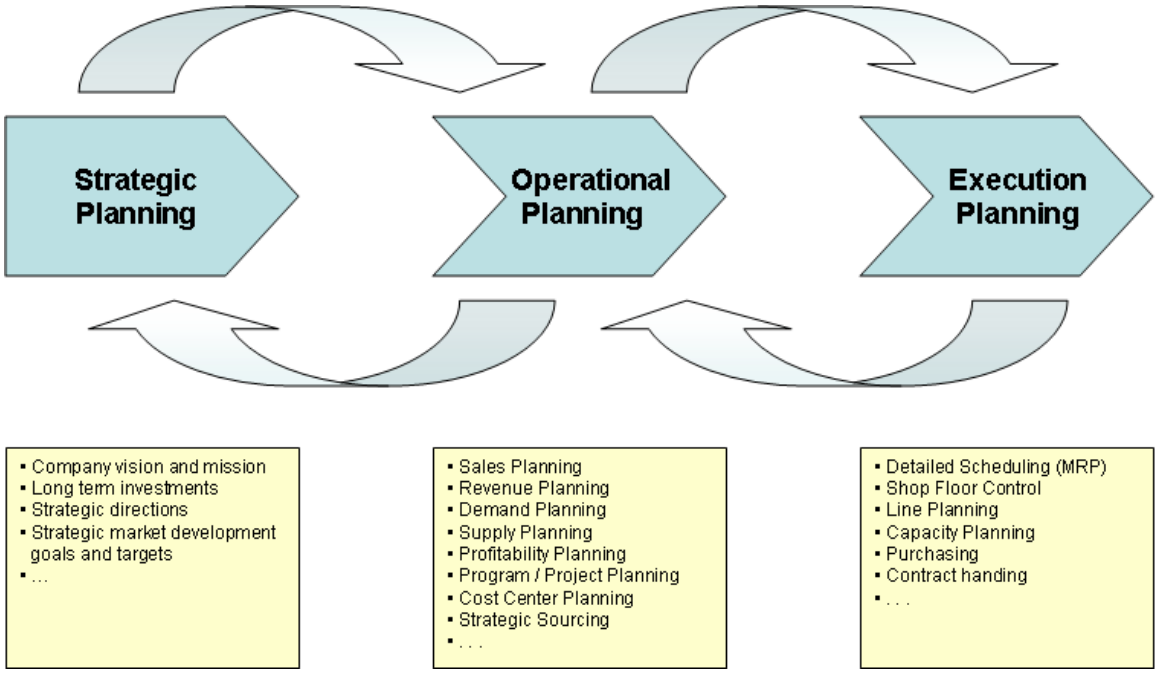
Planning as a management process comprises strategic, tactical and execution oriented plans. Table C.1 provides some general characteristics associated with these different plans.

Table C.1 Characteristics of the Different Types of Management Plans

Characteristic	Strategic	Tactical	Operational
Applicability	Enterprise wide	Strategic Business Unit	Functional Unit
Responsibility	Upper management	Middle management	Operations Management
Goal	Goals and Objectives	Resource Availability	Resource Application
Measures	Strategic	Program, Project	Operations, Activities
Resources	Development	Acquisition/Realignment	Deployment, Utilization
Granularity	High	- >	Low
Time Horizon	Long Term	- >	Short Term

Strategic planning is the foundation of overall planning; the formalization of a company's strategic objectives. It is the starting point for tactical and execution oriented planning that express the 'how' of achieving strategic goals. As illustrated in Figure C.1the different plans are broken down even further into more granular plans to fulfill their respective objectives.

Figure C.1 Management Plans and their Respective Sub-Plans [5]



The scope, requirements and challenges associated with these sub-plans, the role which RCA plays in each and how it supports each subset of strategic and tactical planning is explored in the subsequent sections.

Strategic Planning

Strategic planning is a disciplined effort to produce fundamental decisions and actions that shape and guide what an organization is, what it does, and why it does it, with a focus on the future[6].

Strategic planning determines the enterprise's high-level and forward-looking goals. Strategic goals are expressed foremost in the vision and mission statement. Tools like the balanced scorecard and strategy maps break these goals down further into relevant key performance indicators and financial measures. Table C.2 provides insight into CAM-I's view to the dimensions that these measures relate to, what CAM-I calls decision domains[7].

[5] All images are copyright of SAP AG, Waldorf Germany unless otherwise indicated.
[6] Adapted from Bryson's *Strategic Planning in Public and Nonprofit Organizations*
[7] CAM-I Statement - Designing an integrated cost management system - p.6

Table C.2 Strategic Planning and Decision Domains

Customer / Market	WHY it exists at all. The driving force of the enterprise
Product	WHAT an enterprise is offering to meet customer needs
Process	the HOW. The means to value creation and profit
Resources	WITH – through which the other levels are accomplished

While customer and product goals give direction to where the enterprise is heading, the processes and resources are the enablers of that direction. It is important to understand the significance of including the resource dimensions in strategic planning as it points to investment decisions to be made and directly impacts the bottom-line from a cost-of-resource perspective.

RCA and Strategic Planning

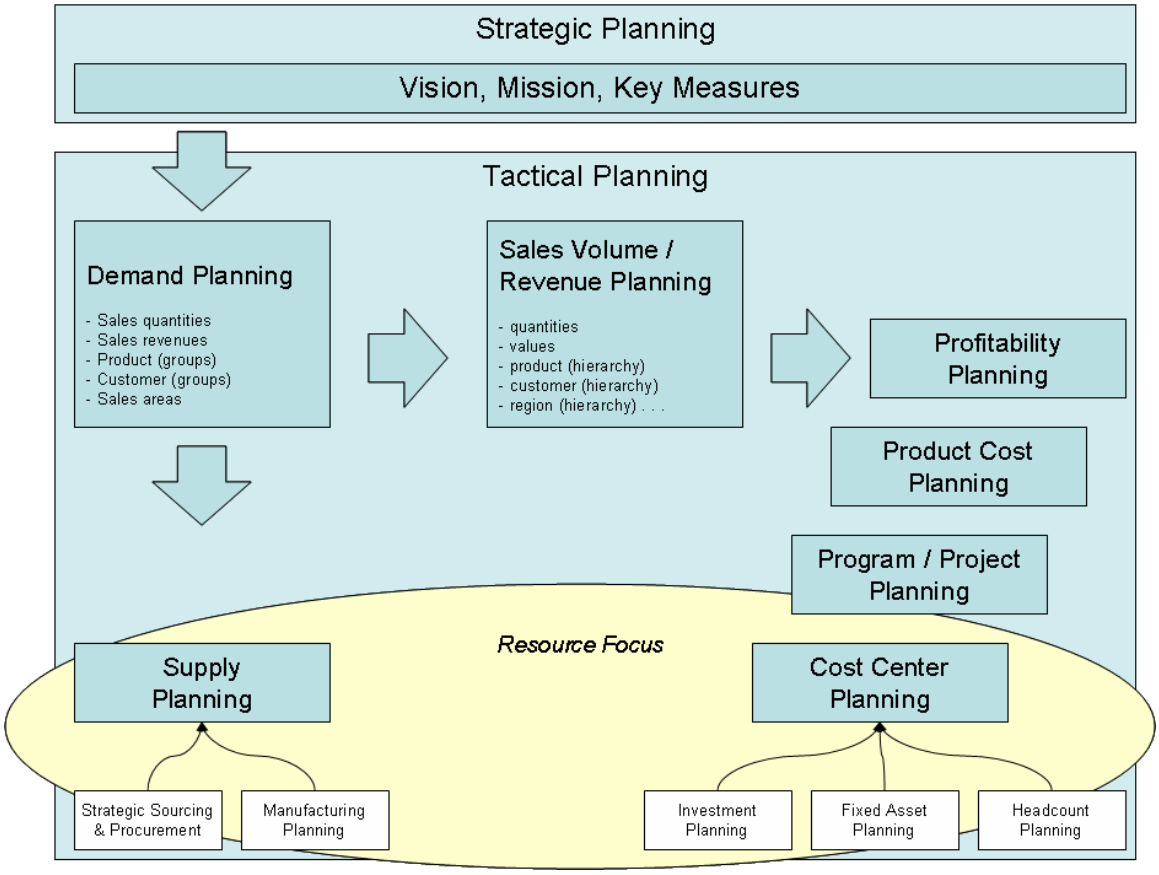
RCA's Integrated Planning Framework explicitly accommodates the decision domains listed above. Moreover, RCA's view of resources and its quantity-based approach provides the basis for converting strategic goals into quantitative resource requirements. Strategic resource goals can be validated, existing resources can be easily financially evaluated and the quantitative and financial aspect of additionally required resources can be determined. This is important as they either relate to selected strategic financial measures like cash flow and customer and product profitability or identify required investment options.

RCA's integrated planning framework also allows for easy simulations, either to identify options to achieve the strategic goals with the given resources or to determine how to take these goals with the existing resources even further. As mentioned earlier the integrated planning framework allows for the modeling of quantities and their values separately or simultaneously.

Tactical Planning

Tactical planning occurs under the guidance of strategic planning with its own set of plans, each customized for their particular objectives and with data and functionality specific to their respective purposes. The inputs into the tactical plans is the more detailed financial and non-financial measures stated in the strategic plan. Figure C.2 illustrates different areas of tactical planning and their relationships.

Figure C.2 Tactical Planning and Its Various Sub-Plans



Demand Planning

Demand planning is the first step in tactical planning. Essentially, customer demand quantities (e..g, products, minutes of use) are forecast over the planning horizon to later be used as inputs in determining optimal resource levels to serve the demand. The targets are defined at a high level e.g., by product and customer groups. Demand planning does not include aspects of processes or resources required to fulfill the targets. The results of demand planning are the starting point for Supply Planning and Sales Volume / Revenue Planning. The management accounting system plays no roll in demand planning which focuses on market and market segment statistical analysis and forecasting.

Supply Planning

Supply Planning takes the information of Demand Planning and uses high-level requirements planning and high-level capacity scheduling to determine the resources (supply) required to achieve the expected product/service output targets. The calculated quantitative requirements for materials and services, internal and external, are the basis for Strategic Sourcing and Procurement decisions and Manufacturing/Operations Execution Planning.

RCA and Supply Planning

RCA's quantity-based approach allows for accurate resource requirements planning while its resource view enables the valuation of the quantitative resource requirements. This information serves as the basis for insourcing/outsourcing decisions, make-or-buy decisions of external services and for products. Through RCA's unambiguous view of cost behavior, fixed and proportional consumption dependencies serve as the foundation for optimized manufacturing/operations execution e.g., effectively incorporating economies of capacity considerations into supply planning.

Sales, Revenue and Cost Planning

Profitability Planning

Profitability Planning takes the expected sales volume from demand planning and adds planned prices/revenue targets. It then associates the cost of the applicable resources and determines the profitability by the various target markets and market segments. The results of Profitability Planning flow into overall P&L, Balance Sheet and Cash-Flow planning.

Total cost for resources in Profitability Planning is derived from direct product costs (from Product Cost Estimate planning), indirect product cost assigned from programs / projects (Program / Project planning) and the resources consumed from cost centers (Cost Center and Business Process Planning)

RCA and Profitability Planning

With its attributable cost RCA calculates the most accurate product and service costs. Moreover, the proper application of fixed and proportional cost behavior and its focus on consumption behavior at the resource level contributes further to decision support and the selection of optimizing alternatives in the planning process. RCA's use of the principle of attributability also allows for assignments of indirect costs directly from programs (like marketing campaigns) and Cost Center planning (like Product Manager salary) to the applicable result segments (products or customers or groups thereof). Unlike allocating these costs artificially to all products and including them in the product unit cost, product and customer segment reporting in RCA will be more accurate and lead to better decision making in the planning process. For more on this aspect of cost assignment in RCA refer the discussion on the attributability principle in Chapter 3.

Product / Service Cost Planning

Product / Service Cost Planning uses information from the quantity structures (like bill of materials) and applicable resource consumption and process assignments and calculates the unit cost of products and services. The determination of a unit cost allows for planning and optimal

choices at the product, customer and distribution channel level (e.g., cost to serve particular customer segments vs. strategic value).[8]

RCA and Product/Service Planning

RCA with its concept of value chain integration lives in the operational systems that contain the various product and service structures. Moreover, these structures are expanded to include cost-to-serve resource consumption and process assignments as required.

Cost Center/Resource Planning

Cost centers are organizational units within an enterprise, set up to perform a particular business function. They own and manage the enterprise's resources and are responsible for the associated costs. The business activities in a cost center are the outputs of the resources that belong to that cost center. While Supply Planning provides information about resource requirements from a transactional perspective (e.g., "widgets" flowing through a manufacturing supply chain), resource requirements for support functions like IT, Finance and HR depend on the way an enterprise has organized and pooled its resources.

Cost Center planning is really resource planning; the quantitative planning of resources required for the manufacturing process as well as all other support functions. The determination of the cost associated with resource usage takes place in Cost Center Planning when the inputs required to provide the expected usage levels are determined. The results of Cost Center planning serves as input to Product Cost Planning for direct and product related resource consumption and to Profitability Planning for direct assignment of resource output to a particular revenue segment. Cost center planning also serves as the source of costs assigned based on the principle of attributability to result segments e.g., marketing campaign costs for a particular product group.

RCA and Cost Center/Resource Planning

The comprehensive view of resources is one of RCA's key characteristics. This is a perfect fit for the planning of resources in Cost Center planning. The use of resource pools and the objective of attributable resource costs increase the quality of the calculated cost rates and assignments through the rest of the planning process. RCA's quantity-based and fixed and proportional consumption and cost behavior concepts for resources enable the most accurate calculation of the cost of resource consumption.

[8] It should be noted that product cost here refers to RCA's attributable product costs i.e., the costs include both inventoriable and non-inventoriable causal costs.

Program / Project Planning

Program / Project Planning combines the cost associated with the use of materials, equipment or labor resource to determine the target cost of a program or project. Programs are either capitalized and put on the Balance Sheet (like Fixed Assets) as financial regulations dictate or assigned to a Cost Center, Product or Service, Result Segment, or another program or project. Programs/projects must be included in tactical planning due to their demand on resources. The results flow into P&L, Balance Sheet and Cash-flow planning.

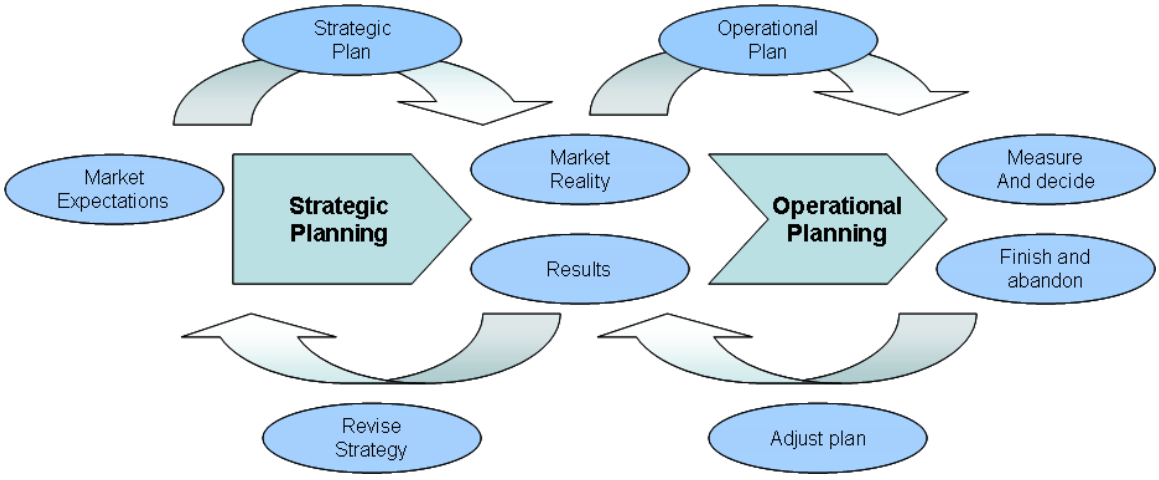
RCA and Program / Project planning

RCA recognizes object types specifically for planning, collecting and measuring program and project inputs and costs. RCA's comprehensive view of resources and quantity based approach ease the planning of programs and projects and provides a 'fully-loaded' view of demand on enterprise resources. Causal consumption relationships can be established and consumption is valuated the resource cost rates. The results are better supply and capacity planning and more precise and more manageable programs and projects.

Integrated Strategic & Tactical Planning

As indicated above, overall planning consists of planning to satisfy particular business objectives. Figure C.3 illustrates some triggers and the sequence of the different planning steps and the ongoing optimization process involved in strategic and tactical planning integration.

Figure C.3 Integrated Startegic and Tactical Planning



Planning is not a one time process; it is an iterative process. Strategic and tactical plans are revisited as often as internal or external changes in the marketplace or opportunities for the enterprise dictate. Resource constraints, 'economies-of-capacity' and aspects of fixed and proportional consumption behavior, visible on one tactical plan (e.g., Product Planning), must be applied to all other tactical plans because of interrelationships between the various tactical plans.

For the strategic plan to be ultimately practical and executable the various tactical plans' dependencies must be recognized and reconciled.

RCA and Integrated Planning

Integrated Planning requires the mapping of strategic goals to tactically executable goals. With RCA's integrated planning framework, changes in strategic goals can be translated directly into the necessary adjustments on a tactical level. Impact to resources and quantities can be evaluated at the tactical level and the results, of a quantitative or financial nature, can be passed back on to other tactical plans or back up to the strategic plans. Since financial data follows quantity information in RCA, no manual re-calculations of financial data is required. Changes in the quantity or resource structure automatically update the financial information. Fixed and proportional cost behavior is an integral part of this calculation as the causal consumption relationships form the basis of the RCA integrated planning framework.

RCA provides a consistent framework for modeling resource consumption and cost behavior through all the levels of integrated planning. In particular the quantity-based approach – by reflecting enterprise economic activity – plays an important role in the integration aspect of planning.

Planning for Optimization

A main contributor to the success of an organization is the successful "conversion" of available organizational resources into products and services sold to customers. Van der Merwe / Jackiw define this successful conversion as 'optimized execution'9.

The enterprises ability to mine the market for and invest in the right resources to effectively convert resource input into sellable resource output

Optimization in this regard can be seen as the efficient use of the resources acquired by the enterprise and the effective application of those resources within the enterprise to produce the products/services required. The following table highlights optimization questions that need to be answered in optimized execution as well as in planning for optimization.

Table C.3 Optimization Areas

External – Input (Source the market)	Determine the right input alternatives to acquire and the technologies to invest in
Internal – Input (Apply acquired inputs)	Optimize use of the resources acquired in an efficient conversion process
Internal – Output	Produce the products and services which achieve strategic and

[9] Van der Merwe, A & Jackiw, C. 1999. Strategic Cost Management in the Airline Industry. *The Handbook of Airline Finance.* McGraw-Hill.

(Produce required outputs)	financial goals.
External – Output (Mine the market)	Apply and sell enterprise output in the market segments that achieve strategic objectives

Capacity management is an example of a typical optimization process which deals with the potential and limitations of resources. Capacity management can take a long term view, aimed at investment decisions, or a more short term view, aimed at the optimization of throughput. The proper management of the cost associated with capacity is vital for the success or failure of an enterprise. In this regard the recognition of the two components that comprise capacity cost is important :

- Costs associated with the use of capacity. These costs can be passed on outputs costs to inventory or directly to the P&L
- Cost associated with the provision of capacity. Passed on to outputs as capacity is used and the remainder are treated as variances or over/under absorption.

To minimize capacity cost, it is necessary to optimize the use of capacity, by understanding and working with appropriate levels of output (theoretical and planned), capacity limitations and the impact of under and over-utilization. For a detailed discussion on capacity and RCA see Appendix D to this deliverable.

When it comes to supporting input decisions RCA's resource focus and quantity based approach provides information about the type and quantity of resources required and their associated cost. This information is important for sourcing decisions (make-or-buy, selection of production alternatives). Investment decisions and resource usage optimization require a resource based approach. RCA's integrated planning framework (including a robust quantity based model) allows for simulation, goal seeking and automatic recalculation of financial results, which enables real-time optimization of resources and financial/strategic goals. . This capability is extremely important as it can be applied not only for the optimization of the initial plan, but also to enable the plan to "adjust" real time for changing customer, market and environmental changes. Higher or lower than expected demand, higher or lower than expected cost of resources like material and labor or competitors actions that require adjustments to sales prices can be substituted into the model and plan adjustments can be determined to achieve the planned financial goals.

On the output side RCA's multilevel marginal P&L view enables the most precise calculation of customer and product profitability which is a prerequisite to make sound product / service mix decisions. The causal assignment of certain fixed costs to different levels in the P&L plays an important role in highlighting areas of responsibility and the need for action in the optimization endeavor.

Other Planning Aspects

Planning and Control

The approval of the strategic and tactical plans is one crucial aspect of managerial control. Another is to actually apply these plans as the standard and determine (measure) the achievement of or progress towards the agreed-upon goals. This activity helps understand 'what happened' and allow for analysis of the reasons for variances. The control process also includes the determination of corrective and adaptive actions.

Corrective actions refer to steps managers take to get the organization back on track i.e., to achieve the original objectives. Adaptive actions refer to steps managers take in recognition that assumptions embedded in the plan or the environment has changed so substantially that the original plan is no longer achievable. New direction and goals flow from adaptive actions.

RCA and planning and control

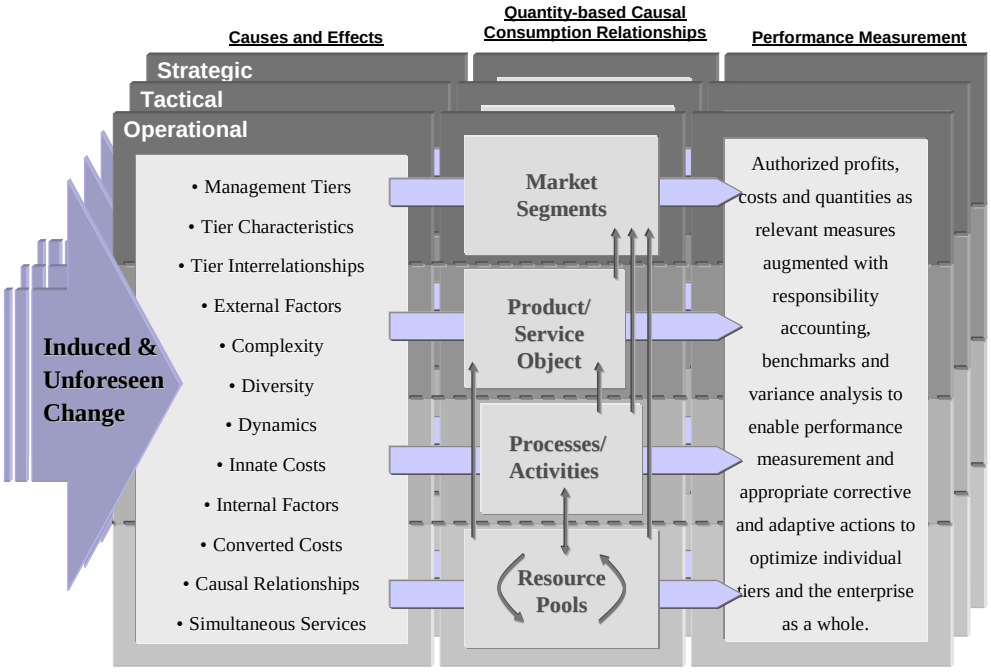
RCA has the primary intent of making the enterprise more proactive and forward looking by means of its emphasis on planning. As mentioned in the introduction of this deliverable RCA is predicated on robust planning. With RCA's resource focus and quantity based approach, planning and control is aimed at the identification of potential issues and ways to overcome them and not pondering on the past. Problems can be identified and opportunities explored and addressed in new, forward looking managerial actions.

The preservation of the nature of cost (fixed and proportional) directly supports the dynamic planning aspect as the quantity structures are flexible enough to adjust to the new planning conditions. Moreover, the same dynamic applies to actual results i.e., authorized quantities and costs are used in all areas of the model rather than a static dollar only budget. Figure C.4 is a graphical representation of the RCA Cube which provides an overview of the planning and control process against the back drop of the various plans discussed above.

Performance Measurement

Performance measurement is tightly integrated within the planning framework, providing input into the key success measures (aka balanced scorecard) and a direct linkage to compensation with goal alignment from "work room to board room". KPIs, or Key Performance Indicators, are the measures which either reflect past performance at a more tactical level (lagging indicator) or help to anticipate future performance (leading indicator). They can be financial or non-financial measures and can be of quantitative or qualitative in nature. They are the foundation of performance evaluation and provide information for internal and external benchmarking.

Figure C.4 The RCA Planning and Control Cube[10]



RCA and performance management

RCA can provide selected quantitative and resource based measures that flow into an enterprise's performance measurement and reward systems. A performance management system based on RCA can leverage information already captured for tactical reporting without additional data capture or data reconciliation. RCA feeds a balanced scorecard system with information on selected financial and key performance measures. Although measures in the balanced scorecard are typically high level, they do require a break-down to the tactical level and as such RCA's resource focus and quantity based approach provides a solid foundation.

Conclusion

RCA in Financial Planning

In the introduction, we referred to several of the "ills" of the traditional planning process. We believe that the core tenets of RCA address many of these ills and would significantly add to enterprise value in the following ways (for convenience, we restate the planning "ill" below and how RCA addresses each):

- Defined in terms of general ledger (G/L) accounts, focuses on monetary values only

[10] Van der Merwe A & Keys, D. 2001. The Case for Resource Consumption Accounting Series #4. *Strategic Finance.* IMA. Montvale, NJ.

- RCA's comprehensive view of resources expands planning from resource-independent G/L accounts to planning for the actual objects used (resources) in conversion.
- RCA's 'Quantity-based cost model' enables planning of quantitative measures in addition to monetary values.
- Involves setting budgets based on organizational structures
- RCA's multi-level marginal P&L allows for the setting of budgets for organization-independent revenue segments (like Customer or product).
- RCA's comprehensive view of resources allows for organization-independent planning objects like orders, projects or business processes.
- Based on what each functional group spent in the prior period, plus adjustments
- Using RCA's quantity-based cost model monetary planning information for quantity consumption is calculated directly based on planned cost rates.
- Too time consuming, requires many iterations and very costly
- RCA's unambiguous view of cost behavior correlates required inputs with outputs in an enterprise for seamless integrated planning.
- Influenced by political gaming and limited buy-in or acceptance of results
- RCA's comprehensive view of resources and quantity-based cost mode establish a foundation that provides 'transparency' of the plan.
- RCA As The Common Denominator

Planning in an organization strives to provide insight into and anticipate potential operational outcomes. Add to this the requirement for proactive optimization, investing in resources that support strategic objectives and mining the market to its full potential and the need for a comprehensive management accounting approach as the foundation to all aspects of planning is clear. This appendix has provided an overview of RCA's place in that process. More importantly however, this appendix should serve to provide the reader with an understanding of the importance of this planning emphasis in marginal analytics. In RCA decision support is not considered something that happens in reaction to some business event (although the reality is that this is sometimes the case) instead decision support is considered an integral part of a proactive stance that begins in planning. From here the need in RCA for extensive marginal analytic support in an organization's planning process and the reason why, in RCA, planning serves as the basis for marginal analytics.

Appendix D: Special Topics – RCA and Capacity in A Decision Framework

Introduction

Proper capacity management is essential for any successful and thriving organization. Resources' capacity must be provided in a cost efficient manner and used effectively to create value. In the latter half of the 20th century the impact of capacity costs increased significantly. Production processes are more and more technology driven and associated with high capital investments. Companies are forced to accept this increase in fixed costs and need transparency into these costs for purposes of optimization.

Capacity-related decisions range from short-term throughput optimization to long term investment planning e.g., from constraint exploitation to make-buy decisions. There are multiple methodologies available to support these complex decisions. In this article we explain how Resource Consumption Accounting (RCA) supports the management process of capacity management. Following a short introduction to the building blocks of RCA, we discuss how RCA improves product costing information for capacity management decision support, compiles a resource's attributable costs for use in for example, investment decisions, and also how RCA enhances performance measurement with regard to capacity.

Building Blocks of RCA

RCA is the name of a new holistic management accounting approach[11]. A key element of the RCA approach is its focus on resources as the starting point for a management accounting system. A view suitable for any industry or company. RCA's resource focus recognizes the following basic insights:

- every company uses resources to reach its business goals,
- every decision managers make is a resource application decision, and
- knowing the cost and consumption behaviour of resources are essential for optimization.

The effective exploitation of these insights requires the calculation of attributable resource costs.[12] RCA uses the following methods in calculating attributable costs:

- Taking *a quantitative approach* to reflecting the causal relationships between resources consumed by other resources and resources directly supporting product or service outputs. For each resource an sender output quantity is determined and this output quantity is used to calculate a cost rate.

[11] A general description of RCA can be found on-line at http://www.focusmag.com in *Focus* magazine, Clinton, B. D., and D. E. Keys. "Resource Consumption Accounting: The Next Generation of Cost Management Systems." Volume 5, 2002.

[12] Attributable costs is the most complete cost concept (i.e., the cost concept closest to full costs) based on the principle of causality. Refer the detailed discussion below.

- Incorporating *concepts of consumption behaviour* which recognizes that some input quantities have a proportional consumption relationship with the output quantity of the resource while other inputs are fixed with respect to the output quantity but are nevertheless required for providing the output.
- Incorporating *concepts of cost behaviour*. A resource's innate costs is defined as the fixed and proportional nature of costs determined by the characteristics of the resources. This approach also recognizes that a resource's innate costs, when proportional, can change to fixed costs (i.e., converted costs) based on consumption patterns. For example, energy costs are normally proportional but could change to fixed if the consuming resource, service or product reflects a consumption pattern that does not vary with its output level.
- Recognizing that fixed consumptions are unchangeable and constant by definition (for the considered relevant range).
- Recognizing that *capacity resides with resources* and that resources perform activities. Activities are analytical views on the consumption relationship between a resource's output and its consumers e.g., products or other resources. Thus, capacity costs are part of the cost rates for the resources output quantities.

Attributable Capacity Costs

Different kinds of decisions have different needs for the costs of a resource. For short-term decisions (e.g., how best to use existing capacity) proportional cost rates multiplied with the change in output quantity should approximate the relevant cost reasonably well. However, for long-term decisions, e.g., adding or dropping a product, the relevant costs are the attributable costs of providing the current level of output.

Attributable costs is defined cost that could be eliminated, in time, if an activity/product were discontinued and capacity were to be reduced accordingly[13]. As indicated in the marginal analytics section of this deliverable two principles govern the establishment of attributable costs:

Causality: The relation between an input and a managerial objective's output, whose nature is such that the input must be consumed if the objective is to be achieved.

Attributability: The responsiveness of inputs (and hence their costs) to decisions that change the provision and/or consumption of resources. (Adapted from Shillinglaw)

Since the focus of this paper is capacity costs within a decision framework, the question is: Which part of total capacity related costs are attributable costs, i.e. what are attributable capacity costs. To answer this question a thorough understanding of the nature of total capacity

[13] See Gordon Shillinglaw: Managerial Cost Accounting, Fourth Edition, 1977, page 259-260

related costs are required.

Total capacity related costs is comprised of two components. First, those costs that are required for a resource to enable its output commitment even if no output is generated in the end i.e., capacity provision costs. Examples of capacity provision costs are depreciation on machines or buildings, insurance, property taxes, rents, and preventive maintenance. The anticipated level of output to be generated is determined by the demands of potential consumers (internal or external). Once a resource has agreed to provide a certain level of output the associated capacity provision costs cannot be avoided for a certain period. The second component comprise those costs incurred to fulfill the output actually demanded i.e., capacity usage costs. Capacity usage costs are the costs of proportional inputs consumed in producing output. Examples of capacity usage costs are consumables, lubricants and electricity consumed during production.

Understanding total capacity related costs is only one aspect of arriving at attributable costs. The denominator/capacity measure used to calculate cost rates is also a key determinant in the end result of cost assignments and hence decision support information. In this regard, the following capacity measures of the providing resource are typically used:

- *Planned capacity level*: The level of output to satisfy the required demand by potential consumers for a given period.
- *Normal capacity level*: Average level of operating activity that is sufficient to fill the demand for the company's products or services for a span of several years, taking into consideration seasonal and cyclical demands.[14]
- *Theoretical capacity level*: The maximum work that can be completed in a full week i.e. 24 hours per day, seven days per week. Time you own the right to use the resource (machine
  7day x 24 hours, person e.g. 40h a week)[15]

Satisfying Attributable Cost Principles: Capacity Denominator and Output Rates

What is the appropriate denominator (i.e. capacity level) to calculate an output rate that will assign resource costs in accordance with the principles of causality and attributability to the consuming resources, activities, products/services or customers?

Capacity provision costs are the costs of fixed units of input; they enable the output commitment and don't change with the level of output. Costs of inputs that vary with the level of output (capacity usage costs), can potentially have proportional and fixed cost portions.[16] Which capacity level or levels are the appropriate denominators for cost rates for capacity provision and

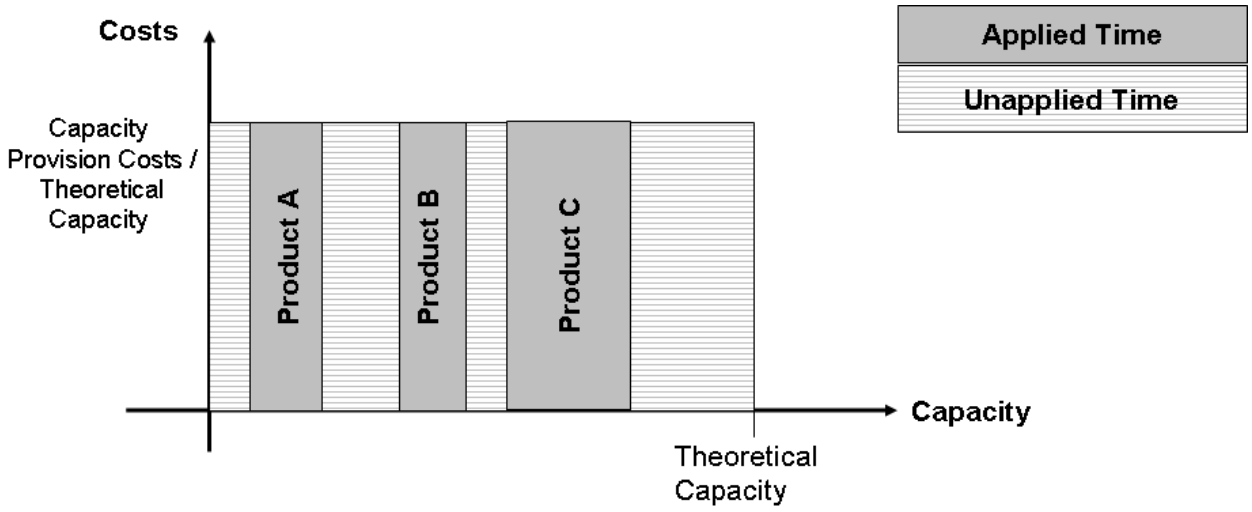
[14] Barron. 1995. Accounting Handbook, Second Edition.
[15] In case of overtime regulations, they should be added here.
[16] Even in the case of a proportional quantity consumption from another resource pool, the fixed cost portions from the providing resource pool stays fixed on the consumer.

capacity usage costs? For the usage costs, the answer is the planned capacity level. This is because, in planning, the usage costs cannot exceed the contracted output demanded. In actual of course the actual usage costs will reflect the actual output generated.

So the question that remains is: Which denominator should be used for the charging of capacity provision costs? To answer this question an analysis of the structure of capacity provision costs over time is required.

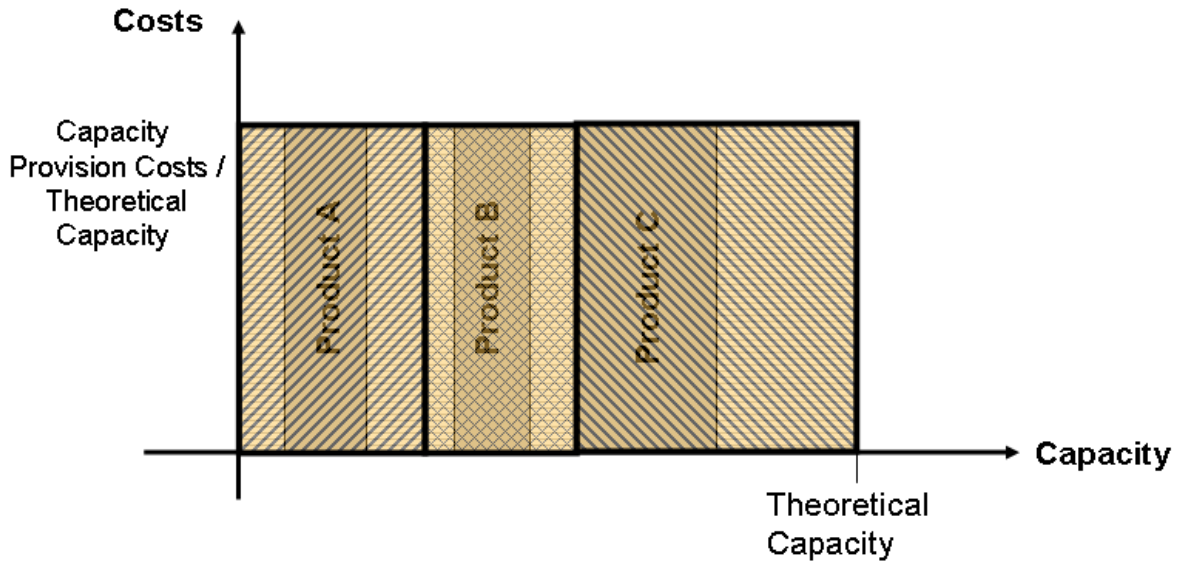
- Viewed over time, there are periods where the resource could be applied to a product/service or customer and there are periods when the resource is not applied. Applied capacity includes capacity needed for set-ups, maintenance or rework.
- So capacity provision costs relate to both applied and unapplied capacity and can be illustrated as in Exhibit 1.

Exhibit 1: Applied and Unapplied Capacity Provision Costs



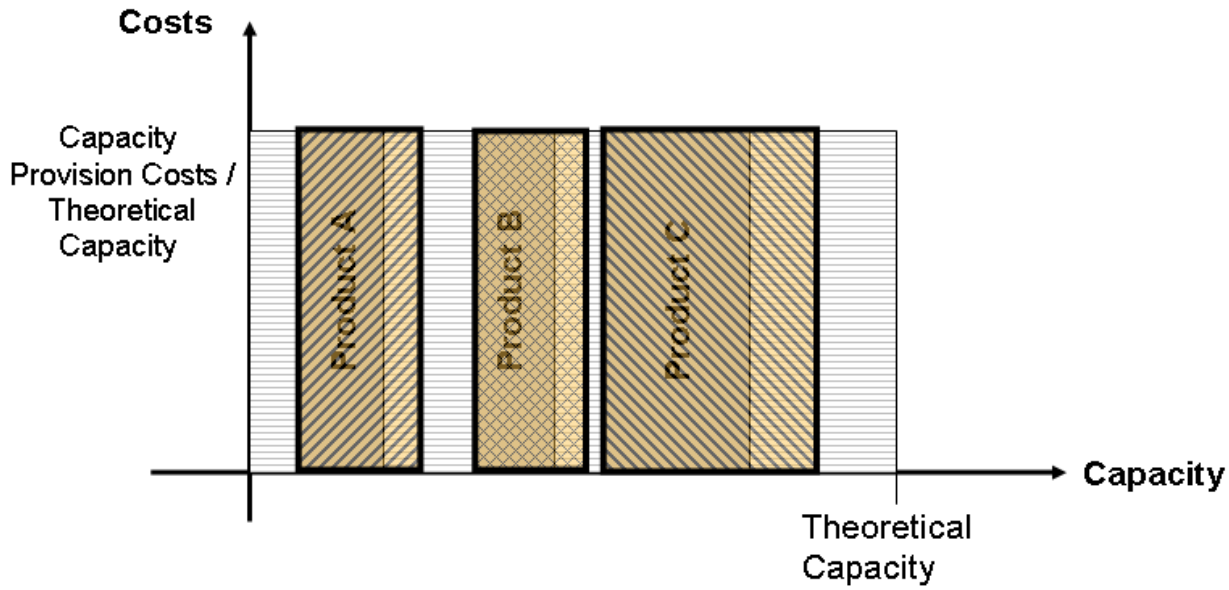
If **planned capacity** is used as the denominator all capacity provision costs are assigned to consumers regardless of use. Common fixed costs e.g., excess/idle capacity costs, are assigned to the lowest level products and services in a manner inconsistent with the principle of causality. Refer Exhibit 2, all of the capacity provision costs represented by the shaded area will be assigned.

Exhibit 2: Planned Capacity Denominator - Assigning Capacity Provision Costs



If **normal capacity** is used as the denominator (where the normal capacity is higher than planned capacity) only some common fixed costs are assigned to the lowest level products or services. Refer Exhibit 3, the shaded areas represent capacity provision costs over and above the capacity actually applied. When normal capacity is lower than planned capacity too much fixed cost will be assigned i.e., over absorption will occur. Either case is inconsistent with the principle of causality.

Exhibit 3: Normal Capacity Denominator - Assigning Capacity Provision Costs

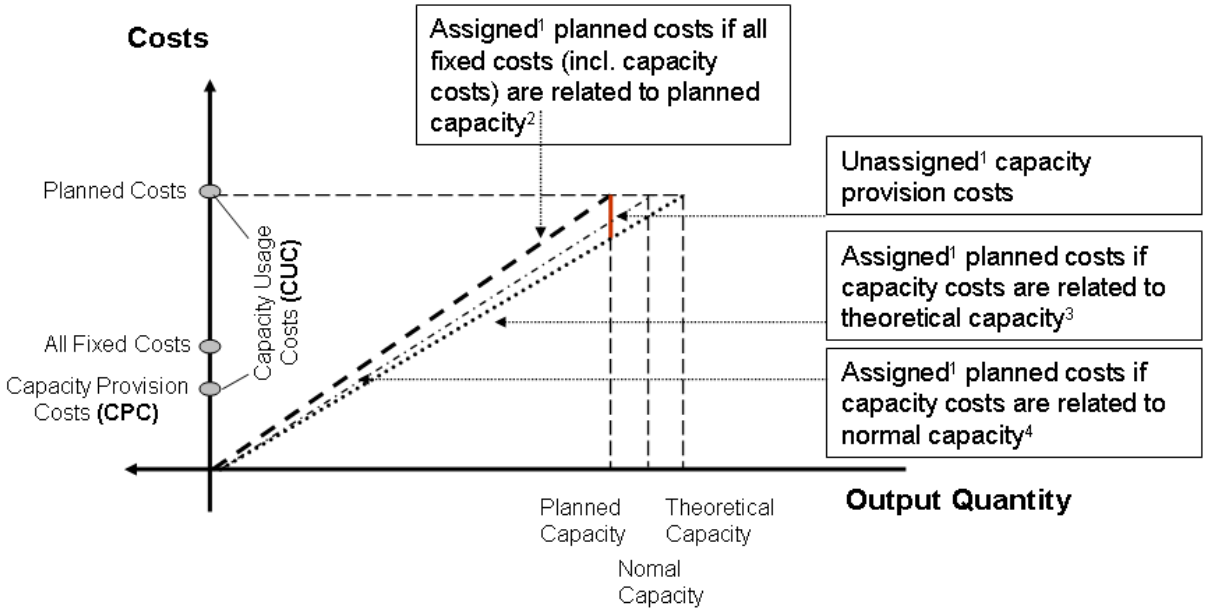


If **theoretical capacity** is used as the denominator - only the capacity provision costs relate to the capacity actually applied are assigned to the products and services produced. Common fixed costs for excess/idle capacity for example are not assigned to the lowest level products and services. Refer Exhibit 1, only the capacity provision costs represented by the shaded capacity applied times will be assigned.

These insights into the assignment of capacity provision costs using the various denominators can be graphically summarized as shown in Exhibit 4. The vertical axis shows the various cost components of total capacity costs and the horizontal axis the denominator options. A cost recovery line for each denominator indicate the total cost each denominator will recover. The common fixed costs that will not be assigned when theoretical capacity is used is highlighted in the graphic.

Since the objective is to assign resource costs in the best causal manner for decision support the conclusion is that resource costs should only be assigned where the resources are actually used. Therefore, capacity provision costs, which represents unproductive resource time e.g., for excess/idle capacity, should not be assigned to productive output such as products/services or customers. Instead, these costs should be assigned to the appropriate levels of the organization based on the principle of attributablility.

Exhibit 4: The Assignment of Resource Costs



[1] to the receiving other resources, products or services
[2] Output Rate = (CUC / Planned Capacity) + (CPC / Planned Capacity)
[3] Output Rate = (CUC / Planned Capacity) + (CPC / Theoretical Capacity)
[4] Output Rate = (CUC / Planned Capacity) + (CPC / Normal Capacity)

An Illustration Example

The following example serves to provide detailed insight into the advantages of using theoretical capacity as the denominator. Assume three products A, B and C are produced on a machine. The capacity provision costs for the machine are $1200. Each product requires 1 hour of machine time to produce 10 pieces. Assume product volumes are as indicated below and results in usage hours for the machine of 120 hours, which equals the machine's planned capacity. Using this denominator in the cost rate calculation yields a fixed capacity cost rate of $10/hr ($1200/120hrs):

Product A 400 pc → 40hrs → $400 capacity provision costs for product A, for unit cost of: $1.00
Product B 600 pc → 60hrs → $600 capacity provision costs for product B, for unit cost of: $1.00
Product C 200 pc → 20hrs → $200 capacity provision costs for product C, for unit cost of: $1.00
Assigned Capacity Prov.Cost:**$1,200**

Better than expected market opportunities allows the company to revise the plan for Product C and produce 300 pieces and not just the 200 originally planned. Actual machine usage now equals 130 hours, which yields a fixed capacity cost rate of $9.23/hr ($1200 /130hr). Each product's product cost is affected as follows:

Product A 400 pc → 40hr → $369.23 capacity provision costs for product A; unit cost: $0.92
Product B 600 pc → 60hr→ $553.85 capacity provision costs for product B; unit cost: $0.92
Product C 300 pc → 30hr → $276.92 capacity provision costs for product C; unit cost: $0.92
Assigned Cap. Prov. Cost: **$1,200.00**

The result is that the product costs for Product A and B are impacted even when there is no change in their volumes. This is clearly not in line with the principle of causality since it would imply that less resources were required to produce the planned volumes. This is typical of the compromise in decision support information that results from full absorption approaches i.e., common fixed costs are arbitrarily assigned to consumers. As discussed above, normal capacity will have a similar result but depending on how volatile actual output is managers could see either over or under absorption of common fixed costs.

With theoretical capacity as the denominator, on the other hand, the change in volume will be accommodated as shown below. The fixed capacity cost rate is then $7.14/hr ($1,200/168 hours), which yields the following result for the original plan and the amended plan:

Original Plan	Amended Plan
Product A 400 pc → 40hr → $285.60 @ $0.71	Product A 400 pc → 40hr → $285.60 @ $0.71
Product B 600 pc → 60hr → $428.40 @ $0.71	Product B 600 pc → 60hr → $428.40 @ $0.71
Product C 200 pc → 20hr → $142.80 @ $0.71	Product C 300 pc → 30hr → $214.20 @ $0.71
Assigned Cap.Prov.Costs: **$856.80**	**$955.20**

Using theoretical capacity as the denominator does not result in changes to the product costs for Products A and B due to a decision to produce more Product C. Moreover, the unit costs of the products do not change due to volume or mix changes. This result is valid for all consumption relationships in an RCA model such as resource pools consuming output from other resources. The assignment of common fixed costs throughout an RCA model is therefore consistent with no ill effects on decision support information.

What to do with the Unapplied Capacity Provision Costs?

The assertion is that only applied capacity provision costs are properly attributable costs, unapplied capacity provision costs therefore remain i.e., $343.20 under the original plan. These costs should be assigned to the relevant margin levels in a multi-level P&L in accordance with the principle of attributability. As illustrated in Exhibit 5 the $343.20 fixed costs should be assigned to the lowest appropriate aggregation level in the P&L where the inputs will be responsive to decisions that change the provision and/or consumption of resources. For example, assume the three products in Exhibit 1 belong to one product group and they are the only products manufactured on the machine. In this case, the appropriate assignment level for these costs would be the Product Group Coverage Margin since a decision to eliminate all three products would mean the machine can also be sold resulting in the $343.20 of capacity provision costs becoming avoidable.

To demonstrate assume that the three products have $12,000 net revenue. The usage costs for each product with their respective proportional- and fixed cost components (proportional/fixed) are as follows:

- Usage Costs for Product A = ($400/$100)
- Usage Costs for Product B = ($500/$150)
- Usage Costs for Product C = ($200/$75)

Under the original plan (with theoretical capacity as the denominator) where the assigned attributable capacity provision costs are $856.80 in total (i.e., Product A = $285.60 Product B = $428.40 and Product C = $142.80) the RCA multi-level P&L will look as illustrated in Exhibit 5. Note, the assignment of the $343.20 of unapplied capacity provision costs to the Product Group Coverage Margin.

Exhibit 5 Multi Level Coverage Margins

$12,000.00	**Net Revenue**		
-$1,100.00	**Proportional Product Costs**		
	$400.00	Product A	
	$500.00	Product B	
	$200.00	Product C	
$10,900.00	**Contribution Margin = Coverage Margin**		
-$1,181.80	**Causally Assigned Fixed Product Costs**		
	$325.00	Fixed Capacity Usage Costs	
		$100.00	Product A
		$150.00	Product B
		$75.00	Product C
	$856.80	Fixed Capacity Provision Costs	
		$285.60	Product A
		$428.40	Product B
		$142.80	Product C
$9,718.20	**Product Coverage Margin**		
-$343.20	**Attributable Capacity Provision Costs**		
$9,375.00	**Product Group Coverage Margin**		
-$5,000.00	**Company Wide Common Fixed Costs**		
$4,375.00	**Operating Result**		

Performance Measurement

One of management's main responsibilities is to provide for the effective and efficient supply of resources (i.e., space, technology, and people). Apart form the decision support aspects discussed above RCA can provide significant support to measure a manager's performance in ensuring the proper amounts of capacity are provided. Moreover, attributable resource cost rates can be used for benchmarking and provides an indication of the efficiency with which inputs are converted into outputs.

Where the resource capacity level is determined for a manager, responsibility is limited to the effective provision of the resource's output. The subunit should be treated as a cost center. When the manager has the authority to influence the investment in resource capacity, the subunit should be treated as an investment center. For performance measurement purposes and if returns are also under the manager's control the the yardstick should be ROI, as opposed to a cost center where the primary measure is that of efficient conversion.

The budgeting and planning process for resource pool output is based on forecasted demand. The inputs for making capacity available are treated as fixed costs. The costs for resource outputs due to capacity usage are treated as the costs of proportional input units. The

budgeting and planning process will also include demand from other internal resource pool outputs resulting in an integrated reconciliation process between resource pools. Budgeted output rates as well as planned idle capacities result from this process.

For performance measurement, the actual output quantity and the input costs and quantities of each resource pool are measured. Actual quantities consumed will be valued with the planned output rates to charge costs to consumers. Performance is not simply evaluated by comparing planned costs with actual costs. Instead, *authorized* costs - i.e., the costs of volume adjusted inputs at the actual output level - are calculated. Proportional planned inputs will be multiplied by the operating level[17] to calculate the authorized costs. When the capacity usage remains unchanged, the authorized costs are the same as the planned costs.

Dividing actual and authorized costs into variance categories (including the costs of unused capacity and input quantity variances) provides valuable information that can be used for analysis and performance measurement.

Conclusion

RCA with its roots in resources and their cost characteristics and by applying attributable cost principles provides a fundamentally different cost information basis suitable for effective support of managerial processes. Moreover, when it comes to decision support RCA is able to provide insight into relevant costs whether the manager is considering small or large changes in output. Because all cost assignments are governed by the principle of causality RCA is able to effectively comply with the requirement: Different costs for different purposes. For performance measurement the RCA approach provides levels of detail and transparency capable of supporting a range of different measurement models.

[17] The operating level is calculated as the actual output level divided by the planned output level.

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