



The Association of
Accountants and
Financial Professionals
in Business

Conceptual Framework for Managerial Costing

*Draft Report
of the
IMA Managerial Costing Conceptual
Framework Task Force*

Preface

In writing this *Conceptual Framework for Managerial Costing*, the members of the task force recognized they were undertaking an audacious and arduous task. The subjects of managerial costing and cost accounting research and writing touch three centuries. While we were aware of some of this work, we were continually surprised as concepts we thought original were found to have been written about before—some in the 19th Century. The task force recognizes that it stands on the shoulders of giants. The task force also knows that it did not give the giants of the past and the present their full measure of credit by meticulously researching their work and the derivation of the concepts we present. However, this document is not a historical review. We thus have no intention of offending; we simply weren't seeking to document the history of the ideas we present.

Instead, in writing this document, we sought to achieve a balance between application to the practical world of the practitioner and providing enough theory to provide a solid conceptual footing for application. We have referenced work that we used directly but did not conduct exploratory research to determine the origin of concepts we present or their histories in the management accounting and cost accounting literature. The team members who comprised the task force are widely read and some are widely published, in the field of management accounting and costing. They view themselves as strongly practitioner oriented. This *Conceptual Framework* contains the principles and concepts the team members believe define the application of managerial costing and cost modeling for the purpose of managerial decisions. While challenging in this type of document, the task force sought to present an orientation toward practice and application

We want to thank the Institute of Management Accountants, Inc. (IMA) for sponsoring the work of this taskforce, particularly President and CEO Jeff Thompson and VP of Research and Professor-in-Residence Raef Lawson. The members of the Foundation for Applied Research provided review, feedback, and guidance on the *Framework*; as did our special industry advisory review panel, which consisted of Dan Hill, Consultant, CorePROFIT Solutions; J. Stephen McNally, Finance Director/Controller, Campbell Soup Napoleon Operations; Robert Goldfarb, Controller, Catalent; and Jerry Solomon, VP Baltimore Operations – Marquip Ward United.

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It is our hope that the profession of management accounting and the practice of costing will be advanced by allowing organizations – private, public, not-for-profit, governmental – to make better decisions and create greater value for stakeholders and society.

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Table of Contents

Introduction	6
Section I: Objective of Managerial Costing	12
Section II: Scope of Managerial Costing	16
Section III: The Characteristics of Managerial Costing	22
Section III.A: Principles for Managerial Costing	27
First Principle: Causality	28
Second Principle: Analogy	31
Section III.B: Concepts for Managerial Costing	35
Modeling Concepts	38
Information Use Concepts	62
Section III.C: Constraints for Managerial Costing	70
Cost Modeling Constraints.....	71
Information Use Constraints	77
Section IV: The Framework in Operation	81
Part IV.A: Evaluating a Company's Operations and Strategy for Modeling	82
Part IV.B: Model Design & Construction	86
Part IV.C: Implementation Factors	101
Part IV.D: An Organization's Acceptance of Managerial Costing	108
Section V: Call to Action.....	113
Appendix: Truth as a Foundation for Managerial Costing.....	118

List of Figures

Figure 1: Input Output Relationships of Resources	19
Figure 3: The Application of Principles, Constraints, and Concepts	25
Figure 4: The Application of the Principles.....	33
Figure 5: The Cost Modeling and Information Use Views.....	37
Figure 6: Modeling Concepts	38
Figure 7: The Relation Between Total Cost and Total Volume—Variability	44
Figure 8: The Relation Between Resources and Output –Responsiveness	45
Figure 9: Capacity Provision Costs and Planned Output.....	50
Figure 10: Segregating Applied and Unapplied Capacity	51
Figure 11: Illustration of the Concept of Work.....	54
Figure 12: Integrated Data Orientation.....	59
Figure 13: Information Use Concepts	62
Figure 14 The Four Optimization Areas and Optimization Scope.....	84
Figure 15: Inputs and Outputs Within a System.....	87
Figure 16: From Mission to Cost: Resources Are Consumed, and Costs Incurred, to Achieve Managerial Objectives.....	90
Figure 17: Tiered Managerial Objectives for An Airline.....	99
Figure 18: Common Applications of Cost Assessments	111

Introduction

This conceptual framework has been written to fill a long-standing gap in the field of management accounting. What is missing is a clear foundational set of principles for costing that focuses on managers and employees, organizational insiders, as the primary users—who we frequently refer to as the customers of the information. The framework defines the principles, concepts, and constraints that must be considered when doing costing in order to fulfill the information needs of managers and employees who require insights for making decisions about their operations. These insights and decisions, made with detailed operational and financial information at all levels of an organization, are what create sustainable economic value. Financial statements, often for regulatory and compliance purposes, are produced in accordance with generally accepted accounting principles (GAAP). These financial statements report the results of decisions and actions to investors and creditors, who are the primary customers of GAAP financial statements, in a structured model and format.

It is somewhat shocking to realize that no framework or guidance exists for managerial costing, a critical area of management accounting. Arguably, the practitioner can piece together such information from various textbooks, articles, and publications—but who has the time to distill a concise set of principles and concepts from this wide and often contradictory body of knowledge that spans over a century? The tendency in recent decades has been to look for the best costing method—traditional standard costing, activity-based costing, throughput costing, German costing methods, resource consumption accounting, lean accounting, and many others. However, a given method is not a panacea; it is an application of particular principles and concepts, and it is limited by certain constraints. These characteristics are not clearly listed, like the nutritional values on packaged foods, for each method. In most cases, they aren't even clearly understood. The authors don't believe managerial costing methods can be labeled as precisely as packaged food, even with the framework presented in this document. However, the framework will dramatically improve current treatment by providing a set of principles, concepts, and constraints that can be used to objectively evaluate approaches to costing and the conditions for applying them for internal decision support.

The purpose of this framework is to help companies expand the use of managerial costing in order to improve the decisions that managers and employees make to optimize operations. The framework will create greater value by achieving managers' objectives as efficiently and effectively as possible—at all levels of the organization. Organizations won't invest in advanced costing approaches if they see their acquisition and implementation as a high-risk venture with poorly quantified results and questionable benefits. This framework seeks to provide clarity to the objectives an organization seeks to achieve from the use of improved costing approaches and systems. Practitioners can use the framework to define their costing needs and evaluate costing solutions against objectively established criteria embodied in the principles,

concepts, and constraints described in the framework. Doing so will help eliminate the risks associated with poor costing methodology and poor system design and selection.

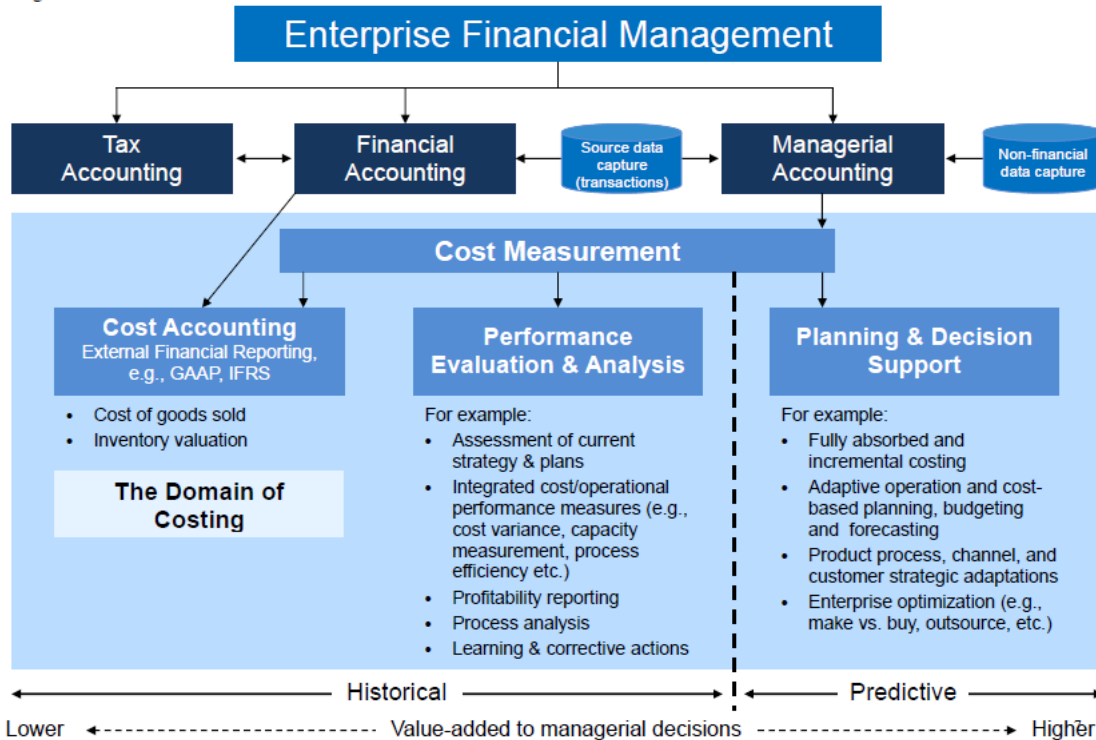
What is Managerial Costing?

The term “managerial costing” was selected to identify the costing information produced for internal use by the managers and employees of an organization. It is information that need not, and in most cases should not, conform to the standards established for financial accounting and financial reporting. The framework presented here was created to provide structure to managerial costing, an area that has often been considered the Wild West of the accounting profession because of adages such as “different costs for different purposes,” “different costs for different questions,” “relevancy is all that matters,” “use what works for your company,” and so on. Beliefs and pseudo-truisms such as these are often used as an excuse or reason not to pursue a deeper analysis of the foundational principles and concepts that underlie managerial costing analyses and models.

It may come as a surprise to many accountants, and even more non-accountants, that more than one financial model can be legitimately applied to describe an organization and used to calculate valid financial information based on the modeler’s assumptions. Furthermore, the models commonly used for external financial reporting have very clear biases and limitations. These limitations are not secrets. They are clearly acknowledged in the conceptual frameworks that have been written by all major accounting standard-setting bodies, including the U.S. Financial Accounting Standards Board, the International Accounting Standards Board, the U.S. Government Accounting Standards Board, the U.S. Federal Accounting Standards Advisory Board, and the International Public Sector Accounting Standards Board, the most recognized sources of GAAP for external financial reporting. Other financial models are also quite common in business. For example, the tax system is a distinct financial model, and many regulated industries must submit financial and operational information that differs significantly from GAAP financial statements. The managerial costing framework presented here will not consider or address financial accounting, financial reporting, or other financial models, except where necessary to highlight some common errors encountered when financial accounting information is used inappropriately with potentially misleading costs for managerial costing and the associated management decision making.

The International Federation of Accountants International Good Practice Guidance (IGPG) titled *Evaluating and Improving Costing in Organizations* (July 2009, www.ifac.org) uses the following diagram to define the realm of managerial accounting (a term apparently used to reflect the range of management accounting’s costing functions in an organization):

Figure 1



Managerial costing, as used in this conceptual framework, addresses creating the information used for Performance Evaluation & Analysis and for Planning & Decision Support in the above IFAC diagram. The authors agree with IFAC’s use of the term “cost accounting” as it is defined in the IGPG in paragraph 1.4:

Examples of cost uses for financial reporting include the valuation of inventories, determination of transfer pricing amounts (for tax optimization purposes), and segmental reporting. Such specific uses of cost assignment are usually mandated by jurisdictions and regulatory authorities, especially where cost assignment affects taxation or the determination of regulated pricing structures. The discipline applied to produce this type of output is usually called “cost accounting.”

The term “management accounting” is often used synonymously with “cost accounting,” “managerial accounting,” and perhaps “managerial costing;” however, the Institute of Management Accountants (IMA) has established a clear definition for “management accounting” in the Statement of Management Accounting #1:

Management accounting is a profession that involves partnering in management decision making, devising planning and performance management systems, and providing expertise in financial reporting and control to assist management in the formulation and implementation of an organization’s strategy.

Managerial costing clearly plays a critical role in the broad field of management accounting. The managerial costing conceptual framework presented in this document contains carefully defined principles and concepts designed to rectify many of the current weaknesses of internal costing practices. It is intended to guide the management accountant in the creation of superior cost and decision-support information free from the constraints of financial accounting conventions and standards. The framework's sole objective is to satisfy the needs of managers and employees who seek to understand the interaction of operational resources and their monetary values in order to select optimal decision alternatives and create long-term sustainable value for their organization and the economy as a whole.

Benefits of a Conceptual Framework for Managerial Costing

A clear framework with a set of principles and concepts can logically model and value an organization's operations to generate high quality information for insights, analysis, and decision making. Management accountants will be able to more efficiently and effectively provide managers and employees with managerial costing's unique insights into the operations and economics of organizations. The benefits of the framework are numerous and are as follows:

- A framework and principles for developing cost and decision-support information for internal use will allow companies, including midsize and smaller organizations, to more consistently enhance their operational modeling and decision-support information, thus improving their competitiveness and sustained profitability.
- Expanding the effective use of cost information among nonfinancial managers who use or would like to use cost information will improve the effectiveness and efficiency of their operations.
- Insight into the limitations of external financial reporting models will have beneficial effects on evaluating risk in the economy because it will highlight the limitations of these models to predict the long-term value creation of companies.
- Investment in managerial costing expertise and systems should expand when decision makers see a clearer, more accepted, and less risky path to creating the effective operational models that provide the cost and decision-support information they need.
- Understanding of the limitations of "transparency" in external financial reporting will improve as businesses and the public become more aware of the differences between financial information for internal decision making and external financial reporting.
- Consistent use of similar cost and decision support concepts and principles across organizations and industries will improve the general understanding of decision-support information and clarify why it is not the same as that used for external financial reporting.

- A conceptual framework for managerial costing assists in differentiating and defining management accounting expertise and its unique knowledge, skills, and value propositions within the broader accounting profession.

Structure of the Framework

This document is structured in a manner similar to the conceptual framework documents that have long existed for external financial reporting standard-setting bodies (and that form the foundation of GAAP). This was done for two reasons:

- To ensure clarity of intent.

The needs of managers and employees for detailed monetary information on operations must be as critically important to CEOs, CFOs, Controllers, and their staffs as is their providing required information to capital markets, investors, taxing authorities, and regulators. The stock market clearly does not value a company for excellently prepared financial statements if operational excellence is lacking. This managerial costing framework is meant to serve as a basis for creating the cost and decision-support information that managers and employees need to be optimally effective in managing an organization's operations—a fundamental element in improving an organization's value.

- To enhance understandability.

It is important to provide a contrast to the much more widely known and widely taught concepts of financial accounting. Therefore, the conceptual framework for managerial costing was structured with the same first three sections as most conceptual frameworks for external financial reporting in order to provide that contrast. This framework addresses:

- Section I: The Objective of Managerial Costing
- Section II: The Scope of Managerial Costing
- Section III: Characteristics of Managerial Costing

This framework also includes two sections on the practical application of the framework:

- Section IV: The Conceptual Framework in Operation
- Section V: Call to Action

Reading the Conceptual Framework for Managerial Costing

Sections I through III provide the meat of the conceptual framework, and the management accountant leading a costing initiative or responsible for providing cost information to his or her organization will want to take the time necessary to understand the principles, concepts, and constraints that define effective managerial costing. Section III is the heart of the conceptual framework and necessarily contains a

substantial amount of theory, though we have worked to provide illustrative examples throughout the section.

For those with a less intense interest, it may be best to read Section I and II, which are fairly short, and then skip to Section IV, which focuses more directly on applying the conceptual framework. However, before reading Section IV, the reader should scan the names and definitions of the principles, concepts, and constraints, and examine the summary diagrams at the end of each part of Section III. These terms are used with precise definitions based on Section III and may not be correctly understood if read without a common use definition in mind.

Probably the most controversial section of this framework is the appendix, which argues that the ultimate foundation of managerial costing is that it pursues truth as opposed to a standard of informational relevance based on a consensus process that sets rules and standards. While you may or may not agree, you should find it thought-provoking—and the authors hope—insightful.

Conceptual Framework for Managerial Costing

Section I: Objective of Managerial Costing

Objective of Managerial Costing

Defining the objective of managerial costing guides the selection of principles, concepts, and constraints in the framework. The objective defines the purpose and the desired outcome of engaging in the effort to design and create the systems and processes that support managerial costing and the information managerial costing must produce.

The objective of managerial costing is to provide a monetary reflection of the utilization of business resources and related cause and effect insights into past, present, or future enterprise economic activities. Managerial costing aids managers in their analysis and decision making and supports optimizing the achievement of an enterprise's strategic objectives.

The paragraphs below explain the significant phrases and terms used in this statement of the objective of managerial costing. Readers are encouraged to study these explanations, because they define some of the fundamental ideas that will be used throughout this conceptual framework.

Managerial Costing—Managerial costing entails linking an organization's resources, activities, products, and services to an economic impact expressed in monetary terms. The focus is on internal operations and meeting the needs of managerial costing's customers—internal management. Managerial costing differs from cost accounting, which is for inventory valuation and product/service costs in accordance with external financial reporting conventions for stakeholders such as investors, creditors, and regulators. Managerial costing is relevant to the financial planning and analysis (FP&A) functions most larger companies are establishing as distinct organizational elements.

Monetary Reflection—Accounting, in all its forms, expresses enterprise operations in monetary terms, in many cases using substantial estimates. Managerial costing, however, must support detailed economic decision making and must accurately reflect the actual resources and processes it intends to represent in monetary terms. The term “reflection” emphasizes the need for a faithful representation of both operational quantities and related monetary values for use in analysis and decision making. The monetary view (and any estimates) cannot obscure business operations in any way that would impede or distort management's predictive tasks, analysis, and decision making.

Resources—To achieve strategic objectives, organizations acquire and deploy resources—people, machinery, buildings, capital. The acquisition and deployment of resources also comprises the source of all the costs of an organization. Managerial cost measurement and cost modeling present unique and insightful information by providing

an accurate reflection of an organization's resources, their usage, and related costs. Cost modeling cannot fully capture many intangible resources, such as the value of a brand or reputation, exceptional teamwork, great leadership, or exceptional creativity or skill. Such characteristics will always require judgment in the use of managerial costing information.

Cause and Effect Insights—To be useful, monetary measures and value must be clearly tied to what an organization does. Internal management makes rational inferences about resource application when making decisions concerning process design, improving operational efficiency and effectiveness, and strategy execution. Much of this logic is based upon insights about cause and effect relationships. Effective managerial costing aids in determining the operational causes of positive and negative monetary outcomes so that they can be replicated or improved, respectively. Cost models must also aid internal management when inferring the monetary impact of possible future changes in production and support operations.

Past—Managerial costing has an important role in organizational learning, including evaluating past results for insights against plans and expectations, and extrapolating from trends and process variation to select appropriate corrective actions. Root causes are not always obvious, and examining historical data to gain insights is often helpful.

Present—Managerial costing must provide a clear model of existing operations. This accurate and timely reflection helps internal management understand how effectively they are currently meeting an organization's objectives. Such monetary insights also add extra significance to nonfinancial measures. Managerial costing should provide insights into the economic effects of tactical decisions with present or very near-term impacts.

Future—Continuous change prevails in business. Managerial costing models reflect the present state, which provides the starting point for projecting, analyzing, and evaluating future actions, options, opportunities, and risks. Internal management's forward-looking entrepreneurial activities are the most influential actions in creating and sustaining value. They can be reflected in monetary terms by adapting the managerial costing model with scenarios and assumptions.

Enterprise Economic Activity—Managerial costing is focused on the entire enterprise or organization, all of its functions and processes (product/service development, production, support, distribution/supply chain, administration, and management), and the resources the enterprise uses to carry out those operations. Enterprise economic activity refers to operations beyond just production or service operations; it includes all resources used by an enterprise to achieve its strategic objectives.

Aids—Cost information is only one consideration in analysis and decision making. Political considerations, customer critical needs, ethical and equitable considerations, and a wide range of other factors are impossible to represent in monetary terms. A cost model's expression of past, present, and future events in monetary terms is highly useful but should not limit the range of causes and their effects that must be considered.

Managers—Managerial costing focuses on the needs of managers and employees making decisions *inside* an organization. Cost information informs their predictive activities, analysis, and decisions, which will sustain and create long-term value consistent with enterprise strategic objectives. For these purposes, managers and employees require information that presents the economic impact of an organization's operations free from distortions and the restricted insight associated with any external reporting conventions for financial accounting, taxes, regulatory bodies, and so on.

Analysis and Decision Making—Analysis focuses on facilitating learning and gaining knowledge about the enterprise's economic activity, specifically its resources and their capabilities, with a view toward achieving strategic objectives. Analysis requires accurate, representative data that will facilitate inductive and deductive logic through cause and effect insights that produce useful information, such as a range of viable decision alternatives. Decision making builds on analysis and requires considering qualitative and other relationships and factors that may not be adequately represented in managerial costing information.

Optimizing—Internal management is tasked with achieving enterprise strategic objectives in an effective and efficient manner. They have the resources the organization has invested in at their disposal, and in every decision they are expected to apply them to realize maximum benefit while consuming the least amount of resources. Optimization should occur with each decision, but it is in a larger perspective a continuous effort to improve and learn.

Enterprise Strategic Objectives—Enterprises have a variety of reasons for existence. Strategic objectives and strategic value need not be expressed in pure monetary terms. Many public sector and not-for-profit organizations focus on nonfinancial objectives; however, they have strong needs for cost measurement and modeling to evaluate their efficiency and effectiveness in meeting those nonfinancial objectives. Managerial costing is most useful to enterprises that seek to increase their value (financial or nonfinancial) over the long term.

Conceptual Framework for Managerial Costing

Section II: Scope of Managerial Costing

Scope of Managerial Costing

The scope of managerial costing entails providing internal information to support the decisions of managers and employees who must optimize business operations. Managerial costing information may be useful externally but will need to be evaluated against external reporting principles, standards, and laws that govern such uses. The following eight tenets capture the scope of managerial costing for internal use.

A. Provide managers and employees with an accurate, objective cost model of the organization and cost information that reflects the use of the organization's resources.

Managerial costing focuses on providing managers with accurate, objective information. Every decision management makes is a resource application decision. For example, the decision to let an employee go due to substance abuse has eliminated that resource out of the available pool. Managerial costing information should therefore be as reflective of the business's resources and processes as practical.

Models that have any other objective than the accurate, objective representation of the organization's resources and processes fall outside this conceptual framework. Examples of such models include those related to compliance tasks such as financial reporting to meet tax needs and regulatory requirements. These costing applications fall outside the scope of this framework because the information generated may distort managers' understanding of costs when making decisions about the best economic use of resources.

The scope of managerial costing caters to the information needs of internal management in an organization.

B. Present decision-support information in a flexible manner that caters to the timeline for insights needed by internal decision makers.

Managerial cost models are not restricted to arbitrary reporting time-period cutoffs for models or information (e.g., end of month, quarter, or year). The appropriate time frame for managerial costing information varies based on the time impact of a decision, the plan or forecast horizon, and implementation of the associated changes. The focus is on representing the organization's use of resources and the resources' operational and economic characteristics as they exist today or might exist in relevant time periods in the future.

The scope of managerial costing caters to the timelines of internal management in an organization.

C. Provide decision makers insight into the marginal/incremental aspects of the alternatives they are considering.

The bulk of decisions in an enterprise consider current resources, capabilities, and outputs in order to achieve strategic objectives. Most decisions are consequently incremental in nature and use existing operations as a baseline. An accurate rendering

of the current application of resources is therefore the logical and appropriate starting point for effective incremental analysis.

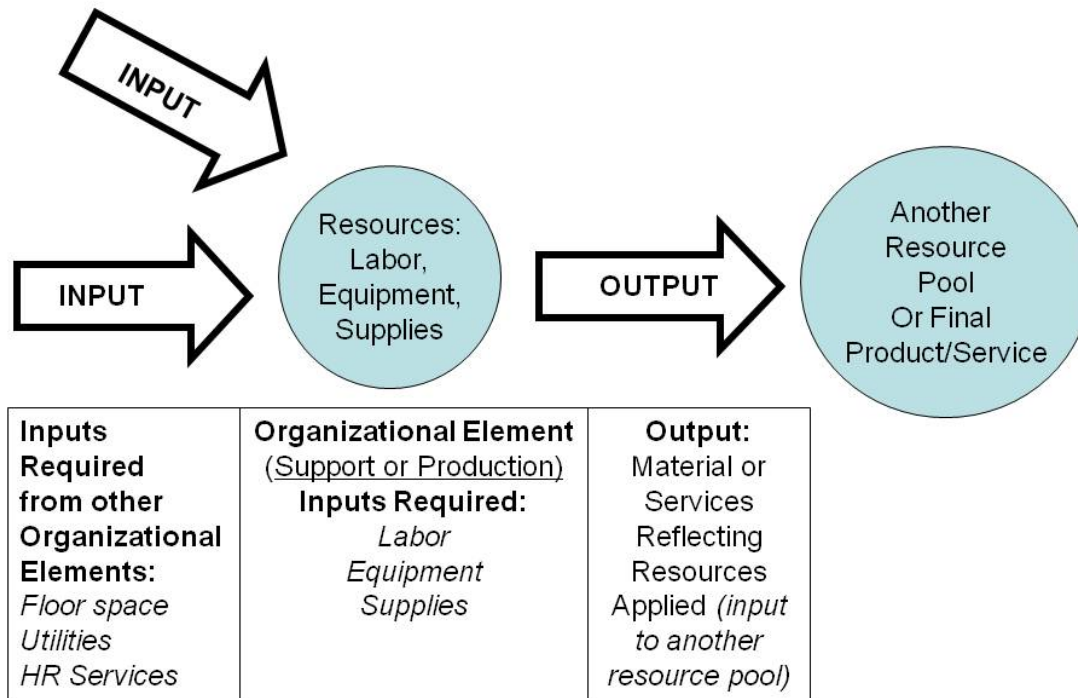
When managers are provided with (1) a clear picture of current resource application, (2) a mechanism for assessing proposed changes in resource application, and (3) the marginal/incremental costs of the actions being considered, they are equipped to properly evaluate the alternatives for achieving stated objectives.

The scope of managerial costing includes providing managers with clear marginal/incremental insights into the resource application alternatives they are considering.

D. Model quantitative cause and effect linkages between outputs and the inputs required to produce and deliver final outputs.

One key to effective decision making is the ability to make two kinds of causal linkages. The first link is from a cause to its effect, such as a drop in sales (the cause) that results in excess/idle capacity (the effect). The second link is from an effect to its cause, such as an unprofitable product (the effect) caused by significant reworks (the cause). Effective managerial costing models must make these kinds of links visible, reflecting the use of resources as they are consumed by the series of input and output relationships as shown in figure 1 that continues along the value chain that lead to final outputs. Depending on a particular organization's decision support needs, the managerial costing model is often required to provide a fairly deep level of cause and effect insight.

Figure 1: Input Output Relationships of Resources



When weak cause and effect linkages exist, associated costs must be modeled in a manner that best reflects the economic impact of related resources for the appropriate segment level in the organization. For example, the excess/idle capacity for a machine dedicated to a particular product must be assigned to that product's gross margin.

The scope of managerial costing entails an accurate reflection of an organization's cause and effect relationships.

E. Accurately values all operations (support and production) of an organization (that is, the supply and consumption of resources) in monetary terms.

The unique quality that managerial costing brings to a nonfinancial model of an organization's operations is the application of monetary estimates to represent the combination of resource quantities that eventually create final outputs. This application of monetary value and the subsequent analysis must not distort the representation of the resources and processes used throughout the organization.

The dependency between resource consumption and costs means that managerial costing begins with an accurate reflection of the nonfinancial quantitative flows of resources.

The scope of managerial costing entails the accurate valuation of all quantitative cause and effect relationships.

F. Provide information that aids in immediate and future economic decision making for optimization, growth, and/or attainment of enterprise strategic objectives.

Managerial costing models must support economic decision making in the present and future. Models must facilitate the accurate determination of avoidable and unavoidable costs and support the calculation of opportunity costs for a range of decision scenarios.

The scope of managerial costing includes consideration of the types of decisions and the strategic objectives of a particular organization.

G. Provide information to evaluate performance and learn from results.

Managerial costing provides feedback on the use of resources and the effectiveness of processes. Managerial costing information can be used for accountability and learning by providing not only results but insight into the causes of those results.

The scope of managerial costing includes providing historical information for evaluation, learning, and identifying corrective actions.

H. Provide the basis and baseline factors for exploratory and predictive managerial activities.

Managerial costing includes using its cost models to project and plan supplementing of historical results and existing resource capabilities for making comparisons and projections. When used for planning and forecasting, a managerial costing model is adapted to allow users to explore cause and effect relationships resulting from new or changed processes and from the resource application alternatives being considered.

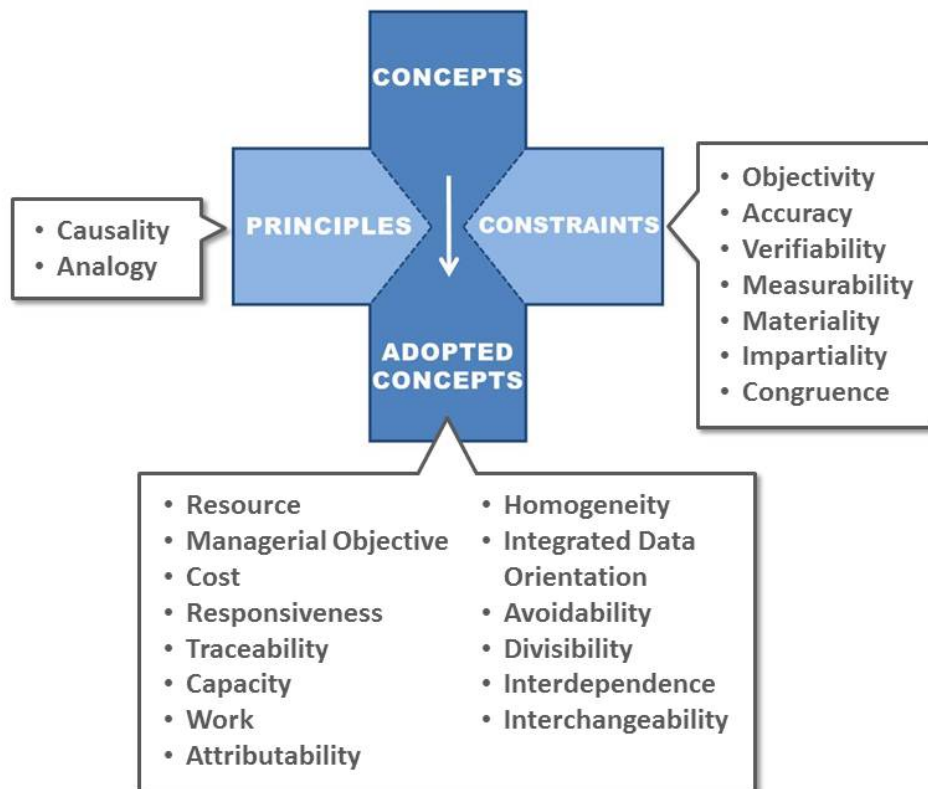
The scope of managerial costing involves model manipulation to support simulation, forecasting, and planning.

Scope of Managerial Costing

A. Provide managers and employees with an accurate, objective cost model of the organization and cost information that reflects the use of the organization's resources.
B. Present decision-support information in a flexible manner that caters to the timeline for insights needed by internal decision makers.
C. Provide decision makers insight into the marginal/incremental aspects of the alternatives they are considering.
D. Model quantitative cause and effect linkages between outputs and the inputs required to produce and deliver final outputs.
E. Accurately values all operations (support and production) of an organization (i.e. the supply and consumption of resources) in monetary terms.
F. Provides information that aids in immediate and future economic decision making for optimization, growth, and/or attainment of enterprise strategic objectives.
G. Provides information to evaluate performance and learn from results
H. Provides the basis and baseline factors for exploratory and predictive managerial activities

Conceptual Framework for Managerial Costing

Section III: The Characteristics of Managerial Costing



A Framework for the Qualitative Characteristics of Managerial Costing

The literature of managerial costing over the last century includes a number of articles and a few books that have been labeled as frameworks. For example, the Management and Accounting Web (www.MAAW.info) has a category titled “Framework for Management Accounting,” but the subject matter is extremely broad. This framework is unique because its focus is neither cost accounting nor management accounting. Cost accounting-oriented frameworks, at least those since the 1930s, are inevitably constrained by cost accounting’s contribution to external financial reporting, where it is viewed as a servant of financial accounting and reporting (Example: George Staubus, *Activity Costing and Input-Output Accounting*, Irwin Publishing, 1971). Frameworks focusing on management accounting also tend to retain financial accounting and reporting as a key customer of cost accounting, but they also bring in decision making, organizational, and behavioral theories to shore up the management focus. (Examples: A. R. Belkaoui, *Conceptual Foundations of Management Accounting*, Addison-Wesley Publishing, 1980, and *The New Foundations of Management Accounting*, Quorum Books, 1992. McNair, C. J. 1993. Form Over Function: Toward an Architecture of Costs. *Advances In Management Accounting* (2): 1-26.)

None of these efforts were successful in terms of achieving wide acceptance as a management accounting framework. Nevertheless, these historical structures were examined for insights into creating and structuring the current framework. These prior attempts were not focused solely on the two critical elements that underlie the current framework: (1) creating internal management information for managers and employees based on two unique managerial costing principles (that is, the principle of causality and the principle of analogy), and (2) incorporating these principles into a conceptual framework. These principles will be discussed in detail in Section III.A.

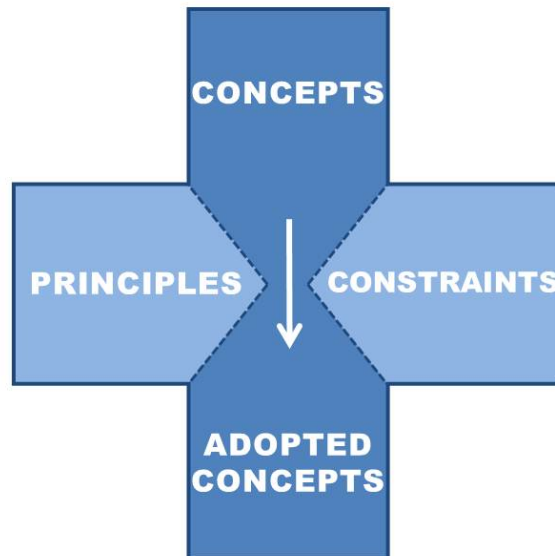
The framework presented here is focused, as defined in the Introduction, squarely on building a model of the organization to support managerial decision making without any compromises to other uses of cost information. To achieve this result in a structured manner, much has been drawn from the work of Professor Gordon Shilling law, particularly the article, “Cost Accounting Principles for External Reporting: A Conceptual Framework,” which appeared in 1979 in *Essays to William A. Paton: Pioneer Accounting Theorist*. The Shilling law framework proved to be a particularly useful baseline to demonstrate the integration of causality and analogy into the existing body of management accounting knowledge. While Shilling law’s framework was intended to guide the selection of measurement principles for establishing a management accounting system with a focus on cost accounting for external reporting, he made wide use of decision support applications in his framework discussion. Shilling law’s approach and the basic building blocks of his framework facilitated the current pursuit of integrating causality and analogy into a management accounting framework focused purely on internal management needs. The essential building blocks for a managerial

costing framework drawn from Shilling law's framework comprise the following three elements.¹

- **Principles** are the gatekeepers of the framework. As principles, causality and analogy wield their influence over the framework as criteria, by defining the underlying purpose of the framework as: (1) cause and effect operational modeling, and (2) the consistent application of the resultant information in managers' inferences. Causality and analogy serve as the litmus test for incorporating concepts into the managerial costing system. Since they embody the purposes of the system, they also serve to guard and preserve those purposes once the system is operational.
- **Concepts** are defined by Shilling law as understood abstractions of a class of relationships, a trait, or a characteristic (1979, 159). The framework presented here uses concepts in the same way. They constitute relationships, traits, or characteristics that need to exist for effective cost measurement, modeling, and use of the information. Examples of concepts include cost, capacity, and managerial objective. In the discussion that follows, concepts are divided into two groups: (1) those related to the principle of causality (or model construction), and (2) those related to the principle of analogy (or information use).
- **Constraints** function as filters in selecting concepts and also provide boundaries for the application of the selected concepts. They contribute to the system of checks and balances in the overall framework. Examples of constraints include objectivity, accuracy, and materiality.
- These three elements and their values are graphically depicted in Figure 3.

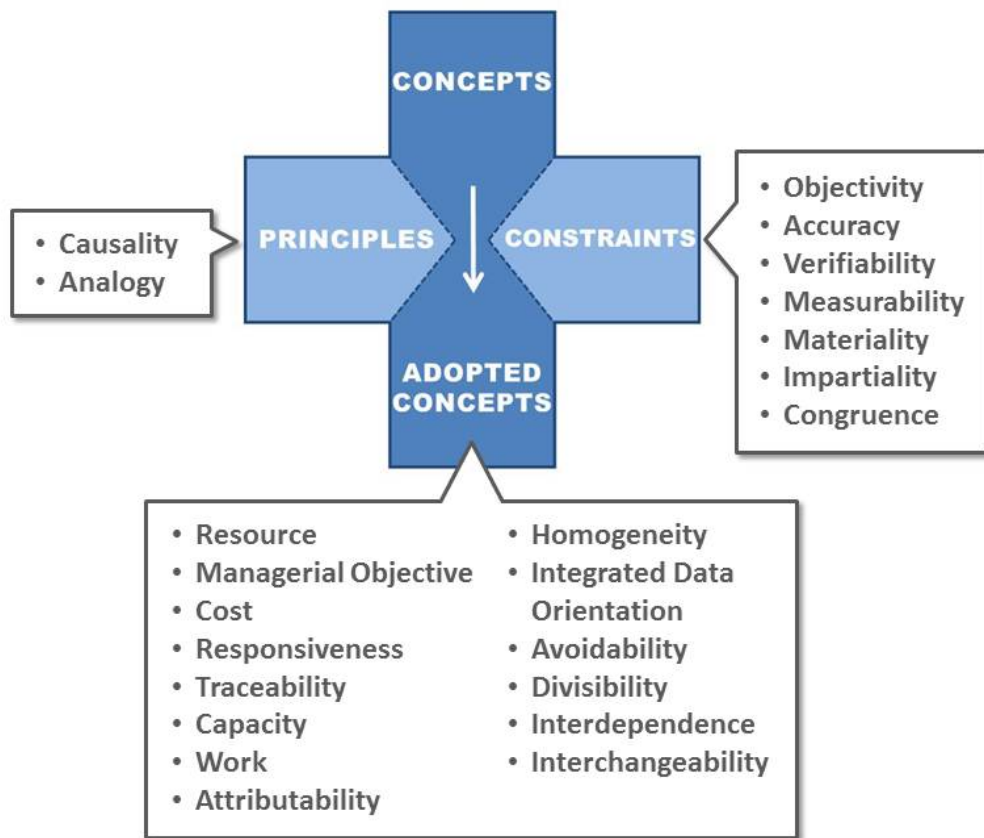
¹ Shilling law's framework suggested six groups of elements progressing from relevant concepts to principles and then on to standards and methods. Only the three primary groups of elements essential to selecting principles is used here because codification and standard-setting lie outside of scope.

Figure 3: The Application of Principles, Constraints, and Concepts



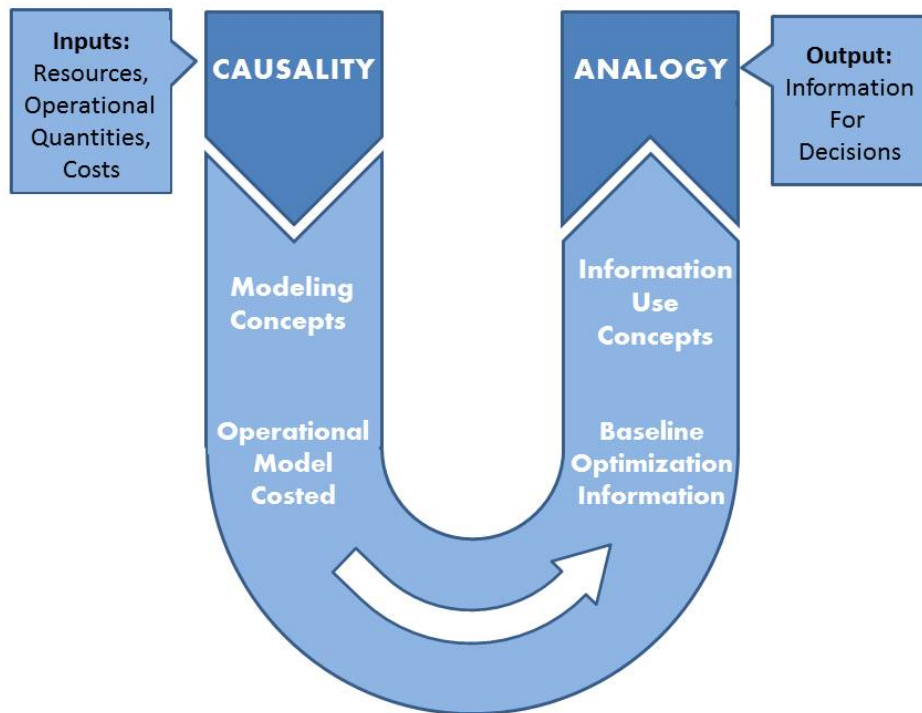
This framework provides a principles-based approach to defining and evaluating an organization's cost model. Not every organization will come to the same implementation solution. As discussed in the Introduction, the nature and complexity of an organization's business will drive different needs for effective internal decision support from its cost model. A thorough understanding of the framework and its principles, concepts, and constraints will enhance an organization's insight into its options for designing, developing, and using internal management information to enable achievement of its strategic objectives in an optimal manner.

The integration of causality and analogy and the expansion of the framework into a full-blown managerial costing framework are discussed in the next three subsections of the framework.



Conceptual Framework for Managerial Costing

Section III.A: Principles for Managerial Costing



First Principle: Causality

Principles can be thought of as innate laws for which proof is not necessary because they are self-evident. Causality, the recognition of the relation between a cause and its effect, is such a principle. Causality is the basis for all inferences in the scientific method. It is appropriate, and in fact essential, to apply causality to managerial costing, and as a principle it is the basis for discerning truth in cost modeling and its decision-support information.

The term “truth” is not used here in terms of achieving an absolutely precise numerical answer. It is instead a direction that guides one toward better, more correct information. Without a definition of truth for managerial costing, all assumptions and any outcomes are valid. The consequence of not pursuing truth is the creation of misleading decision-support information that does not reflect reality accurately. Defining truth provides a benchmark against which one can measure the quality of a model and its assumptions. Truth in cost modeling means reflecting the reality of the operations being modeled. The field of philosophy has many theories of truth. For managerial costing applications, the Correspondence Theory of Truth is most applicable. A simple definition is: “A statement or opinion is true if what it corresponds to is a fact.” (For a more comprehensive explanation of how truth serves as the foundation for managerial costing principles, see the Appendix.)

A cost model must reflect the operations; its elements should correspond to real-world operations. The truth requirement in managerial costing is simply that a cost model must correspond to the operational facts into which it strives to provide management insights. Models are more correct and assumptions are more valid the closer they are to the observable reality, or truth. For example, suppose an organization uses a bottling machine with the capacity to produce 5,000 bottles per hour. Any corresponding cost model should reflect that capability.

The Roles of Money and Resource Quantities

The accounting profession has historically used causality exclusively in the context of value (that is, as a characteristic of cost). Such a monetary view assumes a direct causal link between an output and its costs. Defining causality this way would be adequate if cost information was limited to cost accounting for external reporting.

When managerial costing is used for analysis and decisions to optimize an enterprise’s performance, however, this monetary view falls short because it lacks insight into the more foundational data—the quantities of an organization’s resources. For example, the number of people, number of units of production/output, quantity of scrap, and so on provide understandable and tangible measures of resources and their application. Money can be thought of as a proxy for these underlying quantitative realities. Money is not the lever that results in actual changes on the ground; it is the manager’s ability to understand and adjust the acquisition, use, and consumption of resources that affect change. That is, a monetary view alone provides inadequate insight

into the real facts—the resources, business processes, and goods and services to be affected by decisions and actions.

Money, nevertheless, plays an important role in characterizing diverse economic resources' acquisition, consumption, and trading as a common denominator. You cannot hold a cost cupped in your hands—it is not tangible. Similar to an imaging system on a radar or sonar screen, the monetary view in accounting reflects something else; costs are merely the “imaging” of economic resources and can be thought of as the *meta-language* of these quantitative economic entities. Managers will be most effective when their decision-support information provides them with insight directly into the real thing—the quantities of resources and goods and services they are attempting to optimize. Therefore, for optimization purposes and to effectively manage an enterprise, quantitative information about resources and their consumption form the basis for managerial costing's monetary information.

This quantitative view of causality casts a different light on the traditional view of management accounting as primarily a financial costing method (that is, concerned with allocating expenses collected in the general ledger to cost object buckets, such as a product's cost). Instead of a primary focus on parsing the general ledger's monetary units (e.g., dollars, euros) into operational metrics, quantity-based causality means managerial costing's backbone is an operational model comprised of outputs and their required input (resource) quantities. This allows the managerial costing model to directly connect to the quantitative data of the logistics/operations systems. Operational quantities and their costs—available from source documents (e.g., a goods receipt)—are therefore kept closely coupled throughout an organization's internal value chain.

Defining Causality for Managerial Costing

To support managers' pursuit of optimal resource usage, managerial costing is first and foremost concerned with the quantitative representation of resources, goods, and services. With this objective and the Correspondence Theory of Truth in mind, the definition of causality in management costing is formulated as:

Causality: *The relation between a managerial objective's quantitative output and the input quantities consumed if the output is to be achieved.*²

To distinguish this definition from other definitions, it will be referred to as “the correspondence definition of causality.” As an example of how the correspondence definition of causality is applied, consider a jet airplane flight simulator's electricity consumption that is measured and determined to be 200 kilowatts of electricity for every hour of operation. Management's objective is to sell 250 simulator training hours per month. Based on that objective, the causal relationship is therefore defined as: Output = 250 simulator hours, Quantity of Electric Power Input Required = 50,000 (250x200) kilowatt-hours. Note: At this point, the quantitative causal relationship has been defined without any consideration of costs.

² Adapted from Shilling law, G. 1979, 162.

The following two primary issues arise in applying the principle of causality as defined for managerial costing:

1. The strength of causal relationships can vary from strong to weak. Both types of relationships must be modeled in a manner that supports managerial insight and decision making in order to aid achieving the organization's strategic objectives in an optimal manner.
2. The collection of operational and financial data to provide a monetary view of the causal relationships is required.

Strong and Weak Forms of Causality

An accurate model of enterprise economic activity is only possible if the causality principle is consistently satisfied in quantitative modeling. The proper modeling of causality in managerial costing necessitates a distinction between the strong and weak forms of applying the principle.

Strong Form of Causality: The strong form refers to instances where a consumption relationship can be explicitly quantified. That is, a *requisite dependency* exists between an output (e.g., 250 simulator hours) and an input (that is, 50,000 kilowatt-hours (kWh) required to run the simulator for 250 hours).

Weak Form of Causality: The weak form exists when the input–output relationship cannot be quantified in this manner but an association nevertheless clearly exists. 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 for 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 with the introduction of product C, there is no effect on the units of products A and B produced or the machine hours they consume (that is, the causal relationship). With the weak form of causality there is not a requisite dependency between the output (units of products A and B produced) and an apparent input (the machine's excess/idle hours). Nevertheless, an association exists in these instances that is important to enterprise optimization (that is, in a decision to discontinue the product group, the machine's excess/idle capacity cost is clearly an avoidable cost).

The proper treatment of the principle of causality—in both its strong and weak forms—is important to enterprise optimization and managers' analogous needs. Section III.B of this framework will introduce concepts for achieving the proper treatment of the two forms of causality.

Creating an Effective Monetary View

It is essential that quantitative resource data clearly support any representation of cause and effect relationships that is made in monetary terms.

Managerial costing must provide a monetary view of economic activity, which implies a duality of information. Money serves as a common denominator to weigh and evaluate otherwise incomparable alternatives in decision analysis. Its use in optimization is essential. Managers' information needs are therefore of a dual nature: (1) a quantitative (non-monetary) representation of relevant cause and effect relationships, and (2) the valuation (monetary representation) of those relationships. For example, assume that electricity costs \$0.10/kWh for the simulator training company. This would mean the strong causal relationship defined above can be expanded to reflect both a monetary and a non-monetary view; for example, Output = 250 simulator hours; Electrical Input = 200 kWh/simulator hours; Total Electrical Inputs = 50,000 kWh; and Input Costs = \$5,000.

The concept of Integrated Data Orientation explained in Section III.B. defines how this integration of monetary and operational data is achieved in practice.

Enhanced Cost Modeling

The correspondence definition of causality and its practical application lead to the following advantages for cost modeling:

- Information usefulness is significantly enhanced as managers gain insight directly into the resource quantities they strive to influence/adjust.
- In producing cost information, cost models can be separated from financial accounting's reporting structures and conventions defined for compliance with regulatory agencies.
- Basing the cost model on operational structures and data reduces the administrative effort of collecting and maintaining cost information, since normal operational data maintenance activities double as cost model maintenance.
- An improved approach to modeling weak causal relationships becomes obvious.

Applying the correspondence definition of causality also eliminates a criticism of causality as purely historically oriented (that is, descriptive) and not suitable for forward-looking optimization decisions and actions (that is, predictive). Quantity-based causality supports both. The descriptive view reports what happened, while the predictive view applies the quantity-based method and reflects current resource capability—the very resources management is tasked to use and adjust in order to achieve enterprise strategic objectives in an optimal manner.

In the quest for principles to anchor managerial costing to a bedrock of truth, the principle of causality is key. As defined, causality embodies the Correspondence Theory of Truth and, as such, serves as the starting point to transform managerial costing into a customer-focused (that is, manager-focused) and enterprise optimization-centric discipline.

Second Principle: Analogy

The second principle for managerial costing is analogy. Analogy applies when insights are used and inferences are made about known cause and effect relationships. The simulator example can be used to illustrate the application of this principle. The

causal relationship is known (that is, the simulator consumes 200 kW per training hour). A manager—applying the principle of analogy—can infer that electricity consumption was 200 kWh/hour a month ago and will also be that amount in the future. Thus, a manager uses known cause and effect insights to make inferences (that is, analogous application of the information) about past or future outcomes.

Analogy: *The use of causal insights to infer past or future causes or effects.*

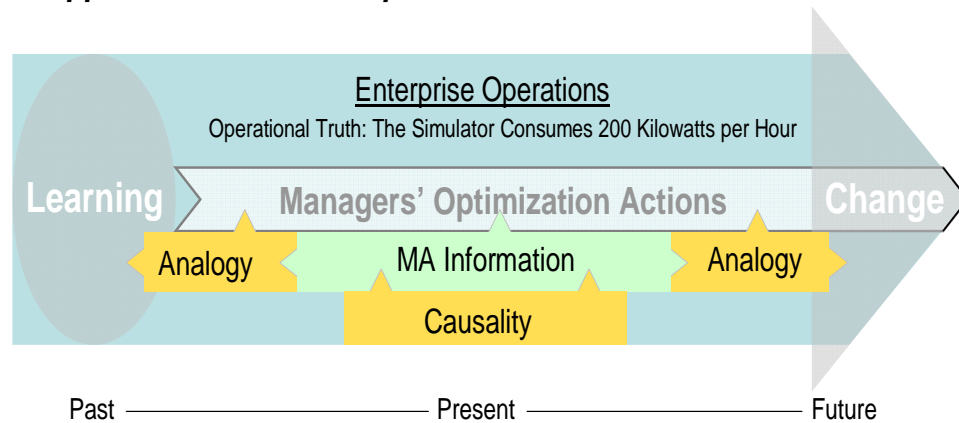
Analogy serves as a principle for managerial costing because it:

1. Governs the way in which cost information is used
2. Lies at the center of enterprise optimization
3. Is inherent in all (rational) managerial actions
4. Is indispensable for organizational learning
5. Unequivocally focuses managerial costing on its primary users—managers

The two principles for managerial costing therefore apply as follows: (1) causality deals with understanding and capturing enterprise quantitative cause and effect relationships, and (2) analogy is concerned with applying causal information in optimization actions. In using managerial costing information, the principle of analogy finds application in two ways, as illustrated in Figure 4:

- First, by using the relationships embedded in the cost model to reflect recurring events (e.g., operating the simulator for 200 hours in the last measurement period). This is useful for understanding and analyzing financial results, for performance measurement, and control. Most importantly, analogy forms the basis for organizational learning when financial results can be logically and efficiently traced to operational causes.
- Second, when using causal insights to infer outcomes of potential future events (e.g., the avoidable costs when considering replacing the current simulator with a new one). Predictive managerial activities that support change and improvement such as planning, simulation, what-if analysis, and evaluating decision alternatives comprise such forward-looking inferences governed by the principle of analogy.

Figure 4: The Application of the Principles



In business, the use of analogy goes beyond its application in using managerial cost information. In fact, its use is pervasive to enterprise optimization in general because it applies even if managers base their decisions on cause and effect relations not considered by cost models. For example, when a manager's primary consideration in making a product continuation decision is the fact that the last time a complementary product was discontinued the company lost an important customer, the manager is projecting a known cause and effect relationship. The principle of analogy fundamentally underlies nearly all managerial decisions and actions and is the basis upon which valuable business experience is developed. A cost model built on cause and effect relationships facilitates learning and decision making by providing clear, logical insights into the operational and financial relationships of an organization for all managers. Such a model can substantially shorten the experiential learning curve.

Analogy is most important in its strategic application because this is where direction setting from the executive team occurs. In this regard, the *aim* of an optimization action must be distinguished from the action's *outcome*. Aim refers to a managerial action's strategic intent—in particular, whether it changes strategy (that is, an adaptive action) or whether it reinforces the current strategy (that is, a corrective action). See Part IV.A for further discussion on the role of analogy in managerial cost model design.

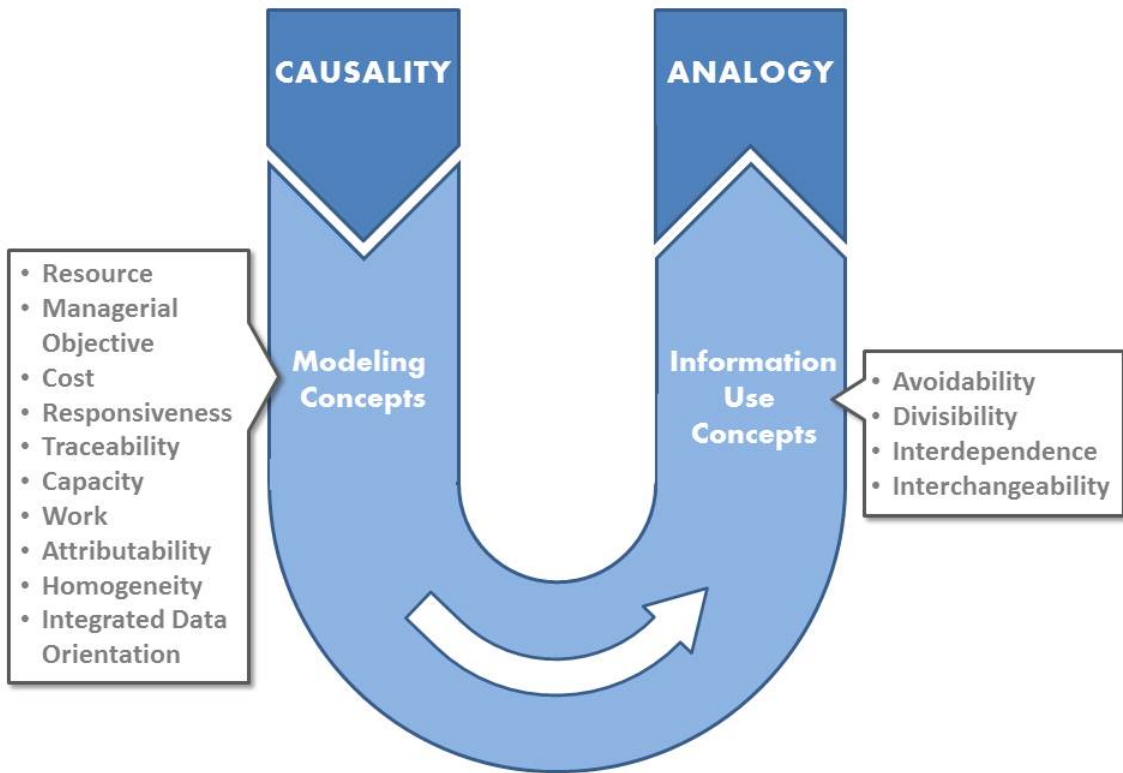
Conclusion

The principles of causality and analogy are not unique to managerial costing. A strong argument could be made that they are fundamental principles for many professional disciplines. For example, they govern the scientific method. They must, however, be emphasized for managerial costing. The core of organizational success is understanding customer needs and designing and executing productive operations that meet those needs. Managerial costing applies causality and analogy as a bridge to model and apply monetary measurements to operations. The framework presented here does not address the essential issue of understanding customer needs, but it does assume a thorough understanding of the operations modeled and measured.

Once a manager understands an operation, cost information compiled based on the principles of causality and analogy will provide a truthful representation of the operation in monetary terms—in order to assist decision making. The concepts in the next section define the elements needed to build an effective cost model based on a thorough understanding of operations.

Conceptual Framework for Managerial Costing

Section III.B: Concepts for Managerial Costing



Concepts for Managerial Costing

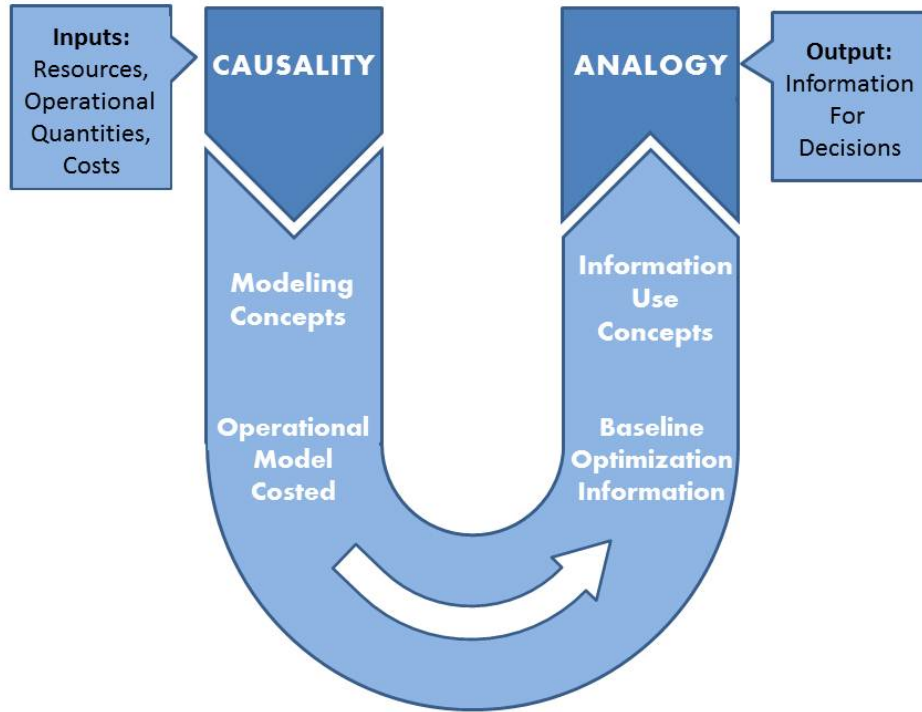
The concepts for managerial costing are framed by two fundamental and connected views: (1) the measurement and capture of an organization's resources and costs referred to as "modeling," and (2) the use of that information for decision making. Figure 5 illustrates the relationship between these views with a "U" shape and their common ground—the generation of information for business optimization decisions.

The objective of the cost modeling view is to provide measurements and calculations (including rates) that reflect the consumption of the organization's resources in support, administrative, and product- or service-producing operations. Resources include the labor, equipment, supplies, materials, external services, and so on that are acquired by an organization in order to pursue its objectives. The importance of building a highly effective model is that it forms the baseline information for a large variety of internal management activities, such as planning and improving and evaluating performance. *Causality* is the principle that governs constructing MA's operational model and the information the model provides. The result from calculating monetary values for the model's consumption relationships is *attributable cost*,³ formally defined as costs of an output that can be eliminated in time if that output were discontinued and resource consumption and/or provision were reduced accordingly; it is as close as one can get to full cost while adhering to the principle of causality.

The intent of the information use view is to provide a basis for how decision makers (that is, at any level—managers, supervisors, or employees) should apply the results of the cost model in order to gain insights and make inferences in order to make decisions and take action. Decision makers apply insights gained from the model's information to infer the use of existing resources for new purposes or new resources for existing purposes (that is, in an analogous manner). *Analogy* is, therefore, the principle that users of the information adhere to in applying the model information in analysis, in making cause and effect inferences (that is, managers' analogous activities), in selecting an optimal decision alternative, and taking adaptive and corrective actions.

³ Shilling law, G. "The Concept of Attributable Cost." *Journal of Accounting Research*. 1963:73–85.

Figure 5: The Cost Modeling and Information Use Views

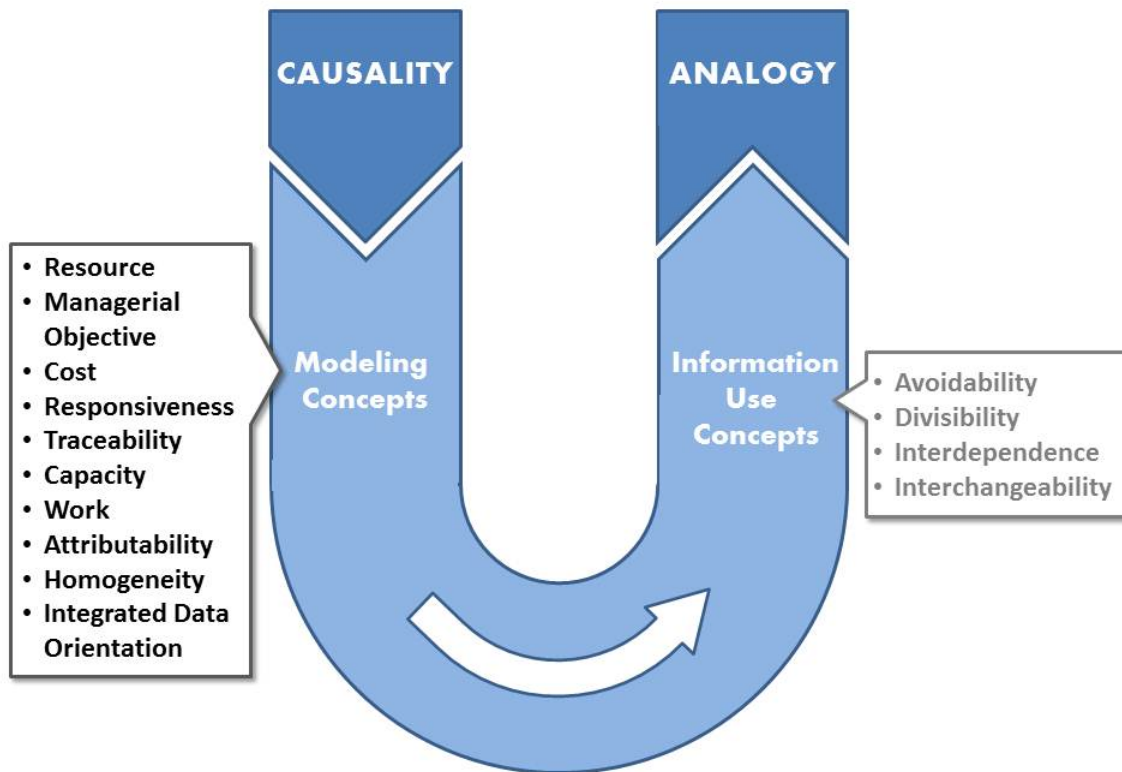


The concepts related to cost and operational modeling are discussed before introducing the concepts relevant to the principle of analogy and the use of information generated by the model.

Modeling Concepts

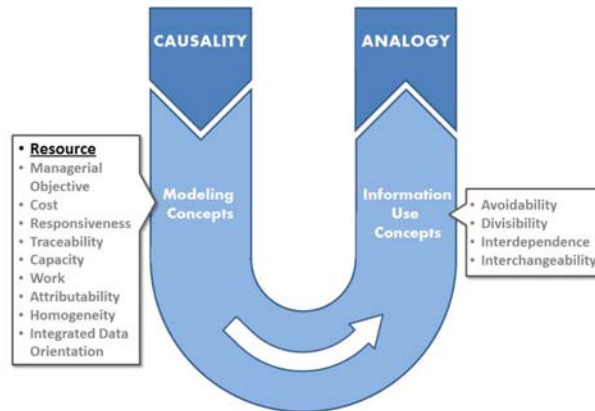
The concepts related to constructing MA's operational and cost model are the focus of Figure 6.

Figure 6: Modeling Concepts



Overview of Modeling Concepts

These concepts serve as the building blocks for a reflective, cause and effect-based model of an organization's operations. They cover (1) the entities that make up an enterprise's operational model (that is, resources and managerial objectives); (2) characteristics of those entities (that is, homogeneity, capacity, work, traceability, and cost); (3) the relationships between the entities in the model (that is, responsiveness and attributability); and (4) the relationships between the data needed for the model (that is, integrated data orientation).

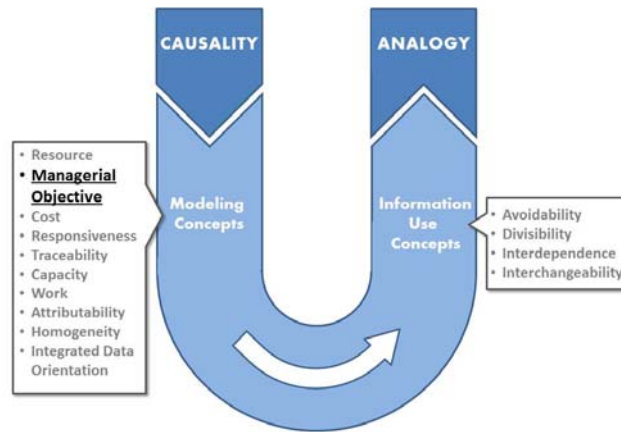


Resource: A definitive component of an enterprise acquired to generate future benefits.

The framework requires the inclusion of the resource concept for at least four reasons:

1. Resources are the source of all costs and demand explicit modeling.
2. Resources are the entities that have productive capacity.
3. Resources are the quantitative entities decision makers must adjust or influence to effect change.
4. Resources are the final determinant in any optimization activity of the magnitude of incremental gain and are the basic building blocks in optimization (refer to the discussion on page 63 on the concept of divisibility).

This definition of a resource is intentionally broad and includes people, machines, information technology, raw materials, and cash as well as resources developed internally (e.g., a hospital's billing software developed in-house).



Managerial Objective: *A specific result or outcome of the application or provision of resources that management chooses to monitor for the purpose of enabling one or more managerial activities.*

The framework requires the inclusion of managerial objective because:

1. Achieving managerial objectives is the reason for employing resources to produce output.
2. Establishing and managing discrete managerial objectives is necessary in order to achieve an enterprise’s strategic objectives.
3. Managerial objectives align with managers’ responsibilities, the need for measurement, accountability, and ultimately incentives (e.g., bonuses).

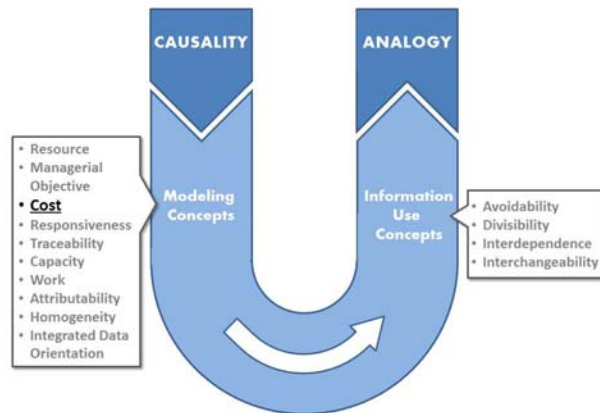
Managerial objectives can be the final outputs of an organization or any intermediate outputs. They can serve any measurement, analytical, or predictive purposes for whatever timeframe managers deem appropriate. Examples of managerial objectives include production activities and support activities provided by the enterprise’s resources (and consumed internally), activities of external or contracted services, saleable products and services, target markets and market segments, and projects to build or acquire resources and infrastructure.

Managerial objectives consume resources, and most contribute to another downstream or higher-level managerial objective. For example, providing machine maintenance is a managerial objective of a Plant Maintenance Team. The output from this objective is consumed in part by Production Line 101, for which the managerial objective is the production of a component of a saleable product. The managerial objective for the saleable product is a defined level of market penetration and profitability in specified market segments and target markets.

An accurate reflection of consumption relationships—characterized in nonfinancial and financial terms—between managerial objectives is important for four reasons:

1. To comply with the principle of causality
2. To provide cause and effect insights for analysis and decision support

3. To accumulate all of an objective's attributable costs, which serve as the baseline for determining the relevant costs for a particular decision
4. To ensure all resources consumed in achieving a managerial objective can be identified for decision making and optimization



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

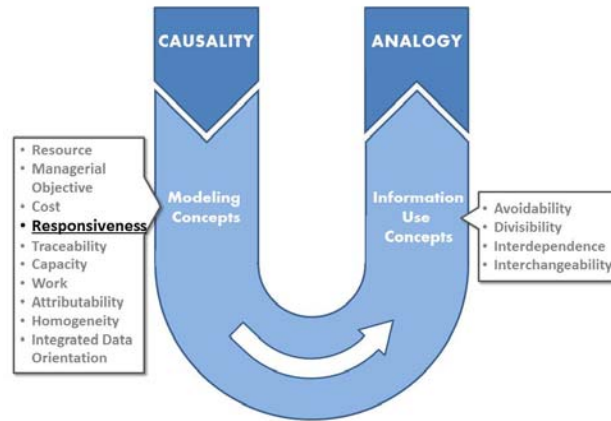
Cost is included in the framework because:

1. Determining the cost of resource use and managerial objectives is the purpose of managerial costing.
2. It presents resource consumption in a general monetary form that allows comparability between diverse alternatives.

In line with the quantitative understanding of causality (Page 26), the traditional view of cost as a direct relation between money and a cost objective's output must be redefined because it does not support the creation of quantitative causal relationships. The cost associated with a managerial objective results from the relation between its output (production man-hours, production machine hours, product, and so on) and the inputs (labor, equipment, raw material, operating budget, floor space, utilities, and so on) required to produce the objective's output.

In the framework, the definition of cost portrays the understanding that the flow of money in a managerial costing model merely reflects the underlying operational consumption of goods and services; money is only the meta-language of economic activity and not the activity itself. Thus, the cost of an input is assigned to a managerial objective because that input quantity is required to achieve the objective in the first place. The definition reflects a consumption viewpoint—money reflects resource consumption. In a consumption view, money is not allocated or assigned in the absence of a causal quantitatively defined consumption relationship.

The definition of cost includes the costs of wasted or inactive resources, that is, resource capacity available for the achievement of managerial objectives but not used. From an optimization perspective, excess/idle capacity always has a cost impact—at the very least, an opportunity cost.



Responsiveness: *The correlation between a particular managerial objective's output quantity and the input quantities required to produce that output.*

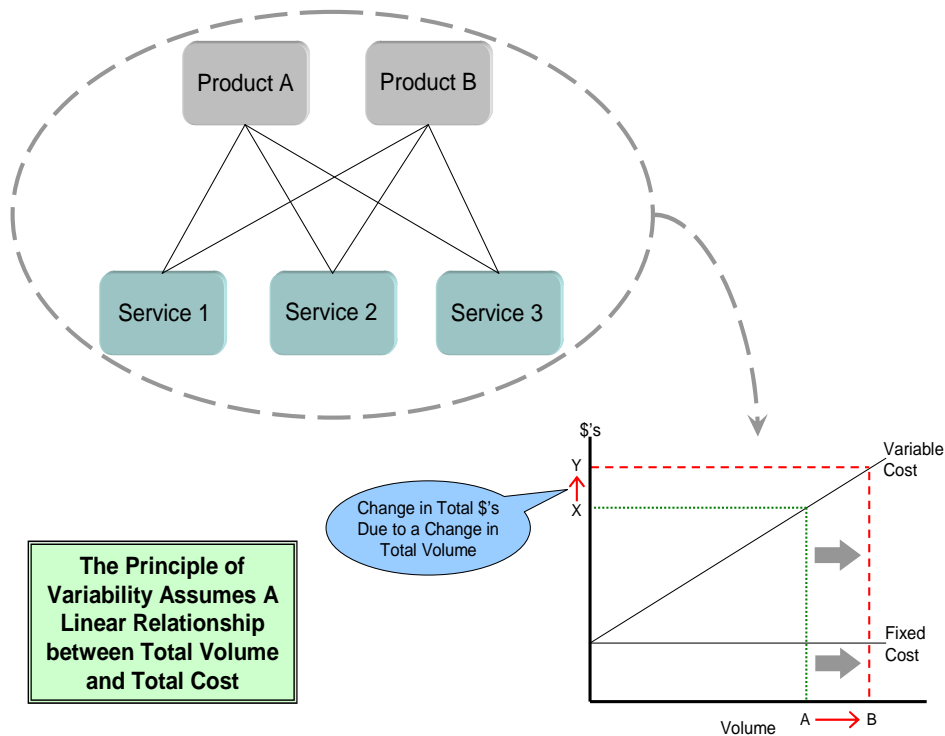
Responsiveness is included in the framework because:

1. It facilitates accurate marginal cost information.
2. It provides insights into the nature of cause and effect relationships.
3. It enables the costing of managerial objectives at all levels throughout the organization.

Responsiveness and Variability

Responsiveness replaces the conventional concept of variability. Variability is defined in terms of the relation between total volume and total cost (Shilling law, 1979, 162). "Variability" implies a linear relationship between total final product output for a company and its total cost. As illustrated in Figure 7, variability assumes that a change in total output from point A to point B will always result in a change in total cost from point X to point Y or vice versa.

Figure 7: The Relation Between Total Cost and Total Volume—Variability



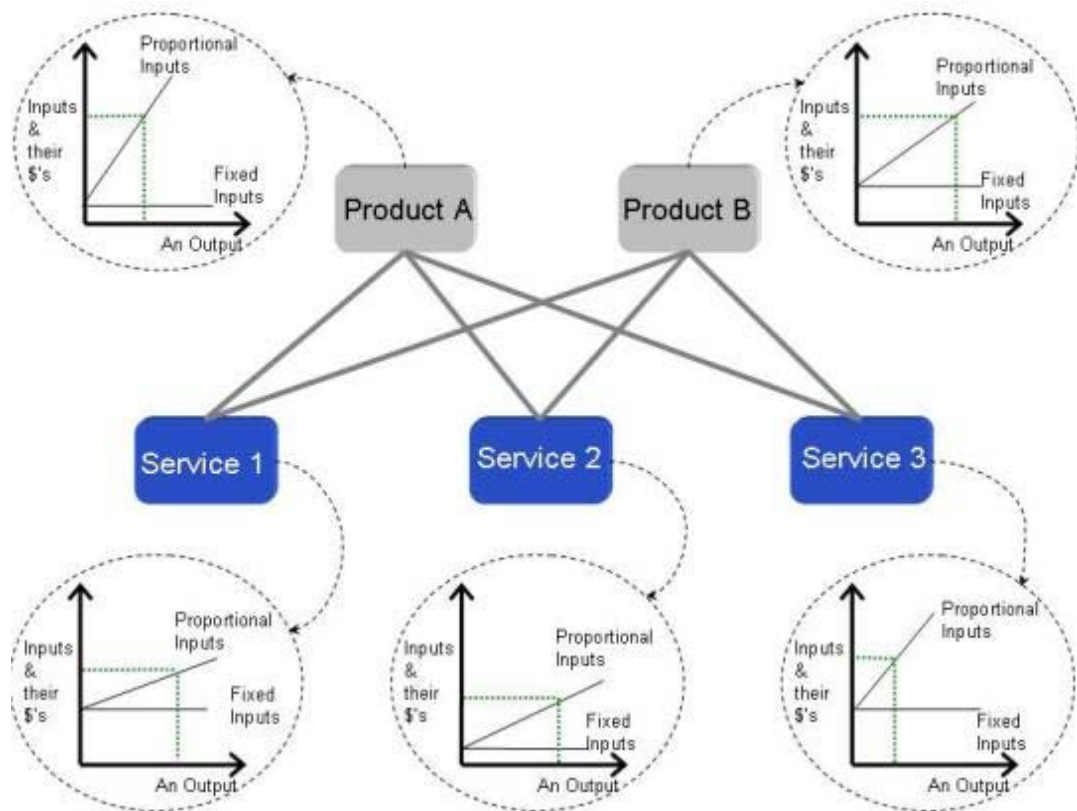
However, toward the latter part of the 20th Century the emergence of multipurpose production facilities and an increase in product customization led to complexity in business and resulted in increased indirect and shared costs. This has unmasked the concept of variability as an overly simplistic view of consumption and cost behavior. For example, when producing fewer, relatively more complex products, total output volume will decrease but can still result in higher total cost due to an increased number of more specialized direct and indirect activities needed to produce these complex products. Additionally, variability’s focus on final output provides little insight into the consumption and cost relationships between resources that interact in a process. Because causality is concerned with the relationship between a specific output and the inputs required to produce it, causality demands more specificity in cause and effect expressions than variability’s aggregate level assumption is able to provide. The concept of variability is therefore replaced by the more robust concept of responsiveness.

Responsiveness reflects the nature of quantitative consumption at the individual managerial objective levels (that is, for each managerial objective the consumption relationships of inputs are defined in relation to the objective’s output). An example is electricity. It can be consumed proportionally in any quantity. However, when electricity becomes an input to a building which provides the output of space (square or cubic feet), the electricity associated with heating or cooling and lighting the space acquires a fixed consumption relationship with the output of space. Electricity consumed by an operating machine would remain proportional to the output of machine hours since that consumption would stop or diminish substantially (in most cases) when the machine was idle.

Modeling Responsiveness

Consistent with the framework's objective of providing managers with cause and effect insights and enabling related inferences, responsiveness is not concerned with the relationship between total volume and total cost as in Figure 7—at least not directly. Instead, it focuses on reflecting the nature of cause and effect relationships at the point within a process where managers must influence the behavior and consumption of resources as shown in Figure 8.

Figure 8: The Relation Between Resources and Output –Responsiveness



Causal relationships can be static, dynamic, or a combination of both in relation to output. These responsiveness characteristics are defined as follows:

- A *fixed responsiveness relationship* indicates that an input will be consumed regardless of changes in the level of output of the consuming managerial objective. Typical examples of a fixed relationship are regular preventative maintenance hours for a flight simulator, the supervisor of the simulator operators, and the floor space for the simulator.
- A *proportional responsiveness relationship* indicates that demand for an input will change as the consuming objectives' output level changes—typically in a linear manner. Examples of proportional responsiveness relationships are the electricity (kWh) the simulator consumes during operation and the simulator operators' hours.

In contrast to the concept of variability, responsiveness does not concern itself primarily with cost behavior—responsiveness deals only with the consumption of input

quantities. This is consistent with the quantitative definition of causality and with the recognition that value (money) is the meta-language of economic activity (that is, money merely inherits the behavioral characteristic of its associated input quantity). For example, a flight simulator with an output of 250 hours consumes 50,000 kWh of electricity proportionate to output. The associated electricity cost of \$5,000 (assume \$0.10 per kWh) is classified as a proportional cost for the simulator. Conversely, the cost of an input quantity consumed in a fixed manner, such as regular preventative maintenance, results in a fixed cost.

Note that the cumulative effect of responsiveness overcomes the flaw identified with variability (that is, responsiveness is able to reflect an *inverse* relationship between total volume and total cost). To illustrate, consider a situation in which fewer, more complex products are manufactured in a larger number of smaller batches, resulting in higher total costs due to the increased number of batches and inspections along with additional planning and scheduling costs. Since responsiveness defines more specific causal relationships for each of these work areas, higher inputs and costs (e.g., overtime) will be reflected in line with each work area's higher output levels even though total product volume will be less.⁴ (*Please note this paragraph defines a specific example and is not a general statement on the merits of small versus large batch production.*)

Understanding the differences between the concepts of proportional cost—*as used in this framework*—and traditional variable cost is important. Due to variability's aggregate assumption—it functions at the total cost level—some circumspection is therefore required when attempting to compare the two cost concepts. Responsiveness, with its proportional cost, can provide a total cost number, but variability cannot be reliably disaggregated to the level of responsiveness (that is, to individual managerial objectives). Therefore, proportional cost is in one sense similar to traditional variable costs (that is, it can express total cost in a manner linear with changes in total volume if individual responsiveness relations so dictate). However, in certain cases—as described above—total proportional cost can and will—when appropriate—behave inversely to total volume.

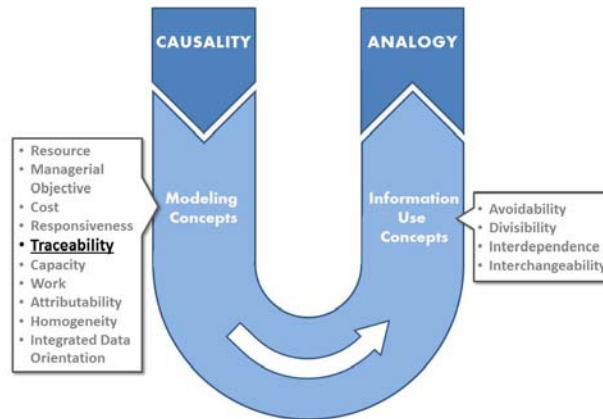
Responsiveness also enables the following two modeling practices, which are crucial to managers' cause and effect insights:

1. Responsiveness allows for the ability to define some of a particular input's quantities as fixed in nature and some as proportional. For example, a simulator consumes preventative maintenance hours regardless of its level of output (that is, a fixed consumption). It also consumes maintenance hours from the same department for repairs (that is, a proportional consumption). In a decision to satisfy additional output demand using existing capacity, only the cost related to proportional maintenance hours are potentially relevant.
2. Responsiveness recognizes that a resource normally *acquired* proportionately can be *consumed* in a fixed manner. For example, a simulator consumes 5 kW of electricity per hour when it is idle to keep hydraulics primed, key components and instruments heated, and diagnostics active. This input quantity (43,800 kWh per

⁴ It is essential that the term "output" here be understood as reflecting specific resource outputs (e.g., inspection outputs, scheduling outputs, and planning outputs) and not finished goods or services.

year, 5 kWh/hr x 24 hr/day x 356 day/yr) is a fixed consumption for the simulator and results in fixed costs of \$4,380 (43,800 kWh x \$0.10) for the year regardless of the level of output toward the managerial objective of providing simulator training. Thus, responsiveness allows for changing the nature of an input—from proportional to fixed—when the change is reflective of the nature of a particular causal relationship. Moreover, once a cost is fixed within a process, it cannot become proportional. This means that under responsiveness costs will become increasingly fixed as resources are consumed through consecutive causal relationships in a productive process.

Establishing the concept of responsiveness in the MA framework is critical in striving for a reliable representation of operational cause and effect insights. Responsiveness and the manner in which it accommodates causal relationships and their characteristics provides managers with a superior operational foundation to base inferences in their analogous or information use activities, such as analysis, decision making, and planning. Responsiveness is the cornerstone of the marginal/incremental information that the managerial costing model will provide.

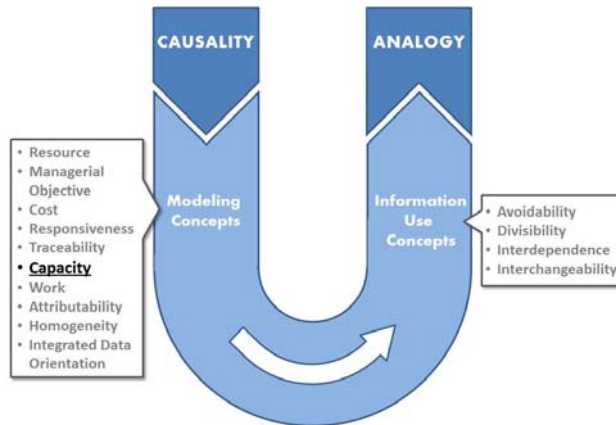


Traceability: *A characteristic of an input unit that permits it to be identified in its entirety with a specific managerial objective on the basis of verifiable transaction records.*

Traceability is included in the framework because:

1. Cause and effect relationships between inputs and outputs of managerial objectives must be identified. Traceability is defined to align with the quantitative nature of causality (that is, a certain quantity of resources is needed to produce a certain level of output). Traceability must be viewed in quantitative resource terms.
2. Resource consumption must be connected with specific managerial objectives when a causal relationship exists.

Examples of verifiable transaction records that allow for the tracing of resource quantities are bills of materials, product routing steps, material requisitions, time cards, invoices, transaction execution records in software applications, and machine design specifications and ratings. During the conceptual design of a cost model, traceability should at face value be considered evidence for causality. The absence of traceability indicates the lack of a strong causal relationship, the lack of a quantitative consumption relationship, and hence a relationship must then be modeled using the concept of attributability discussed on page 53.



Capacity: *The potential for a resource to do work.*

Capacity must be included in the framework because:

1. It provides the limits of a resource's capability to contribute to achieving managerial objectives.
2. Using resource capacity effectively in achieving a managerial objective is key to optimization.
3. Excess or idle capacity represents a major optimization opportunity.

Types of Capacity

Capacity is a key characteristic of resources; therefore, capacity-related resource inputs and their costs should be treated with care. The principle of causality and the various analogous uses of capacity-related information necessitate a distinction between two types of capacity inputs: (1) those required for *capacity provision*, and (2) those related to *capacity usage*. *Capacity provision* inputs and the associated costs must be incurred before the first unit of output can be generated and until the decision is made to eliminate the particular capacity. *Capacity usage* inputs and their associated cost are incremental and required for each unit of output generated. These types of resource capacity are defined as follows:

1. A resource's *capacity provision* inputs are those required to enable its output commitment even if no output is generated in the end. The anticipated level of output to be generated is determined by the planned demands of consumers (internal or external). A resource's capacity provision costs are the costs of the fixed input quantities it must consume to meet its committed capacity. For the flight simulator example, such capacity provision inputs would include capital represented by depreciation, preventive maintenance, and costs for the building space the simulator occupies. Once a resource has been committed to provide a certain level of output, the associated capacity provision costs cannot be avoided until a decision is made and action taken to eliminate the capacity.

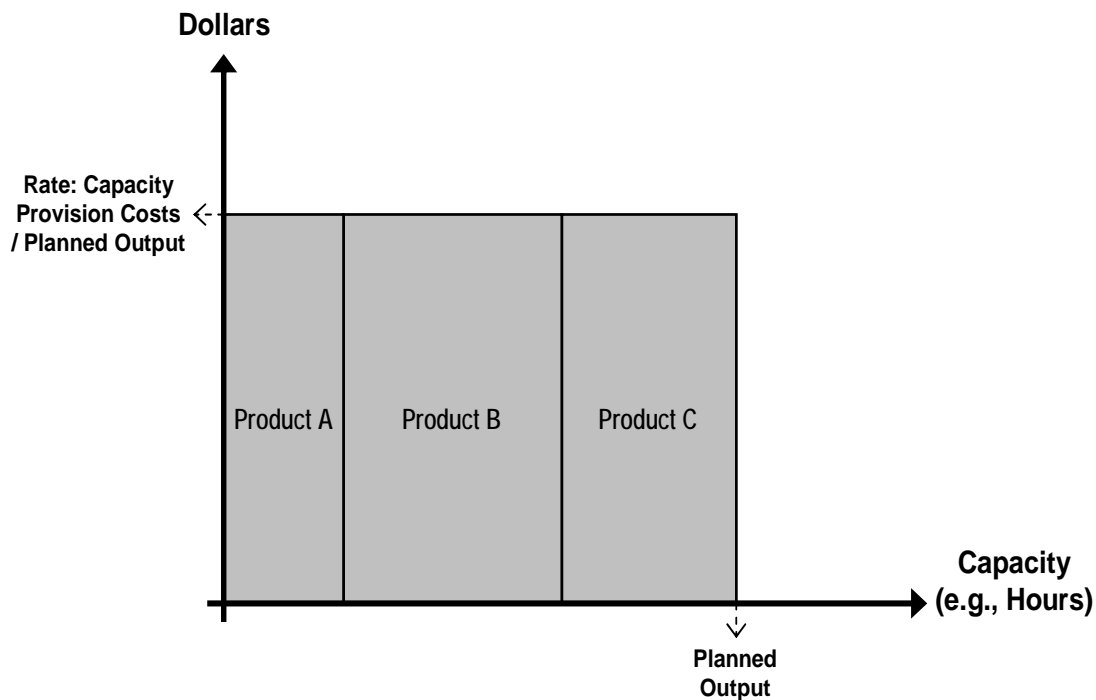
2. A resource's *capacity usage* inputs are those additional inputs—over and above capacity provision inputs—incurred to provide the output actually produced and consumed by other managerial objectives. Capacity usage costs are the costs of proportional inputs consumed in producing output. Examples include consumables, lubricants, and electricity consumed during productive output.

Modeling Capacity

The assignment of all capacity costs, from both the provision and usage inputs, is a function of the denominator volume used to calculate the capacity resource's output cost rates. Capacity usage inputs and their costs are incurred causally as demanded by the consumers of capacity, and the appropriate denominator for calculating the capacity usage cost rate is planned output. A resource's actual capacity usage costs will reflect its actual output generated.

The assignment of capacity provision inputs (and their costs) is more challenging because the causal relationship is not typically as strong. The question is: What is an appropriate denominator level for calculating an output rate to assign capacity provision costs? The answer to the question requires a denominator volume that will appropriately reflect both the strong and the weak forms of causality with regard to capacity provision inputs. For example, consider using planned output for this purpose, as illustrated in Figure 9.

Figure 9: Capacity Provision Costs and Planned Output



As illustrated in Figure 9, if planned output is used as the denominator for rate determination, all capacity provision costs are assigned to products (though assignment

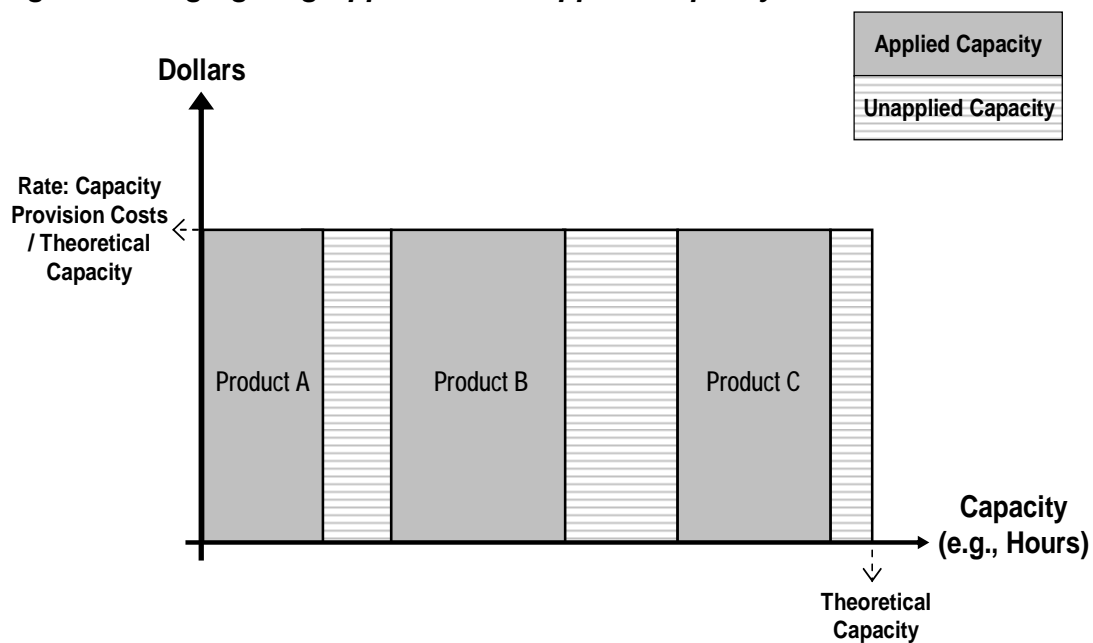
could be to activities, resources, managerial objectives, and so on) consuming that resource capacity. In this case, *common fixed costs* (costs that have a very weak or no consumption relationship with a specific output, such as excess/idle capacity) are assigned to products A, B, and C in a manner inconsistent with the principle of causality. This arbitrarily spreads some capacity provision costs to the consumers (products A, B, and C in this case) and compromises managers' cause and effect insights. In short, the products will be over-costed.

Therefore, the denominator used to assign capacity provision costs must reflect:

- When resource capacity is *applied* to produce a product/service as well as when the resource remains *unapplied*.
- Capacity provision inputs and their costs as relating to both *applied* and *unapplied* capacity. This is illustrated in Figure 10.

Note: *Applied capacity* is defined as productive capacity (time spent making product) and nonproductive capacity (time for setups, planned and unplanned maintenance, rework, and so on) that can be causally related to a specific output with a consumption relationship. *Unapplied capacity* includes all idle/excess time as well as nonproductive capacity that does not have a strong causal relationship to a specific output.

Figure 10: Segregating Applied and Unapplied Capacity



As illustrated in Figure 10, if theoretical capacity (see definition below) is used as the denominator, only the capacity provision costs related to the capacity actually applied are assigned to the products and services produced. Common fixed costs, the lightly textured (non-product) areas in Figure 10, are not assigned to the products and services produced. In this instance, only the capacity provision costs represented by the darker, shaded, capacity applied areas (product) will be assigned to products A, B, and C, respectively.

Since the objective is to assign a capacity resource's costs in a causal manner

for the purposes of managers' analogous use, it is clear that capacity provision costs should be assigned to a resource's entire period of availability. Therefore, capacity provision costs for idle/excess resource time should not be assigned to productive output but should instead be handled in accordance with the concept of attributability (page 53). For optimization purposes, theoretical capacity is the appropriate denominator for assigning capacity provision costs to the consumers of capacity. Any other denominator, including practical capacity, will assign some unapplied capacity and its provision costs arbitrarily to the products produced.

Note on Capacity Definitions:

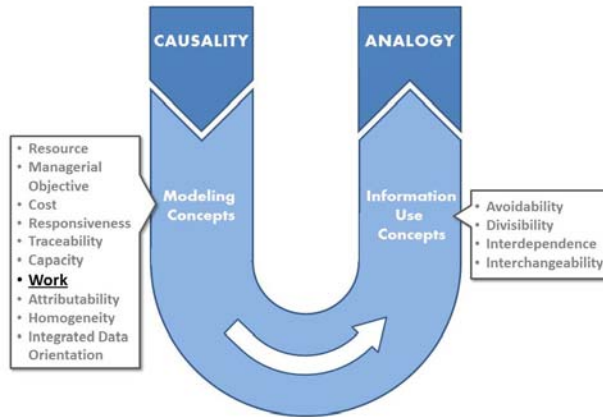
Idle/Excess Capacity: Capacity not currently scheduled for use. The CAM-I Model breaks idle capacity into three specific classes: not marketable (no market exists or management made a strategic decision to exit the market), off limits (capacity unavailable for use), and marketable (a market exists but capacity is idle).*

Nonproductive Capacity: Capacity not in a productive state or not in one of the defined idle states. Nonproductive capacity includes setups, maintenance standby, scheduled downtime, unscheduled downtime, rework, and scrap. Variation is the primary cause of nonproductive capacity.

Productive Capacity: Capacity that provides value to the customer. Productive capacity is used to change a product or provide a service. Productive capacity results in the delivery of good products or services. It may also represent the use of capacity for process or product development.

Theoretical Capacity: The full period a resource is available based on ownership rights or contract agreements. Buildings and equipment are typically available 7 x 24 x 365. Human resources are typically available for an agreed upon number of hours per week. Overtime is an additional resource when used.

Source: Klammer, Thomas (editor), Capacity Measurement and Improvement: A Manager's Guide to Evaluating and Optimizing Capacity Productivity, The McGraw Hill Companies, 1996.



Work: A measure of the specific nature of units of resource output.

Work is included in the framework because:

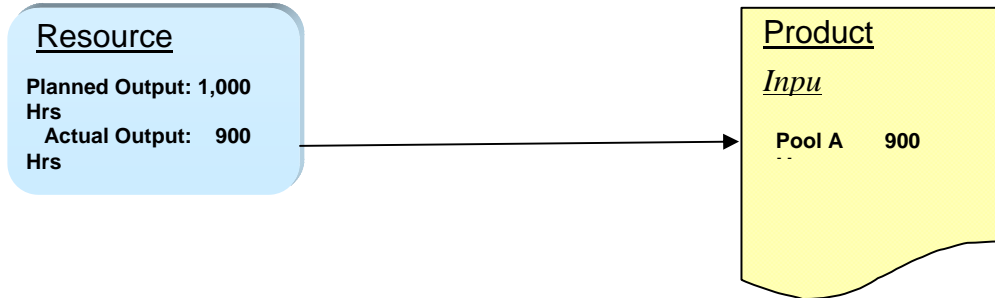
1. Resources engage in specific work activities or business processes to accomplish managerial objectives.
2. The ability to model work provides decision makers with information that is often important to optimization efforts.
3. The work concept is also useful for analogous purposes when insight into the nature of work is beneficial to managers' optimization endeavors (e.g., for process improvement).

Work came to prominence as the foundation of activity-based costing and is incorporated into the framework with its application subject to the quantity-based definition of causality. An illustration of the consumption of resource quantities with and without the concept of work is provided in Figure 11. Work is used in modeling when it provides important decision-support information, enhances accuracy, reduces the level of administrative effort in modeling, or is cost-beneficial in expressing a causal relationship. For example, this is true in purchasing where resource time recording is administratively prohibitive and the work output (the number of purchase orders or contracts) provide an easily accessible and traceable output measure to consumers.

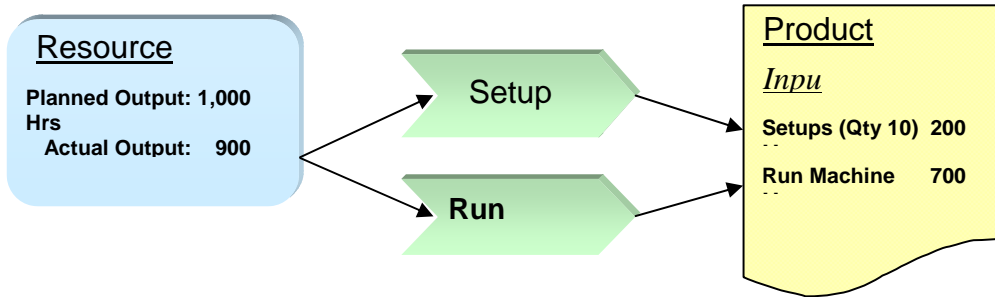
To effectively model the concept of work requires the use of resource quantities to maintain traceability of the resource capacities throughout an enterprise model. Work activities do not have capacity themselves; they merely transmit capacity usage.

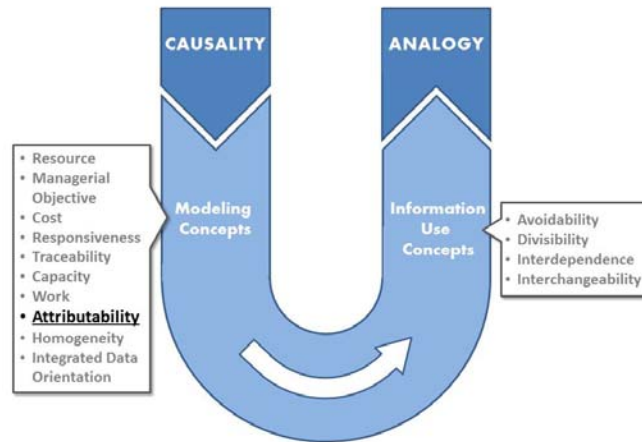
Figure 11: Illustration of the Concept of Work

Without the Work



Using the Work





Attributability: *The responsiveness of inputs to decisions that change the provision and/or consumption of resources.*

Attributability is included in the framework because:

1. Not all resources have strong cause and effect relationships with a managerial objective.
2. Costs with a weak causal relationship to a managerial objective are often relevant costs in decision making.
3. The costs associated with a resource with a weak causal relationship to an output can distort decision-support information if not modeled and used appropriately.

Attributability governs the application of the weak form of causality. Causality was discussed in the principles section; however, its relation to attributability needs elaboration.

In particular, common fixed costs and other costs, which cannot be quantitatively associated with specific outputs in a causal manner, fall within the sphere of influence of the concept of attributability. Another term often used in association with this category of costs is “business sustaining costs.” For optimization purposes, these costs need to be assigned to business levels (for example, product, product group, a plant, a region, a distribution channel, or the entire organization), where they are relevant in decision making. The common practice of allocating these costs to outputs arbitrarily, or with the same effect, based on a highly generalized driver, distorts decision-making information at many levels of an organization.

Attributable Cost

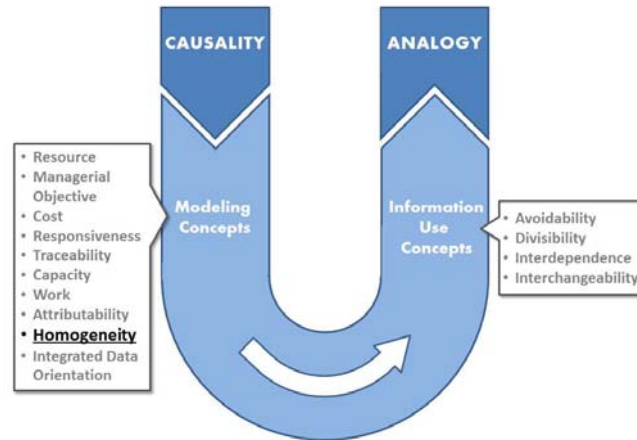
As previously defined on page 35, attributable cost is the costs of an output that could be eliminated in time, if that output were discontinued and resource consumption and/or provision were reduced accordingly. Therefore, a managerial objective’s attributable costs may include the following when they exist and apply: (1) all direct costs, (2) causal

support costs, including a proportionate share of capacity provision costs, and (3) attributable common fixed costs.

The attributable cost concept is the most complete cost concept based on the principle of causality—it effectively incorporates both the strong and weak forms of the principle. For this reason, the attributable costs of a managerial objective serve as the baseline information for managers' analogous needs (refer to Figure 1).

Modeling Weak Causal Relationships

It is important to note that quantitative causal relationships in the managerial costing framework relate to specific outputs, while costs assigned based on the concept of attributability are generally assigned to business levels. The term “business level” refers to a combination of related managerial objectives for which specific optimization activities are undertaken. Excess/idle capacity cost for a product group is an example of attributable fixed cost. Another example would be an airline that assigns business class lounge costs in Paris to the product group “Destination Paris.” If the airline decides to no longer fly to Paris, the lounge costs are clearly avoidable, and hence they are attributable to that business level. At more aggregate levels, more costs will be attributable until at the highest level (that is, the operating result for the enterprise) company-wide common costs are attributable. Examples of such entity-level attributable costs are the Office of the President and the Public Relations Department. It is only at this highest level of an organization that attributable costs will equal full costs.

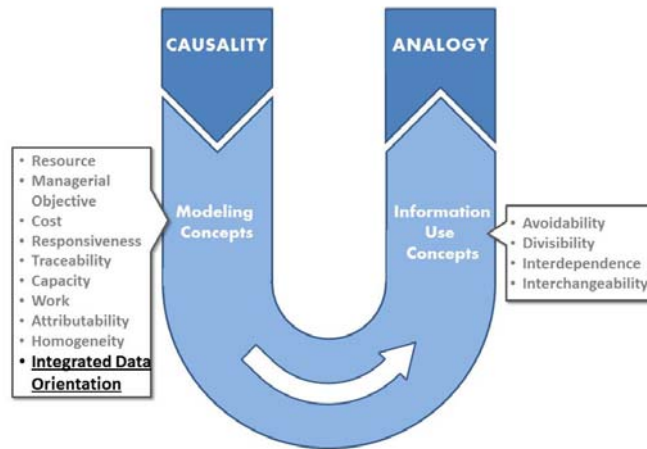


Homogeneity: A characteristic of one or more resources or inputs of similar technology or skill that allow for their costs to be governed by the same set of determinants and in an identical manner.

Homogeneity is included in the framework because:

1. Resources need to be grouped around similar capabilities and outputs for managerial purposes.
2. Organizational elements (e.g., departments and cost centers) must often be divided into homogeneous groupings of resources to be modeled effectively.

Homogeneity is a long-recognized concept that plays a key role in cost measurement and modeling. It allows for the grouping of like resources into a single managerial objective in order to manage, optimize, and charge for the use of those resources in a cost-effective manner. To illustrate, the homogeneity concept leads to the conclusion that equipment from two production lines that always make the same product be modeled in different resource pools if one production line and its equipment had significantly different technical and cost characteristics. This should occur even if the two production lines had the same supervisor. Similarly, highly qualified technicians and trainee technicians with significantly different wages but who often work together on the same job orders require separate resource pools (based on the concept of homogeneity) in order to accurately reflect their respective consumption rates and costs.



Integrated Data Orientation: *Information about an organization’s economic resources, events, and their corresponding monetary values, free from traditional accounting conventions, which allows for the aggregation of elementary data elements and their values for any purpose.*

Managerial costing requires a consistent set of source data with the following characteristics:

1. Not restricted to traditional financial accounting defined conventions
2. Consistently stored for access and retrieval throughout the organization rather than by financial users only
3. Integrates operational and financial data

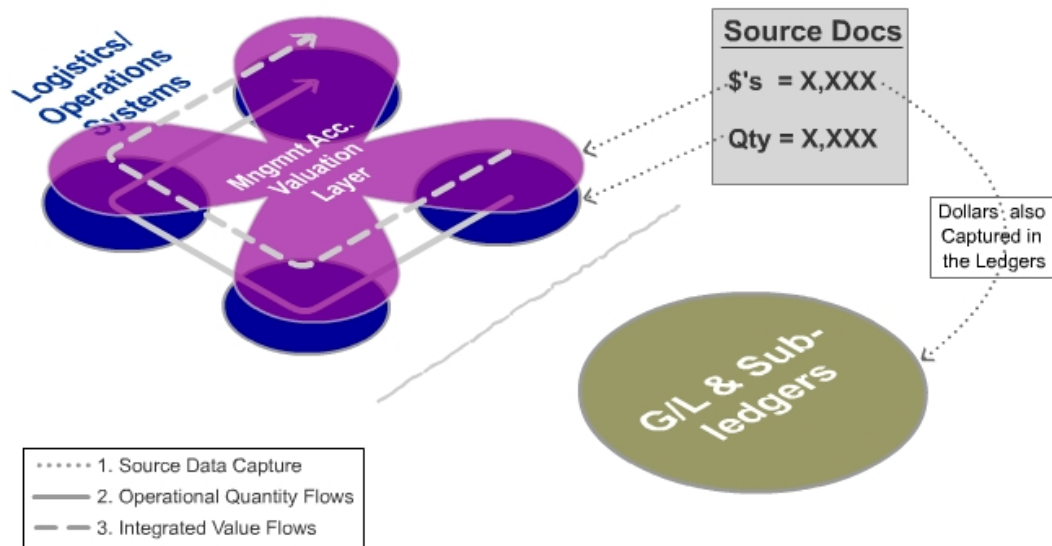
Traditional accounting systems are restricted to information that is provided through the use of traditional accounting artifacts such as debits and credits, journal entries, the chart of accounts, the general ledger, and various subledgers. The concept of integrated data orientation prevents managerial costing from being dependent on the general ledger and allows for a clean separation of financial accounting and managerial costing.

Using integrated data is also a primary enabler of operational modeling and provides the quantitative nonfinancial information needs of enterprise optimization. The ability to apply more than one valuation layer to the quantitative operational model solves the issue of cost information that must be compiled based on different principles, such as financial accounting’s matching and periodic principles and managerial costing’s need for causal information.

In traditional management accounting practice, monetary units captured from source documents are recorded in the general ledger and the quantities are recorded in operational systems. As illustrated in Figure 12, with the concept of integrated data orientation, the cost modeling system comprises a valuation layer on top of the operational quantity-based model guaranteeing direct linkage and integrity of optimization information. The inherent integrity of quantities coupled with their values in the different valuation layers allows, as an alternative to GL-summarized data,

appropriate information to be generated from source transactions for the different uses of cost information, such as inventory valuation for external reporting using traditional monetary focused cost accounting techniques, and enterprise optimization using monetary valuation tied to cause and effect based operational resource flows.

Figure 12: Integrated Data Orientation.



Two key weaknesses of the traditional accounting model are:

1. Its dimensions are limited. Most accounting measurements are expressed in monetary terms, a practice that precludes maintenance and use of productivity, performance, reliability, and other multidimensional data.
2. Its degree of integration [with functional areas of an enterprise other than finance] is too restricted. Information concerning the same set of phenomena will often be maintained separately by accountants and non-accountants, thus leading to inconsistency plus information gaps and overlaps (McCarthy, 1982, pp. 554-555).

McCarthy (1982) also noted that in the traditional accounting model, the “aggregation level” for stored information is too high. Accounting data is used by a wide variety of decision makers, each needing differing amounts of quantity, aggregation, and focus depending upon their personalities, decision styles, and conceptual structures. Therefore, information concerning economic events and objects should be kept in as elementary a form as possible in order to be aggregated by the eventual user.

Enterprise resource planning (ERP) software systems are well suited to implementing the integrative data concept within a cost model. ERP systems provide integration through the implementation of an enterprise database that spans the range of enterprise activities and locations (O’Leary, 2004, p. 65).

Relating the Integrated Data Orientation Concept with Other Concepts

Integrated data supports the concept of verifiability of a cost model. Using data prepared for other purposes allows managers to verify with little effort the source data of a costing model. One can readily confirm that figures used in a cost model match figures used in operational reports. The use of integrated data also reduces the amount of resources required to maintain and use a costing model. When data are used in operations, they are already validated. Confirming data validity reduces or eliminates the need for validation prior to use in a costing model.

Bibliography

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- O'Leary, D. E. (2004). On the Relationship between REA and SAP. *International Journal of Accounting Information Systems* , 65-81.

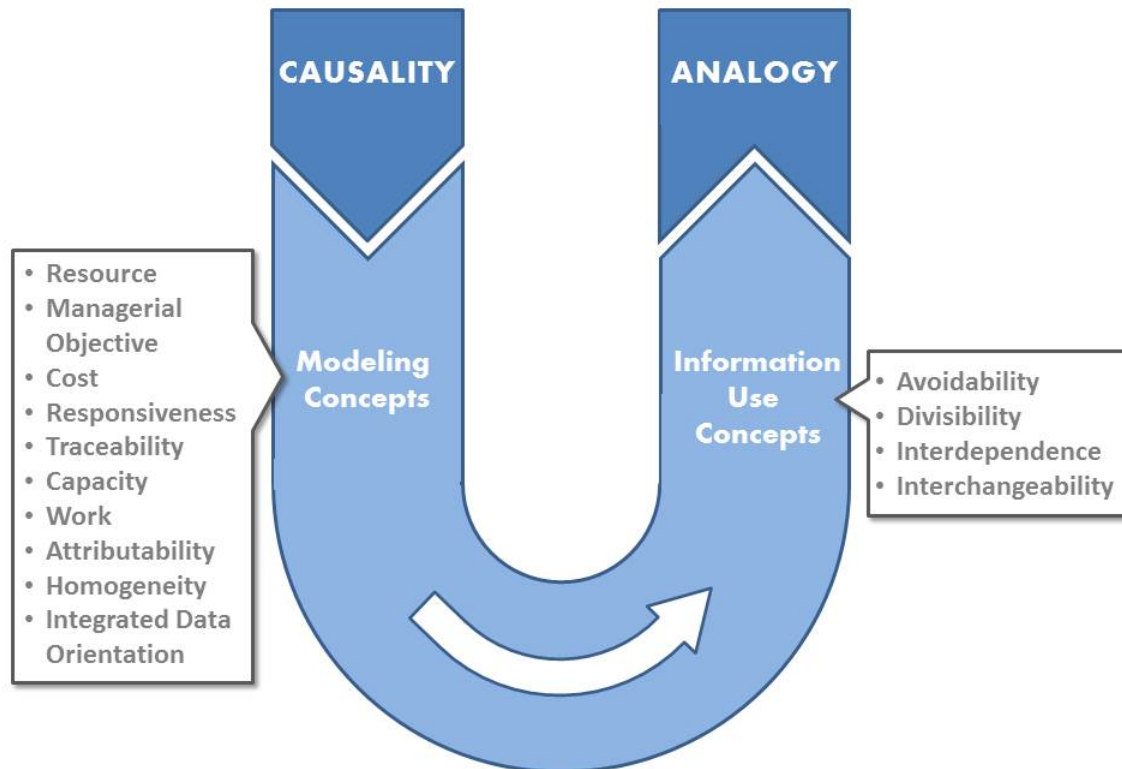
Modeling Concepts

Resource	A definitive component of an enterprise acquired to generate future benefits.
Managerial Objective	A specific result or outcome of the application or provision of resources that management chooses to monitor for the purpose of enabling one or more managerial activities.
Cost	A monetary measure of (1) consuming a resource or its output to achieve a specific managerial objective, or (2) making a resource or its output available and not using it.
Responsiveness	The correlation between a particular managerial objective's output quantity and the input quantities required to produce that output.
Traceability	A characteristic of an input unit that permits it to be identified in its entirety with a specific managerial objective on the basis of verifiable transaction records.
Capacity	The potential for a resource to do work.
Work	A measure of the specific nature of units of resource output.
Attributability	The responsiveness of inputs to decisions that change the provision and/or consumption of resources.
Homogeneity	A characteristic of one or more resources or inputs of similar technology or skill that allow for their costs to be governed by the same set of determinants and in an identical manner.
Integrated Data Orientation	Information about an organization's economic resources, events, and their corresponding monetary values, free from traditional accounting conventions, which allows for the aggregation of elementary data elements and their values for any purpose.

Information Use Concepts

The concepts applicable to the principle of analogy, the use of managerial costing information, are illustrated in Figure 13:

Figure 13: Information Use Concepts

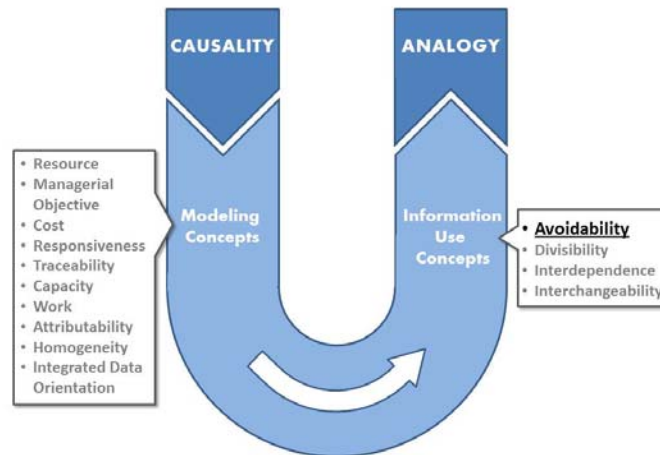


Overview of Information Use Concepts

The cost model generates information about the consumption of resources and their costs; however, decision makers must be knowledgeable about concepts that apply when using the model information. Resources and managerial objectives are highly interdependent in a model, and countless qualitative factors can change and have an impact on their costs. The concepts governing information use comprise the following two groups:

1. Those primarily relevant to analysis (that is, avoidability and divisibility). Resources are employed to achieve managerial objectives, but the consumption characteristics associated with those managerial objectives may not be divisible in the same way. For example, a process may require 1,000 hours of skilled labor, but such skilled labor is only readily available on a full-time basis. As decisions are made to improve or change the achievement of managerial objectives, resource consumption and resultant costs may or may not be avoidable. Thorough analysis is often required to determine resource divisibility and the costs that will become avoidable.

2. Those primarily relevant to decision making (that is, interchangeability and interdependence). Resources of similar types may be interchangeable and changes can be accomplished much more rapidly than the model can be updated. Interdependencies also often exist. For example, a plating company adopts a new electroplating process for a key product. If by adopting the new process the plating company adds additional work steps to its changeovers, then the productivity rate of its plating process will diminish. Information use concepts in this category highlight the need to consider qualitative aspects in decision making.



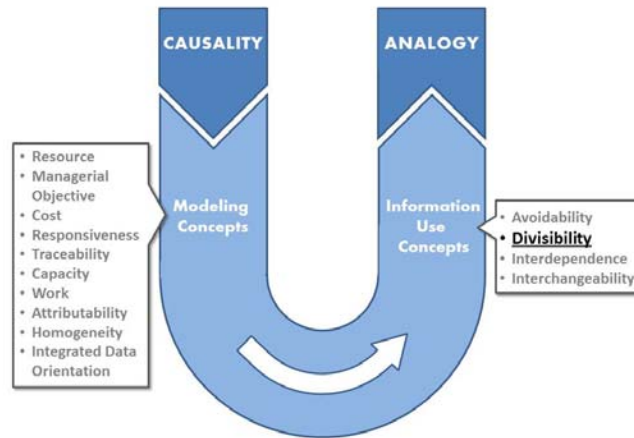
Avoidability: *A characteristic of an input that allows for the input (and hence its costs) to be eliminated as a result of a decision.*

Avoidability is included in the framework because:

1. It is a pivotal concept in analysis (that is, for every decision scenario an enterprise faces, understanding the avoidable and unavoidable costs is crucial).
2. Decision makers need to evaluate whether changes in resource consumption will result in the ability to avoid the costs of affected resources.

Avoidability is well known in the management accounting profession, but in the context of the framework it is important to understand that it is applied with a focus on input units rather than costs. Avoidability is not a characteristic of costs but of input quantities. This is consistent with the earlier characterization of money as the meta-language of economic activity, and also applies to the use of monetary cost information in decision analysis. The application of the concept of avoidability in decision analysis leads to determining a decision alternative's avoidable costs. Avoidable cost is defined as cost incurred for a managerial objective that will—immediately or in time in some instances—no longer be incurred if the need for that objective is eliminated.

For example: If a maintenance procedure is improved, saving 1,000 hours of technician resource time, the cost is avoidable only if one can reduce the number of technician hours supplied. (See the next concept for more discussion.)



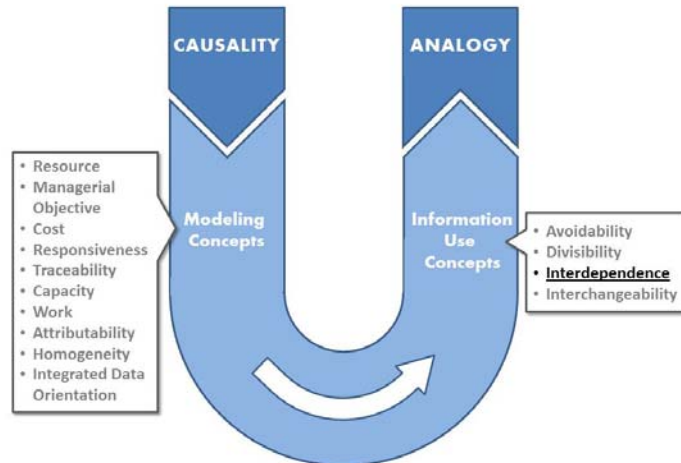
Divisibility: *A characteristic of a resource that allows it to be associated in its entirety with the change in a managerial objective's output resulting from a decision.*

Divisibility is included in the framework because:

1. It is a characteristic of resources that is critical to decision making.
2. It is a key factor in determining whether costs are avoidable.

In decision analysis, the magnitude of any incremental gain that a particular cost reduction decision will yield depends entirely on whether resources affected by the decision can be eliminated or sold (that is, if the resource is divisible, its cost can be avoided). Similarly, resources needed for any increase in output can only be acquired in certain divisible units. Thus, resource divisibility is one of the primary determinants of avoidability.

For example: Consider a team of highly trained maintenance technicians whose skills are in high demand in numerous industries. A low-cost equipment monitoring system could save 1,000 hours of technician time per year. The maintenance technician time is only divisible if one of the technicians is willing to work part-time or you are willing to risk a lower level of maintenance coverage by eliminating a full-time technician (assume 1,600 productive hours per technician per year).



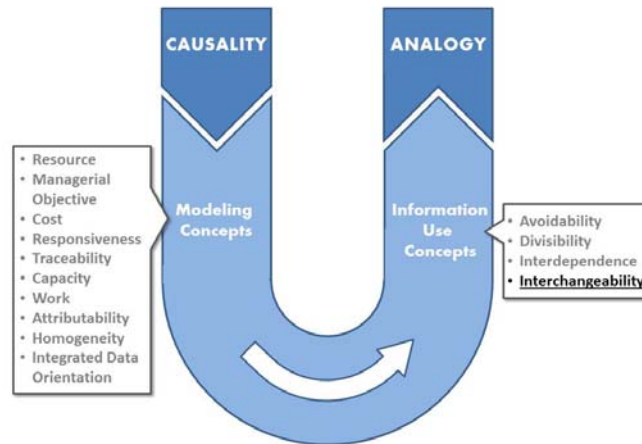
Interdependence: *A relation between managerial objectives that occurs because of a decision to use resources to achieve one objective that affects the amount or quality of resources required to achieve other objectives.*

Interdependence is included in the framework because:

1. Interdependence has many qualitative dimensions that must be considered when using information from a cost model.
2. It is a key causal factor (often qualitative) to be considered together with the causal information the cost model provides.
3. It is a causal factor that can outweigh quantitative consumption relationships and may therefore dictate selecting a decision alternative that might otherwise be considered suboptimal.

Interdependence highlights the need, in analysis and decision making, to consider cause and effect relationships other than pure consumption causal relationships. Such interdependencies are typically decision-specific and are difficult to model ex ante in the cost model. Nevertheless, it is often possible to infer interdependence when considering the operational cause and effect relations incorporated in the cost model. For example, opening a new plant, Plant B, may require that talented people from an existing Plant A be transferred to the new plant to help train the new workforce and establish operations quicker. This will have a direct impact on the productivity and costs of Plant A that will be apparent to managers but may be difficult to quantify.

The concept of interdependency highlights the criticality of understanding the operations of an organization holistically. No model, whether cost-oriented or purely operational, can substitute for a functional understanding of the physical operations performed to create value in an organization. Without this understanding, the risk that even high-quality data and carefully constructed information will lead to less than optimal decisions remains great.



Interchangeability: *An attribute of any two or more resources or resource outputs that can be substituted for each other without affecting the costs of the other resources that are required to carry out the activities to which the interchangeable resources are devoted.*

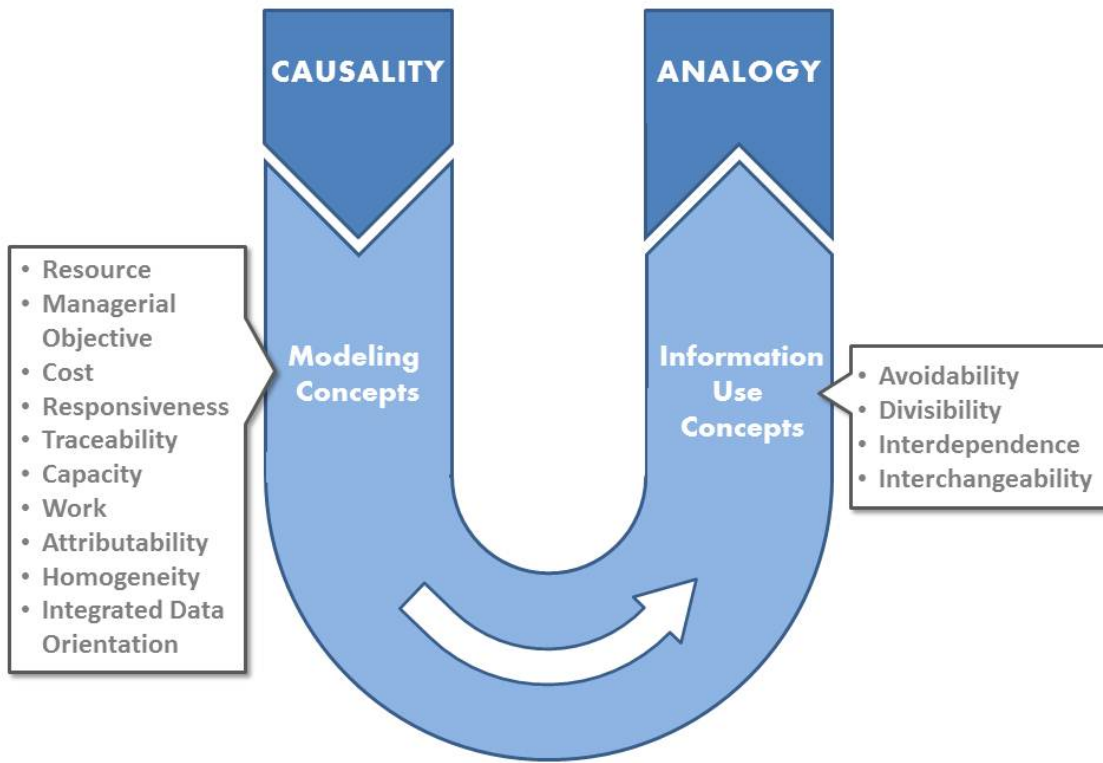
Interchangeability is included in the framework because:

1. The wide range of resources that can be substituted and the speed with which they can be substituted will exceed the ability of a model to adapt.
2. Resource fungibility (that is, a resource with the capability to be used in various productive processes), not necessarily currently modeled, could be a viable alternative in many decision scenarios.
3. Managers need to consider all options for achieving managerial objectives in a timely manner.

The effects of interchangeability or a lack thereof can often also be gleaned after the fact from the cause and effect insights incorporated in the cost model. For example, two workers do the same type of work, but one is less skilled and requires more inspection and rework. These workers are interchangeable but will change the cost structure of the resource pool. The cost impact of interchangeability is normally apparent in a historical analysis but is difficult to model since it is often unknown beforehand whether the substitution will be feasible or acceptable (e.g., to the customer).

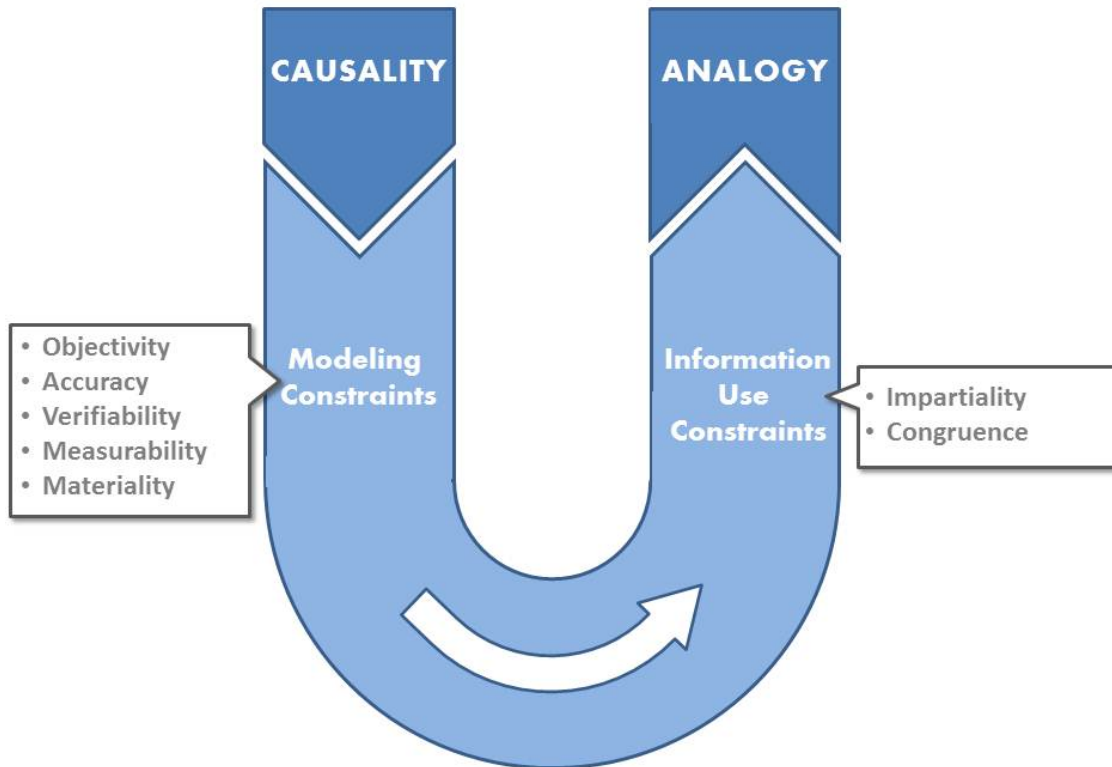
Information Use Concepts

<i>Primarily relevant to analysis:</i>	
Avoidability	A characteristic of an input that allows for the input (and hence its costs) to be eliminated as a result of a decision.
Divisibility	A characteristic of a resource that allows it to be associated in its entirety with the change in a managerial objective's output resulting from a decision.
<i>Primarily relevant to decision making:</i>	
Interdependence	A relation between managerial objectives that occurs because of a decision to use resources to achieve one objective that affects the amount or quality of resources required to achieve other objectives.
Interchangeability	An attribute of any two or more resources or resource outputs that can be substituted for each other without affecting the costs of the other resources that are required to carry out the activities to which the interchangeable resources are devoted.



Conceptual Framework for Managerial Costing

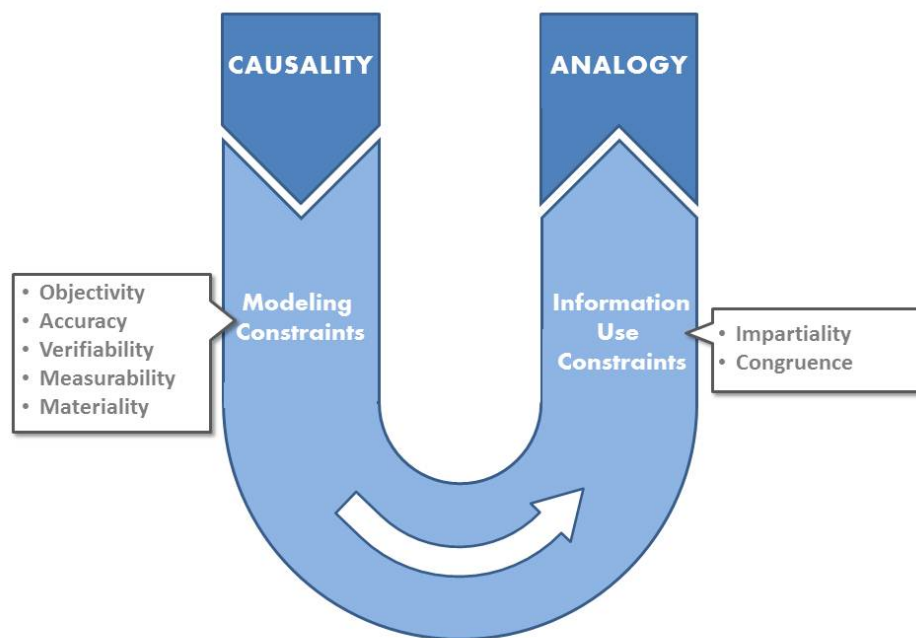
Section III.C: Constraints for Managerial Costing



Constraints for Managerial Costing

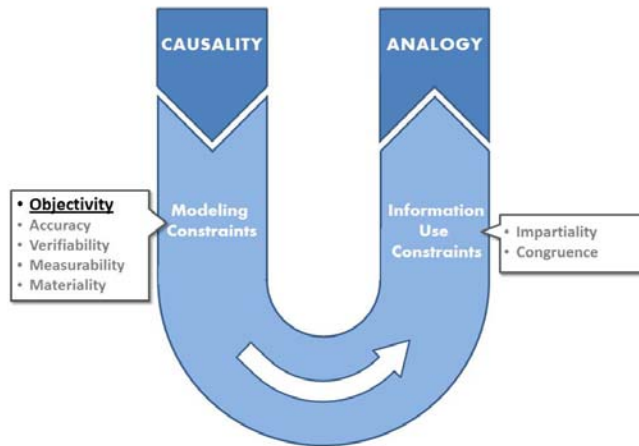
Within this framework, we started with principles and then defined supporting concepts. In turn, constraints are a boundary of the zone in which principles and concepts are allowed to govern. For this document, constraints are the implicit requirements that qualify applying modeling and information concepts. Concepts that meet the qualifying boundary requirements are included; other concepts are irrelevant. Most of the constraints identified are not absolute but operate within a range. If a concept is applied with integrity to its definition and within the boundaries of the framework constraints, a higher-quality cost model and better decision-support information will result.

This section will first discuss constraints applicable to modeling and then those that apply when cost information is used.



Cost Modeling Constraints

Five constraints are applied to the concepts associated with managerial cost modeling, namely: Objectivity, accuracy, verifiability, measurability, and materiality.



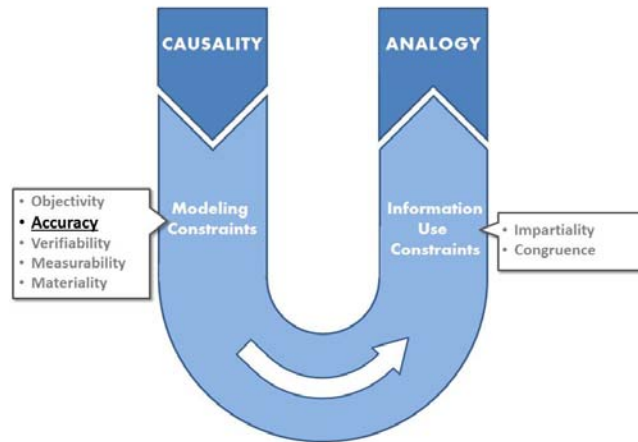
Objectivity: *A characteristic of a cost model that shows it to be free of any biases.*

A cost model should be free from intentional bias. This is a fundamental goal, a basic requirement, and hence it is a constraint. Modeling with the intention of producing a biased result falls outside the scope of this framework.

Objectivity is established during cost model construction when decisions are made about which organizational resources and outputs to include in the model and how they should be modeled. Thus, managerial costing information can only be objective if the model that produces that information is constructed in an unbiased manner. Objectivity reinforces the application of the Correspondence Definition of Truth, which stresses that truth is based on observable facts.

This framework seeks to establish the principles, concepts, and constraints for modeling an organization’s operations and resources as they can be verified. The model serves as the baseline for a wide variety of planning and analysis activities. When planning and analysis is done, a range of assumptions with varying probabilities of success will be examined. Objectivity, as framed here, applies to the baseline model. Failure to apply objectivity when constructing the model will invalidate planning assumptions and skew planning and analysis efforts and results.

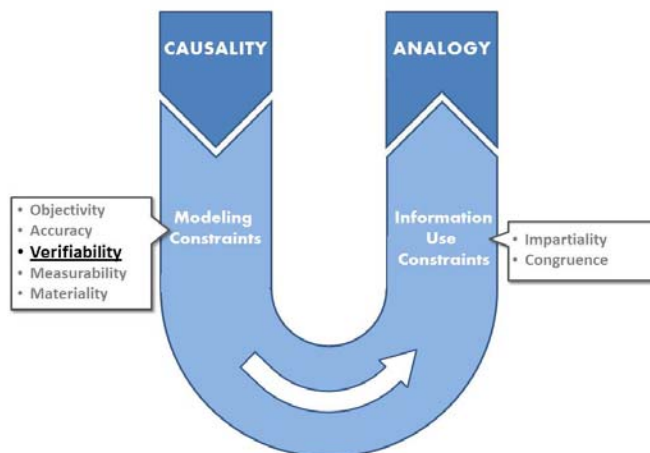
For example: When considering a change to a process, one is interested in possible unintended consequences. Therefore, it is common for a decision maker to desire to know the maximum amount of costs that could result from remotely possible, but damaging, unintended consequences from a process change. This type of analysis can be useful and is not meant to be discouraged by the operation of the objectivity constraint.



Accuracy: *The degree to which managerial costing information reflects the concepts you intended to model.*

A cost model should reflect the concepts and principles explained in this framework; that is, a managerial costing model should reflect essential and important relationships and their cumulative effects (that is, costs). Cost modeling not intended to do so lies outside of the scope of this document—for example, costing for tax or external financial reporting must subordinate the principles and concepts in this framework to generally accepted accounting principles or tax laws.

It is important to recognize that accuracy in reference to cost is normally associated with a numerical output; that is not the case in this framework. This constraint focuses on the accuracy of the relationships between resources and managerial objectives. Even with this nonfinancial focus, accuracy is conditional to the context for which cost information is to be used. That is, an organization with razor-thin margins requires more accuracy in modeling the relationships generating their cost information than a company with 80% or 90% margins.

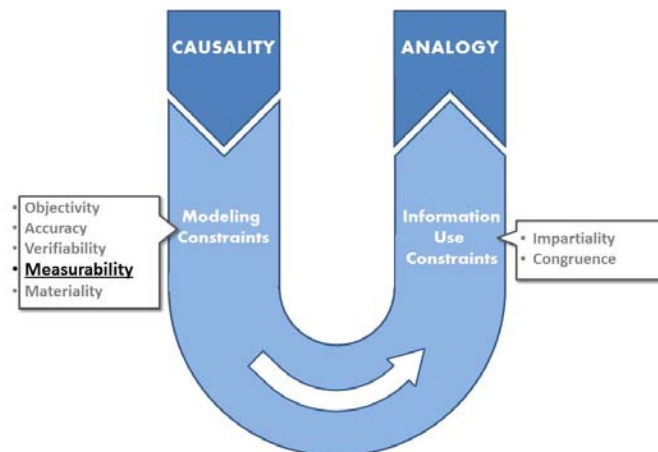


Verifiability: A characteristic of modeling information that leads independent reviewers to arrive at similar conclusions.

An objective of a modeler is to create a model that could be reviewed by an independent person who would arrive at similar conclusions about the model's design. Cost models should be designed and developed in such a way that a user should at all times be able to determine or test the accuracy or correctness of the assumptions represented. Verifiability of cost information is crucial to users trusting what the model provides.

In this framework *information* refers first and foremost to quantitative, nonfinancial operations information reflecting the flow of economic goods and services. These quantities are subject to the verifiability constraint since they serve as the foundation for modeling and valuation. Cost model information should be verifiable as a feature of each quantitative input unit.

In scientific research, scientists often attempt to verify the findings of research published by other scientists. To accomplish this, they must be provided the same starting information and test procedures to conduct their experiments and verify the published results. This context applies to verifiability in cost modeling.

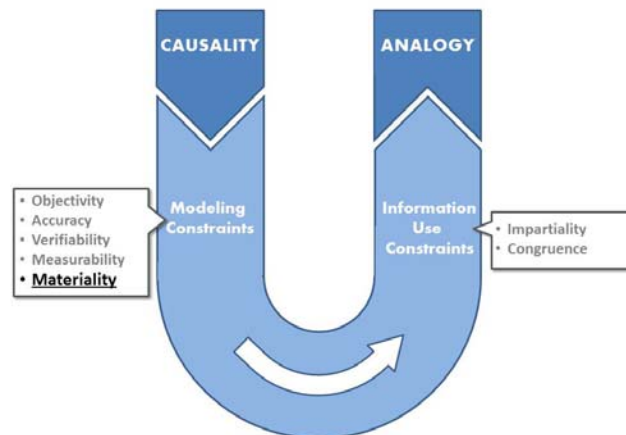


Measurability: A characteristic of a causal relationship enabling it to be quantified with a reasonable amount of effort.

The measurability constraint requires a cost modeler to create a model with relationships that are quantifiable with a reasonable amount of effort. In the past, prior to the easy availability of data provided by integrated enterprise-wide data warehouses, this measurability constraint was very restrictive. In most cases, it limited cost modelers to financial transactions and account balances available in general ledgers and subledgers. However, the German Grenzplankostenrechnung (GPK) approach has shown that integrated data orientation allows for far more detail in management accounting with less effort (Friedl, 2006). Moreover, due to the real-time nature of

operational controls, the typical shop floor collects data in excess of that needed to meet the demands of managerial costing's measurability constraint. This data can be used to model far more detail and accuracy, if warranted. For example, check outs of jigs and dies from the tool crib in a machine shop are tracked by job and employee in a log; most cost models would be satisfied with knowing only which jigs and dies of significant cost (that is, the material ones) were used on a job.

Measurability is a constraint that is also applied by production/operations in determining the quantitative information they use. Cost modeling that uses integrated data orientation is, in many cases, in a position to accept production/operation's application of the measurability constraint. The Managerial Costing Framework's focus on operational quantities (instead of modeling abstract dollar amounts alone) provides a clear option to achieve better measurability and organizational linkage when production/operations has already made judgments about the appropriate levels of tracking for resources, managerial objectives, and relationships. It is unlikely a cost model will need the same, much less a greater, level of detail.



Materiality: A characteristic of cost modeling that would allow for simplification without compromising managers' decision-making needs.

An objective of a modeler is to create a model that is parsimonious in the sense that it includes no unnecessary details. The materiality constraint requires that cost modelers simplify without compromising the information needs of managers. Measurability and materiality function as counterweights to each other. As mentioned earlier, the level of detail and accuracy required depends on the uses of the information, but the incremental benefits of the greater visibility that results from the additional effort to attain it must exceed the incremental administrative effort to collect the data.

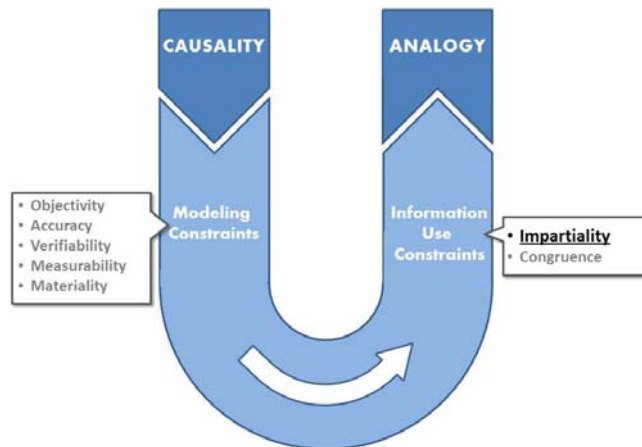
Materiality has traditionally been defined in terms of the error that results because significant information has been omitted. Frequently, information is lost as a result of aggregating—which reduces effort but causes a loss of information that a finer level of detail would provide.

Such aggregation reduces the time and effort required to store and use data that was appropriate in the past. Today, though, with integrated data, the need to

compromise using aggregation has been reduced because the effort required to measure has been reduced. The measurability constraint is now less restrictive. Fewer inputs need to be excluded from cost models because of the effort to measure them. In fact, managerial costing's issue is no longer the effort of collecting an appropriate level of detail but that of weeding out unnecessary operational detail. The application of the materiality constraint has changed from minimizing the error in cost measurement information due to compromises in implementation (that is, aggregation) to that of appropriately reducing unnecessary detail in order to satisfy managers' analogous needs

Information Use Constraints

Two constraints are applied to the concepts associated with the use of cost model information: Impartiality and Congruence.

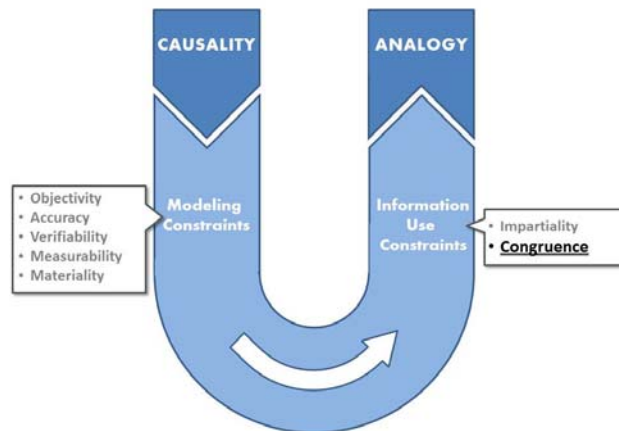


Impartiality: *The unbiased consideration of all resource application alternatives.*

Impartiality is an important component of any optimization activity in that it recognizes the need for: (1) a lack of prejudice on the part of managers, and (2) consideration of all options for applying resources.

In one sense, this constraint is similar to the objectivity constraint in modeling. However, in using managerial costing information, the added requirement is that managers should not limit themselves to merely those opportunities that are obvious and conventional. Creative, entrepreneurial evaluations of the situation are required; managers must assess a wide range of alternatives.

Managerial costing analysis needs to present the facts and data associated with all alternatives from the cost model for use in decision making in a professional and impartial manner. The recommendations of management accountants and decisions made by managers seldom rest solely on the results of cost modeling but are affected by qualitative managerial and behavioral factors as well.



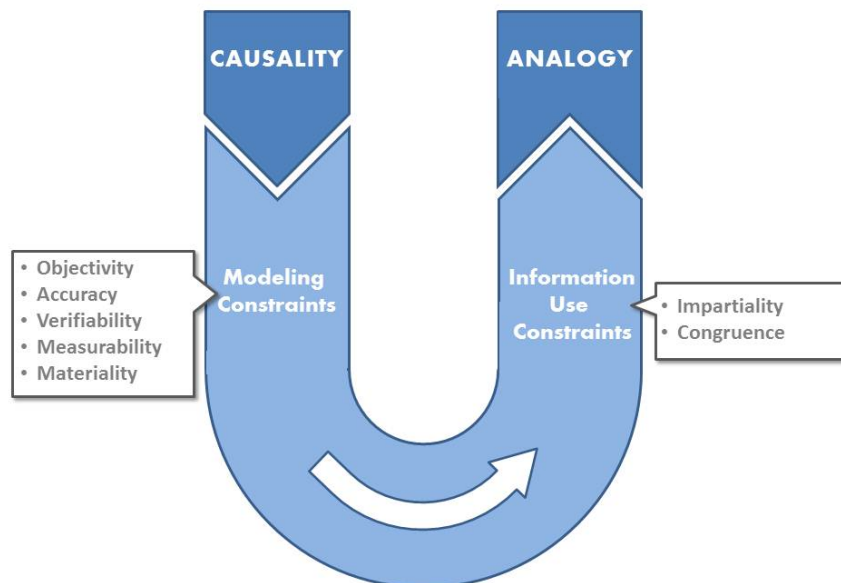
Congruence: *The interdependence of individual managerial actions to attempt to achieve both individual and enterprise objectives in an optimal manner.*

Congruence requires that managers recognize the dependence of overall enterprise optimization on their individual actions. Enterprise strategy expresses enterprise objectives and the path to achieving them with actions, projects, and changes. Cost information plays an important role in supporting managers in achieving these objectives in an optimal manner. The selection of the most congruent alternative is informed by a manager's evaluation of the incremental gain of all related resource application alternatives as well as all relevant qualitative causal aspects, such as customers' likely reaction to a price increase on a product that can easily be substituted or the impact on an organization's reputation. All other things being equal, the alternative with the largest incremental overall gain over the status quo, despite potential localized suboptimal outcomes, is the optimal solution and the one that satisfies the congruence constraint.

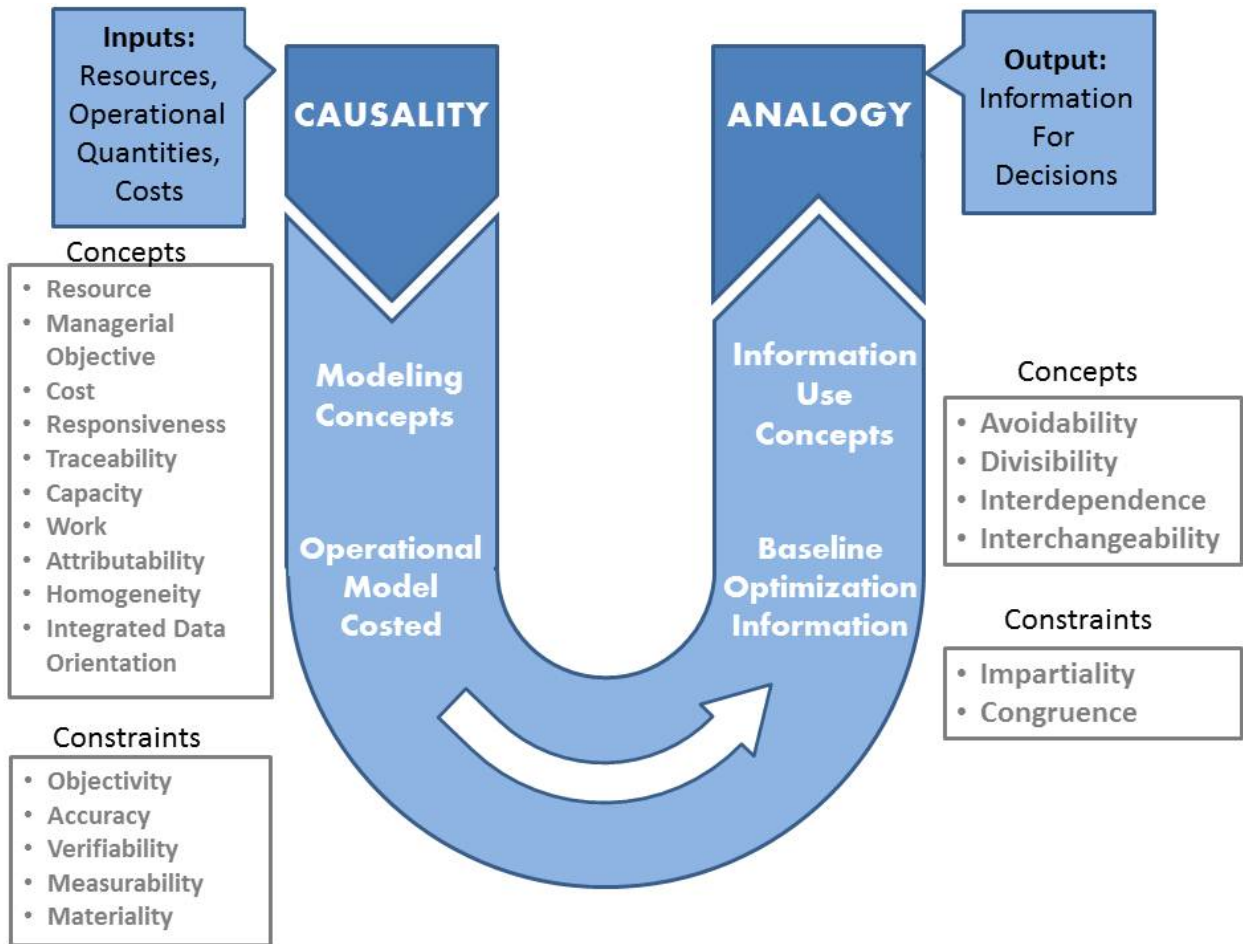
This constraint recognizes that cost information is not the only factor in decision making; however, cost information and the supporting cost model should facilitate congruent action from an objective, quantitative perspective.

Constraints for Managerial Costing

<i>Modeling Constraints</i>	
Objectivity	A characteristic of a cost model that shows it to be free of any biases.
Accuracy	The degree to which MA information reflects the concepts you intended to model.
Verifiability	A characteristic of modeling information that leads independent reviewers to arrive at similar conclusions.
Measurability	A characteristic of a causal relationship enabling it to be quantified with a reasonable amount of effort.
Materiality	A characteristic of cost modeling that would allow for simplification without compromising managers' decision-making needs.
<i>Information Use Constraints</i>	
Impartiality	The unbiased consideration of all resource application alternatives.
Congruence	The interdependence of individual managerial actions to attempt to achieve both individual and enterprise objectives in an optimal manner.



Summary – Principles, Concepts & Constraints



Conceptual Framework for Managerial Costing

Section IV: The Framework in Operation

Part IV.A: Evaluating a Company's Operations and Strategy for Modeling

Managerial costing is always accomplished in the context of supporting the achievement of an organization's strategic objectives and optimizing its operations toward that end. The managerial costing practitioner must evaluate, understand, and incorporate the organization's strategy and operations into the design and construction of an effective managerial cost model and apply the resulting decision-support information effectively.

Where to Start

Current operations serve as the foundation for optimization information for the following three reasons. First, at any point in time the organization's current investments (resources deployed), its value chain, its products/services, and its market segments and customers equate to the status quo, and collectively they are what managers are tasked to use to achieve strategic objectives. Second, whenever change is to be introduced, managers begin with the status quo as the baseline in their decision making (that is, any change must demonstrate a net incremental gain). Third, in evaluating decision alternatives, managers' best guidance as to future outcomes is often provided by their understanding the cause and effect relationships inherent in the conversion process they are attempting to influence and improve.

Enterprise Optimization – Context, Aim and Scope

Managerial decisions that select optimal outcomes are the primary drivers for best achieving strategic objectives. In turn, decision making is influenced by three characteristics of a company's optimization environment that must be considered in managerial costing conceptual design—context, aim, and scope.

The Context of Optimization Decisions

All optimization decisions occur within an industry environment, a competitive situation, and the company's own current conditions and disposition. This is the company's optimization *context*, and it determines the nature and frequency of the types of decisions its managers will make. For example, within its context, selecting a new facility location could be strategic to one company (e.g., Toyota opening a new truck plant in Texas) and tactical to another (e.g., Starbucks opening another store on a corner one block away). Similarly, one more unit of output will be an operational decision for one company (e.g., an additional batch of dough for the local bakery) but a strategic decision to another (e.g., Boeing considering whether to make a B737 or divert the resources to B787 Dreamliner production to regain its competitive momentum vis-a-vis Airbus).

Optimization context provides managerial costing with a frame of reference and dictates the focus for supporting managers. For example, in a distribution business, operational insights are critical to achieving internal efficiency (e.g., receiving, picking, packing, and shipping) and to understand what a profitable minimum order size is. On

the other hand, in an outsourcing business, the mix of products and services (e.g., application hosting, infrastructure, and business processes) structured and priced for a particular deal is often critical. These examples reveal the importance for decision makers of understanding what it entails to arrive at an optimum outcome in different contexts—insight for which managerial costing should be the primary contributor.

The Aim of an Optimization Decision

The *aim* of optimization decisions should not be confused with the decision's *outcome*. *Aim* refers to a managerial action's strategic intent—more specifically, to change strategy (an adaptive action) or to reinforce existing strategy (a corrective action).⁵ *Adaptive actions* alter the company's existing strategy/plan because changes in the internal or external environments nullified prior assumptions. An example is an airline deciding on an earlier implementation of a fleet replacement program due to the effects of global energy demand on crude oil prices. In contrast, *corrective actions* are steps taken to bring an organization back on track with its existing objectives. For example, a competitor introduced a new product, so corrective actions are required to realize the planned market share target, which has fallen short.

The distinction between adaptive and corrective actions is important for managerial costing because of different information requirements for each. *Adaptive* actions are dependent on information that will assist managers in making extrapolations and projections as to future outcomes. Managers are best served by cause and effect information with appropriate structure and detail to facilitate their forward-looking activities. In contrast, *corrective* actions are triggered by information providing insights into the deviation of actual results from the plan or target. Here, the information focuses on actual results and their causes and effects in order to help managers understand what transpired and to guide appropriate corrective actions. The aims of optimization decisions require managerial costing to support planning,⁶ simulation, measurement, and analysis through cause and effect insights. The principle of causality is therefore essential to the effective support of managers' optimization actions.⁷ The historical data is less important than the relationships. Relationships are essential for modeling the future and understanding the past.

Optimization Decisions and Their Scope

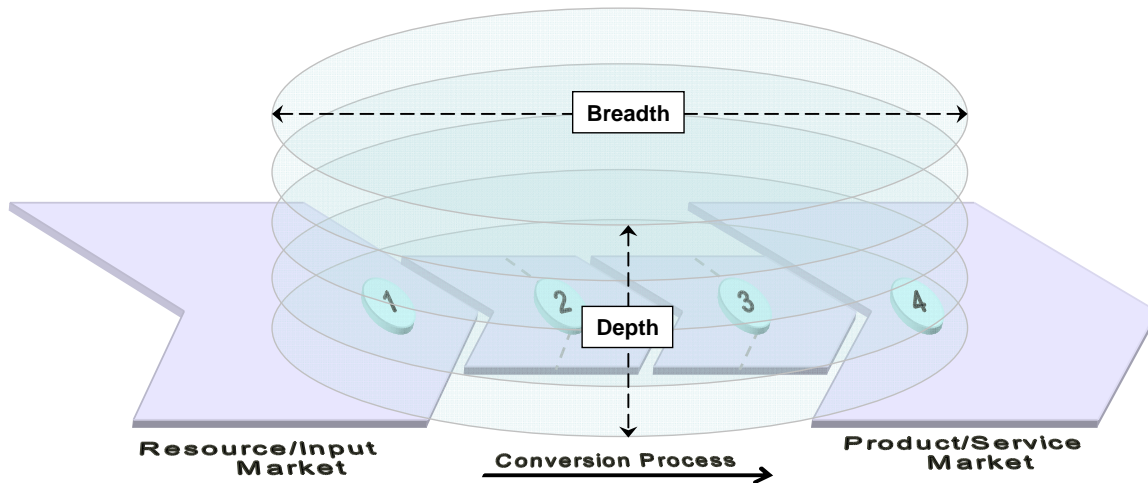
Optimization scope is comprised of two dimensions: (1) *breadth*—the value chain areas targeted by a decision, and (2) *depth*—the extent of cost insights required to fully understand a decision's impact/effects. Figure 14 demonstrates how these two dimensions relate to the conversion process.

5 Shilling law, G. 1982. *Managerial Cost Accounting*. Fifth Edition. Richard D. Irwin, Inc. Homewood, IL. 60430. p. 8.

6 Budgeting is a form of planning. So are rolling financial forecasts. This article does not explicitly discuss them, but they are implicit in the discussion. They are also only one type of decision of the many that management accounting should support.

7 Van der Merwe, A. 2007. Management Accounting Philosophy: Cornerstones for Restoration. The second in the series. *Cost Management*. Sept/Oct Issue. RIA Group. New York, NY.

Figure 14 The Four Optimization Areas and Optimization Scope⁸



Breadth consists of the four value chain optimization areas:

1. *Sourcing resource/input markets.* Here, decisions consider new technologies, methods, and worker/equipment resources, and strive to maximize limited capital resources through asset replacement, investment, sourcing, and outsourcing.
2. *Applying resource/inputs in conversion.* Efficiency is emphasized—doing things right—and decisions address resource application, utilization, realignment or redeployment, process improvements, eliminating waste, and capacity management.
3. *Producing outputs.* Effectiveness is the focus (doing the right things—producing the right outputs). Examples include decisions that deal with product make-or-buy, supporting new product introduction, process improvements, reengineering, and eliminating waste.
4. *Realizing gain from enterprise outputs.* This involves creating the desired outcomes in product/service markets. Decisions cover target markets and market segments, costs-to-serve these, product/service mix, product discontinuance, entering new markets, creating new products/services for existing markets, and market mining.

More incisive decisions typically span more than one value chain area. An example is the introduction of the iPod—a new product creating a new market and requiring new technologies and inputs to produce. For managerial costing, the breadth of optimization decisions dictates the types of managerial objectives⁹ to use and calculate values for in a model.

⁸ Van der Merwe, A. 2007. Management Accounting Philosophy. Filling Up the Moat. Number 3 in the series. *Cost Management*. Nov/Dec Issue. RIA Group. New York, NY.

⁹ In managerial costing, the types of managerial objectives can include those related to resources, work activities, products, service lines, distribution channels, and customers.

Depth is concerned with the information needs related to the magnitude of change that result from optimization decisions. Incisive decisions require deeper insight into causal relationships and the effects they are likely to have. To this end, decision-support information must comprise a range of cost concepts that provides insight into the level of optimization influence. The cost concepts include:

- Throughput costs (when deciding to produce one additional unit within the relevant range¹⁰).
- Incremental costs (the difference in total costs between two alternatives in a decision).
- Short-term proportional costs (when considering the opportunity cost of mutually exclusive uses of resources).
- Attributable costs (for divestment decisions such as a bank outsourcing its information technology function).
- Full costs¹¹ (for strategic decisions, such as a tool manufacturer entering the South American market by establishing a plant in the region).

For managerial costing, optimization context, aim, and scope, therefore, dictate the level of detail for various cost concepts and the level of resource consumption and cost modeling insight that must be provided. Moreover, the principle of causality is essential as the basis for cost information; managerial activities are heavily dependent on causal insights, and the accompanying monetary information managers rely on must naturally be based on the same principle. In the outsourcing business example above, insights key to success are resources' (servers and network infrastructure) attributable costs and the demand patterns for resource outputs (e.g., processing power and bandwidth) and their incremental costs.

A cost model must generate decision-support information that appropriately addresses the context, aim, and scope associated with an organization and its strategy. The application of the managerial costing framework principles—causality and analogy are universal. However, the management accountant will need to make appropriate choices and trade-offs among the framework's concepts and constraints in order to find the correct balance and focus for any particular organization.

10 The *relevant range* is an economic term typically meaning a range where changes in demand levels require proportional changes in consumed material but not in the worker or equipment level.

11 Often referred to as fully absorbed or fully loaded costs.

Part IV.B: Model Design & Construction

Cost modeling entails the following six steps:

- A. Identify the resources (and their costs) the organization retains for its use.
- B. Identify the managerial objectives required to support managers' needs.
- C. Develop an understanding of the cause and effect relations between managerial objectives.
- D. Design a model that captures the managerial objectives and their causal relationships.
- E. Provide a description of the model to include its scope, intended uses, required inputs, outputs, and underlying assumptions and limitations.
- F. Apply and maintain the cost model.

A. Identify the resources (and their costs) the organization retains for its use.

In cases where integrated data orientation is lacking, an organization's general ledger is a good starting point, usually adequate for identifying the costs of resources it procures and the expenses for them.¹² Additionally, an understanding of each type of resource's inherent characteristics is needed, which starts with an understanding of the physical entities that managers oversee and about which they make application decisions. Specifically, a modeler needs to understand each resource's output, storability, and cost behavior characteristics. The latter refers to how the resource's various cost components behave in relation to its output (that is, whether the cost change is proportionate to output or remains fixed—the concept of responsiveness).

B. Identify the managerial objectives required to support managers' needs.

A cost model reflects the reality of an organization's resources, the work and outputs of the resources, and how the work and output are consumed in producing intermediate and final outputs. One must understand an organization in all these respects in order to establish managerial objectives that are representative and will provide useful causal insights and related cost information.

Managerial objectives can be grouped into three tiers:

- Tier 1 is for resources and their outputs, which comprise resource pools and activities/processes.
- Tier 2 is for products and services, including production orders, service orders, and projects.
- Tier 3 is for result segments, including entity level (for example: plant, business unit, or legal entity), market segment, and target market cost objects. In "for profit" entities, these managerial objectives also generate revenue to enable profitability management.

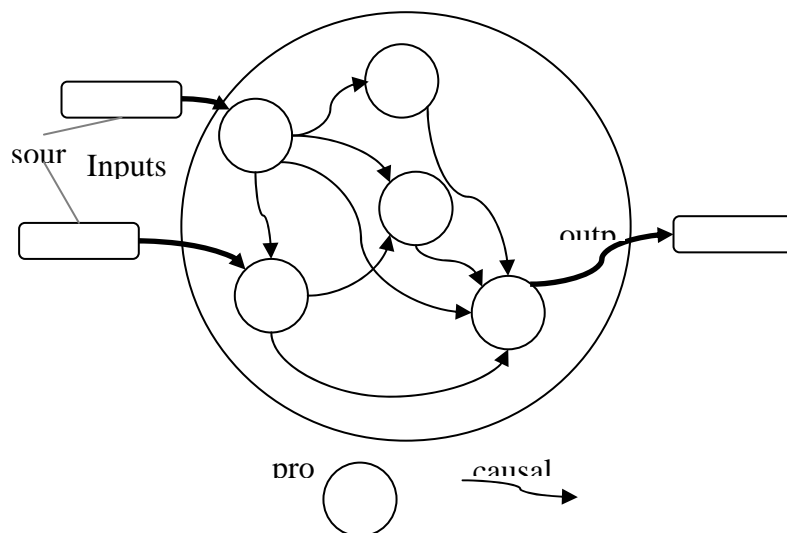
¹² However, the general ledger is inadequate for many other cost modeling needs.

As discussed in Part IV.A of the framework, the particular managerial objectives a modeler will employ are determined by managers' analogous needs. That is, managers' planning, analytical, decision-making, and optimization needs determine which of the above managerial objectives are used and at what level of granularity they are established. At the very least, they should correspond to individual managers' areas of responsibility.

C. Develop an understanding of the cause and effect relations between managerial objectives.

Resources, captured in first-tier managerial objectives, are used to provide outputs that represent ultimate managerial objectives as well as outputs that become inputs used in achieving intermediate managerial objectives. In managerial costing, this system of inputs, intermediate outputs, and ultimate outputs must be understood and modeled. The model captures an organization's cause and effect relationships, which (in turn) serve as the basis for assigning resource costs through the model. Figure 15 is an example of input and output causal relations within such a system.

Figure 15: Inputs and Outputs Within a System¹³



D. Design a model that captures the managerial objectives and their causal relationships.

Equipped with an understanding of the organization, its objectives, managers' needs, its resources, their activities, and outputs, a management accountant can begin the tasks of designing an adequate representation of the relationships between resources and their consumers, expressed in quantitative input–output relationships. Once this quantitative model is established, resource costs serve to value the model in decision-appropriate monetary terms.

¹³ Adapted from George Mobus' "Question Everything". World Wide Web: <http://questioneverything.typepad.com/>. Retrieved January 6, 2011—although, there is nothing particularly novel about Mobus' graphic.

A set of illustrations is provided in Section G (below) that will shed more light on this step in the conceptual design. The scenarios presented discuss some of the most common cost-determination challenges, relating them to the concepts presented in the framework.

E. Provide a description of the model to include its scope, intended uses, required inputs, outputs, and underlying assumptions and limitations.

It is crucial that users of cost information understand not only the principles inherent to their cost model's conceptual design but also what the underlying assumptions are that went into constructing the model and the model's limitations. For example, if financial depreciation is used, users must recognize the limitations of the model in providing insight into product life-cycle profitability and the compromises in product/service gross margins due to the forced and often much shorter asset life used in financial depreciation compared to the actual economic life of the asset. That is, while the asset is being depreciated, products/services will be over-costed, and once the asset is fully depreciated, products/services will be under-costed.

F. Apply and maintain the cost model.

By feeding resource costs and output quantities into a completed model, one can calculate costs for the various managerial objectives specified. These costs, then, are available for use in monitoring and decision-making activities. Keeping the model current, including adapting it to managers' changing analogous needs, is a vital part of consistently providing managers with relevant information. In model conceptual design, the constraints in the framework related to modeling (e.g., measurability and materiality) and to managers analogous needs play an important role in curbing the size and complexity of the model. Countless managerial costing initiatives have failed because modelers were oblivious to what it would take to maintain their unrestrained conceptual design effort.

Illustrative Scenarios for Designing a Cost Model

In order to illustrate applying the conceptual framework in designing a cost model, we will use the simplified setting of an airline as an example. We will work only with a subset of the airline's resources and managerial objectives—just those necessary to illustrate some key points.

For these purposes we will consider only three resources:

- Aircraft fuel
- Pilots
- An Aircraft

Only four managerial objectives will be considered in the illustrative example:

- Operate Flight 123.
- Provide a trip for a coach class passenger to Destination X.
- Operate a daily flight to Destination X.
- Serve Destination X with a daily frequency of flights and two passenger classes.

Our discussion here will follow a progression intended to be easily followed that addresses the managerial costing concepts identified in the two categories used in the framework, namely, Modeling Concepts and Information Use Concepts. Although this part of Section IV is primarily concerned with model design and construction, we are including a limited application of information use concepts to clearly delineate concepts that can be confusing, in particular, causality (a modeling concept) and avoidability (an information use concept).

The concepts that will be illustrated are:

- Modeling Concepts
 - Managerial Objective
 - Resource
 - Traceability
 - Responsiveness
 - Integrated data
 - Homogeneity
 - Capacity
 - Attributability
- Information Use Concepts
 - Divisibility
 - Avoidability
 - Interchangeability
 - Interdependence

This subsection begins by introducing a resource required to achieve a particular managerial objective—aircraft fuel to provide a specific flight. From there we alter the example by changing the assumption about how the airline acquires fuel. In order to cover other concepts, the discussion proceeds to add an additional resource, pilots, and an additional managerial objective, which will bring the airline’s customers into focus. That is, this discussion starts with product-costing before extending to result segments. These scenarios will allow us to touch upon all the concepts in the framework.

In the fuel resource discussion, we will address characteristics inherent in the resource itself and in the manner in which it is consumed by the airline. This will facilitate a discussion on types of resources and their characteristics that are important to optimization. With the discussion of airline pilots, in addition to introducing the need to provide cost information about a second managerial objective, we will address some common capacity issues.

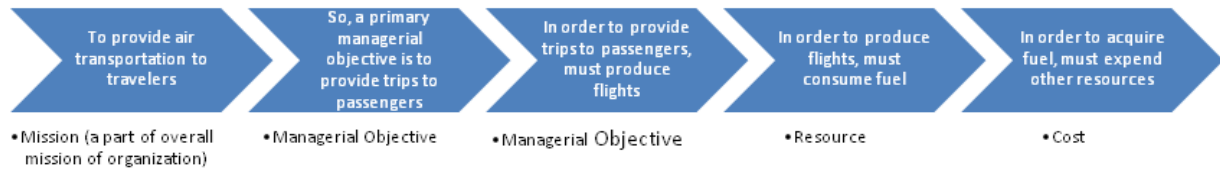
Scenario 1. Fuel for Flights with Fuel Purchased for Each Flight.

Let’s assume that an airline purchases fuel for each flight in exactly the quantity required to perform the flight; that is, prior to each flight, the airline purchases from the outside supplier the fuel required to fly to its next airport directly. Let’s further assume that the fuel provider invoices the airline for each flight’s fuel.

In order to produce a flight, the airline consumes fuel, a resource. The economic value sacrificed by the airline to acquire the fuel is represented by cost. The path to costs in

this scenario of necessity leads from the airline’s mission through one of its managerial objectives. Figure 16 depicts a path from the airline’s mission to its fuel costs.

Figure 16: From Mission to Cost: Resources Are Consumed, and Costs Incurred, to Achieve Managerial Objectives.



Part of the mission of the airline is to provide air transportation services to travelers. So a primary managerial objective is to provide trips to passenger-customers. In order to provide trips to passenger-customers, the airline produces flights, flying airplanes between airports. In order to produce flights, the airline consumes fuel. In order to acquire fuel to produce flights, the airline incurs costs.

Applying Modeling Concepts in Scenario 1

Managerial Objective. An airline manager would be interested in knowing, “How much does it cost to produce Flight 123?” and, more specifically, “How much is the cost of fuel required for Flight 123?” The managerial objective of interest in this scenario is, therefore, “Flight 123.” Notice how the manager’s analogical needs feature in establishing the managerial objective for Flight 123. For him to make a profit on Flight 123 or forecast future fuel costs, he needs this information.

Resource. A serviceable aircraft is the first resource the manager needs. In our scenario, the second is fuel. These two resources are examples of the two categories of resources the management accountant has to model. The first category is those with capacity and highly perishable outputs (e.g., the aircraft with flight hours as its output). This type of resource will be discussed in more detail in Scenario 2 when we introduce the pilots. The second category is resources that can be stored and used when required. Resources of this class are typically direct materials—jet fuel in our scenario. It is important to note that because fuel is a direct product cost in Scenario 1, the modeler does not have to establish a managerial objective for fuel.

Traceability. In Scenario 1, the airline receives a separate invoice for the fuel provided for (and consumed during) Flight 123, and the fuel costs are traceable to Flight 123. In situations like this, a cost modeler seldom needs to consider any cost determination method beyond simple tracing. In order to determine the fuel cost of each flight, the airline merely needs to identify the fuel provider’s invoice for each flight and post the invoiced cost accordingly.

Responsiveness. In this scenario, the responsiveness of the quantity of fuel consumed to flight output is not a complicated factor in cost modeling. Nonetheless, note that the relationship between fuel costs and flights is highly responsive. Each additional flight hour results in the consumption of additional fuel. Fuel consumption, and therefore fuel costs, have a proportionate responsiveness relationship to Flight 123’s output, as opposed to a fixed relationship.

Applying Information Use Concepts in Scenario 1

Divisibility. Aircraft fuel is a highly divisible resource; it can be divided into very small quantities. In Scenario 1, high divisibility creates the opportunity for the airline to avoid much of the cost of Flight 123 should the airline decide to not produce the flight.

Avoidability. Fuel costs, in Scenario 1, are easily avoided by the airline by choosing not to produce Flight 123. That is, if the airline chooses to operate Flight 123, it will consume fuel for which it will need to expend other resources. If the airline were to choose not to operate Flight 123, it would avoid the cost of fuel.

Scenario 2. Fuel for Flights with Fuel Purchased in Bulk Quantities.

Now, let's modify the assumption about the manner in which the airline acquires fuel. Instead of acquiring fuel flight-by-flight, assume that the airline purchases fuel in large shipments (at least larger than the quantity required for a single flight). The airline stores the fuel and loads the required quantities for each flight.

Further assume that the airline's fuel provider invoices for each bulk shipment and that the airline's enterprise resource planning (ERP) system captures and stores the quantities of fuel loaded prior to each flight. As with Scenario 1, assume that the amount of fuel remaining onboard after each flight is either insignificant or a constant amount.

Applying Modeling Concepts in Scenario 2

Managerial Objective. In this scenario, fuel is a resource that justifies having one or more dedicated managerial objectives. This is because a variety of additional resources now need to be acquired, planned, managed, and paid to get the fuel onboard the aircraft. These other resources include storage facilities, refueling trucks, personnel to operate equipment and comply with environmental and safety regulations, and so on. The bulk acquisition and storage of fuel, the distribution to flights, and the airline potentially getting involved in hedging to shield itself from fluctuating crude oil prices create a complex optimization challenge that justifies dedicated managerial objectives.

Responsiveness. In Scenario 2, the responsiveness relationships of fuel costs will now include some fixed-cost responsiveness relationships. This is because the storage facilities and the distribution equipment in the airline's fuel infrastructure add a component of fixed costs to Flight 123's fuel cost.

Integrated Data. A conventional accounting system comprised of general ledger, accounts payable, accounts receivable, and so on would not store the quantities of fuel on hand and loaded prior to each flight. An ERP system, though, typically would and makes these quantities available for costing flights.

Traceability. To trace fuel cost to specific flights, internal records of transfers from the airline bulk fuel facility to specific flights must be maintained. Additionally, the inventory of fuel must be continuously valued as fuel is purchased at different prices.

Applying Information Use Concepts in Scenario 2

Divisibility. Fuel is as divisible as it was in Scenario 1. As defined in the framework, a resource's divisibility is an inherent trait of the resource and not something affected by the quantities in which the resource is acquired.

Avoidability. The change in how the airline purchases fuel in Scenario 2 highlights an interesting aspect of avoidability, namely, that there is often a time dimension to the ability to avoid a cost. In this instance, because of how the airline purchases fuel, it will only see the cash benefit of the cancelled flight's fuel the next time it buys—a little less—bulk fuel. In contrast, in Scenario 1 the fuel cost was avoidable and the cash benefit was realized at the time the flight was scheduled or very soon thereafter.

Scenario 3. Pilots for Flights.

Now, we introduce a second resource, pilots. Assume the airline acquires pilot time by employing fulltime employees—pilots. Further, assume the airline produces flights that exactly occupy all pilot time acquired and that all pilots possess the same technical qualifications and receive the same pay.

Applying Modeling Concepts in Scenario 3

Managerial Objective. Similar to fuel in Scenario 2, modeling pilot costs requires specifying at least one managerial objective. This resource pool will have the output of block hours. Block hours start from push back at the departure gate and end when parking at the arrival gate (that is, the time a pilot is occupied producing a flight). Assume the FAA limits pilots to 60 block hours per month. If the airline has 10 pilot-employees, the annual capacity of the pilot resource pool will be 7,200 ($60 * 12 * 10$) block hours. All the inputs (and their costs) required to produce block hours will be accumulated in the pilot resource pool, including pilot salaries, fringe benefits, certification allowances, uniforms, training, facilities, transportation, lodging and meals away from home base, and the costs of other internal support resources such as Human Resources and Purchasing.

Responsiveness. The responsiveness of pilot costs will have both fixed and proportionate relationships to their block-hour output. For example, required simulator training time results in fixed pilot salary costs, while salaries paid for block hours flown are proportionate to the pilot resource pool output. This means that a pilot block hour will have a fixed component and a proportional component to its rate.

Traceability. Airlines must keep meticulous records about pilot block hours flown, pilot assignment, and pilot utilization to ensure compliance with FAA regulations. Pilot block hours are, therefore, traceable to specific flights and serve as the basis for assigning block-hour costs to flights.

Homogeneity. In this scenario, because the technical qualifications and salaries of pilots are all the same, the same block-hour rate applies for all pilots.

However, if pilots were not homogeneous, for example, some pilots had a much higher pay rate, then a cost modeler should consider pooling the higher-paid pilots into their own resource pool based on the concept of homogeneity. With two or more such homogeneous sets, pilot costs per block hour would differ. Individual flights are then assigned pilot costs using the appropriate pool's block-hour rate. This distinction adds value if there is a real difference in how the different pilot's block hours are consumed by flights.

Applying Information Use Concepts in Scenario 3

Divisibility. The resource is only divisible if a change in output is large enough to make the resource as a whole surplus to requirements. Cancelling a single flight that would have consumed eight block hours means the pilot will sit idle. A pilot resource is only divisible if long-term flight schedule changes result in the demand for block hours decreasing by at least 720 block hours (that is, the annual capacity of a pilot).

Avoidability. Since the pilot resource is not divisible, any reduction in block-hour demand will result in both the fixed and proportional cost per block hour being

unavoidable to the airline. Conversely, a divisible pilot resource would mean that the proportional costs, as well as some of the fixed costs, for 720 block hours become avoidable. An example of block-hour fixed costs that will be unavoidable are pilot facility space (e.g., the pre-flight briefing room space costs), which will be unaffected by one less flight.

Scenario 4. Pilots for Flights—with Unused Pilot Time Each Day.

Now, let's modify the assumption that the airline uses exactly all of each pilot's available block hours. Assume that the airline uses two aircraft types for two distinct business segments: (1) short-range aircraft for domestic flights managed by a domestic business unit, and (2) long-range aircraft for international flights managed by the international business unit. This requires two different sets of pilots based on aircraft certification. That is, for Scenario 4, assume that the airline uses some, but not all, of the available pilot block hours for each set of pilots. This might happen because of the airline's choices about what flights to operate or as a result of adverse impacts on the planned flight schedule such as poor weather conditions.

In this scenario, not all block hours available are consumed. Some pilot block-hour costs will be left unassigned; these represent hours of excess or idle time not assigned to any specific flight, such as Flight 123. Based on the principle of causality, only the block hours required to produce Flight 123 were assigned to that specific flight cost object.

Applying Modeling Concepts in Scenario 4

Capacity. The demand for pilot capacity imposed by the airline's flight schedule is less than the available pilot capacity. As alluded to under Scenario 3's Managerial Objective discussion, the pilot resource pool must be managed and optimized for the available capacity and the costs of pilot block hours. The cost determination challenge here is what to do with the cost of the pilot capacity that is unused.

Attributability. Applying the principle of causality, the pilot time acquired in excess of that needed to operate flights cannot be assigned to individual flights produced. Instead, in accordance with framework principles, the cost of excess block hours is accounted for using the concept of attributability.

In Scenario 4, pilots are interchangeable across all flights of their business unit—short-range pilots for the domestic business unit's flight schedule and long-range pilots for the international business unit's flight schedule. The appropriate level of attributability for excess/idle pilot block hours for each of the pilot resource pools is, therefore, the respective business unit's gross margins. If certain aircraft types were dedicated to specific routes, it would be possible to assign excess/idle pilot block-hour costs to a lower-level managerial objective and manage block-hour capacity and utilization at, for example, the route profit-and-loss level. In contrast to the common practice of spreading excess/idle capacity costs to lowest-level products (e.g., Flight 123's block-hour cost)—and hiding it—the concept of attributability applied in the manner described ensures that key optimization metrics are visible and highlighted at the level where they are managed.

As an aside, and to demonstrate the flexibility a modeler sometimes has in cost model design when applying framework concepts, consider how pilot standby capacity should be included in the airline cost model. Is standby time, which incurs a separate standby allowance cost, part of idle time? Should standby costs be assigned to flights based on the principle of causality (that is, flights that draw on the standby pool are documented and can be charged accordingly), or should standby costs be assigned, using the concept of attributability, to a specific result segment similar to excess/idle

capacity? The modeler likely has at least the following three options to incorporate standby capacity into the airline's cost model:

1. Treat standby capacity and related costs similar to excess/idle costs and highlight it as a separate line item in the business unit profit and loss statement. In this way, standby capacity is managed on an exception basis, such as when its costs exceed a certain threshold number (e.g., a percentage of productive block hours flown).
2. Collect the standby hours and related costs in a dedicated managerial objective for managing standby capacity. If this method is selected, a procedure for costing is needed, such as charging flights that draw on the standby pool.
3. Treat standby capacity costs as a cost of doing business. That is, calamity can befall any pilot on his way to work or any flight schedule, and having pilots on standby to prevent an escalating ripple effect from such events throughout the network necessitates having standby capacity. As a cost of doing business, standby capacity costs can be included in the pilot block-hour resource pool and included as part of the fixed-cost component for each block hour charged to flights.

Which alternative is the most appropriate? The cost modeler should not make this decision on his own. Instead, as will be discussed in Part IV.C, to facilitate manager acceptance of a cost model and ensure that their analogous needs are met, managers should be consulted in determining model outputs.

Work. Scenario 4 also lends itself to demonstrating the application of the concept of work. Assume that the airline is operating significantly below the industry standard for pilot block hours flown per year but does not have much excess/idle capacity. The manager would like more analytical insight into how much time pilots spend on various activities. In this case, the modeler might employ the activity-based costing concept of work and define the types of activities pilots spend their time on—such as executing a flight, training, dead heading (that is, repositioning between airports to start a new flight), laying over away from home base, and standing by. With this additional analytical insight, managers could assess factors related to pilot work efficiency. For example, the effectiveness of flight crew schedulers in assigning pilots to service slots could be assessed.

This additional analytical insight would come at an increased cost and result in a more complex model. A cost modeler must weigh the added benefits and costs of the additional model detail, complexity, and maintenance.

Applying Information Use Concepts in Scenario 4

Interdependence. To illustrate the difference between causality (the principle in model construction) and interdependence (a key concept in decision making and information use), assume that the manager gets the information on all the activities pilots are involved in and how much time they spend on each activity. He concludes that flight crew scheduling is the likely source of the problem. Upon further investigation, the manager determines that an antiquated scheduling software application prevents flight crew schedulers from responding in an optimum manner to sudden changes in the flight

schedule. In the event of one or more disruptions, such as weather delays, unscheduled aircraft changes, or delays due to an air traffic control override, the scheduling software invariably causes an inordinate amount of pilot dead-heading and layovers. Layovers result because pilots reach their short-term on-duty limits while out on a route and must be taken off duty away from home base. This, in turn, increases meal and lodging costs and has even resulted in aircraft changes because only pilots certified on a different aircraft were available to take over. Thus, a snowball effect often wreaks havoc in crew scheduling.

When the manager raises the issue with the scheduling supervisor, she reminds him that she had requested a new flight crew scheduling software application two years ago, but the airline's capital investment board had given the project low priority. It was not funded. The decision to not invest in a new software application was taken without insight into all of the *interdependencies* that exist in the airline's flight network. With the insights from a new managerial costing system, the manager will now be able to demonstrate the interdependencies related to the decision and the need to replace the existing scheduling application. Interdependencies are reflected by cause and effect relationships, but these differ from normal operational causal relationships that are explicitly modeled in the cost model because interdependencies often relate to abnormal operational circumstances or suboptimal operations, as in the scheduling example. In using managerial cost information, managers should consider interdependence, whether evident implicitly in cost information (but still requiring interpretation as in the scheduling example) or not evident at all, such as for qualitative cause and effect relationships (low pilot morale due to continued suboptimal scheduling).

Scenario 5. Pilots for One More Flight.

Assume that the airline has upgraded its flight crew scheduling application and now makes much better use of its pilots. This has resulted in more excess/idle pilot block hours. Further assume that an airline manager is considering the possibility of producing one more flight on the Destination X route utilizing some of the unused block hours.

Applying Modeling Concepts in Scenario 5

None. The decision in Scenario 5 can be evaluated with the model as constructed.

Applying Information Use Concepts in Scenario 5

Avoidability. The cost of fuel required to operate the additional flight can easily be avoided by not operating the additional flight. As far as pilot costs are concerned, the flight can be produced using pilot block hours that would otherwise go unused (that is, the related block-hour costs are unavoidable). Since the pilots required to operate the additional flight are already employed and will obtain no more pay as a result of operating the additional flight, the pilot compensation associated with the additional flight are sunk costs and not relevant to a decision about whether one more flight is economical to operate. In fact, the lucrative nature of decisions that can use existing idle capacity (and its sunk costs) is highlighted by the contribution to profit compared to a scenario where two new pilots would have to be employed to produce the additional flight; in the excess/idle scenario the contribution to profit is significantly higher—by at least the amount of two pilots' total compensation.

Interchangeability. Note that an assumption of resource interchangeability underlies the decision in Scenario 5. In part, the lucrative nature of the opportunity exists because pilots are interchangeable. That is, pilots can be assigned to the new flight without any cost impact on other flights. In the case that pilots were not interchangeable, the cost effects on other flights would have to be included in the analysis of the new flight opportunity.

Scenario 6. Adding the Customer Dimension.

The airline provides each flight with the intention of providing airport-to-airport trips for several customers simultaneously, including business class customers, coach class customers, and freight customers. Further assume that the airline provides only nonstop, single-flight trips to its customers. And for this scenario, let us follow the original, simple fueling assumptions for other flight costs: (1) that the airline purchases fuel and pays for navigation and landing for each flight, and (2) that the respective providers invoice the airline for each flight's fuel and services.

Applying Modeling Concepts in Scenario 6

Managerial Objective. As illustrated in Figure 17, managerial objectives are established for each of the three types of customers the airline serves. These cost objects reflect the revenue from these customers and the respective causal costs that can be assigned to each managerial objective. A higher-level managerial objective for

Flight 123 is also established and contains all the flight's causal costs. As indicated by the arrows, the contribution margin and gross margin for the flight are obtained by subtracting flight costs from the sum of margins of the three customer cost objects. This tiered or cascading view of managerial objectives is typical of result segments and is easily accommodated by multi-dimensional slice-and-dice OLAP tools when a cost model is designed to collect the information.

Consider that the cost objects for each day of the week can be summarized into a route cost object and, in turn, all routes to Destination X can be summarized into a destination cost object. In this way, various attributable costs can be incorporated into margins at each level; for example, the costs of the business class lounge at Destination X, which will be attributed for inclusion in the Destination X attributable margin. Moreover, the airline can compare the profitability of Flight 123 on Mondays with other days of the week or the profitability of customer types (e.g., coach class) for different days of the week or even different months (that is, seasonally).

Figure 17: Tiered Managerial Objectives for An Airline

Business Class			Coach Class			Freight		
	<i>Marginal</i>	<i>Attributable</i>		<i>Marginal</i>	<i>Attributable</i>		<i>Marginal</i>	<i>Attributable</i>
Revenue	\$30,000	\$30,000	Revenue	\$120,000	\$120,000	Revenue	\$45,000	\$45,000
Meals	750	750	Snacks	750	750	Pallet		150
Entertainment		2,000	Entertainment		1,000	Loading	250	2,500
Cabin Crew	960	2,080	Cabin Crew	2,880	6,240			
B/Class Margins	\$28,290	\$25,170	Coach Margins	\$116,370	\$112,010	Freight Margins	\$44,750	\$42,350

Flight 123		
	<i>Marginal</i>	<i>Attributable</i>
Fuel	50,000	50,000
Navigation	5,000	5,000
Landing Fees	2,500	2,500
Flight Crew	2,000	4,400
Maintenance	2,400	8,000
Aircft Depreciation		19,200
Flight Margins	\$127,510	\$90,430

Traceability. Fuel costs and other flight costs are not directly traceable to a specific customer. Attempting to allocate flight costs to the customer-level cost objects would result in an arbitrary allocation that seriously compromises managers' causal insights. Clearly, landing fees, navigation costs, and so on are flight costs and relate to operating the flight and not whether one more customer is served.

Applying Information Use Concepts in Scenario 6

Avoidability. Using a cascading set of managerial objectives as in Scenario 6, managers are provided clear insight into inputs (and their costs) that are potentially avoidable at each level of causal assignment; that is, for each managerial objective. Of course, such strict adherence to the principle of causality means that a full cost view (arbitrary as it would be) is not available at the customer level.

Given the traditional use of managerial costing to generate final product or service costs for financial reporting based on full absorption of cost, many managers might not be comfortable with cascading margins and a strict adherence to the principle of causality. In this regard, there are a few things to note:

1. Arbitrary full absorption to the customer level for the airline creates the illusion of causal insight. In reality, arbitrary cost allocations leave managers with no clear cause and effect insights and compromise the use of real causal inputs and their costs if they are mixed with non-causal allocations.
2. Using cascading margins, managers are equipped to use relative margin analyses to identify business segments, at any level, for rationalization or profitable exploitation. For example, in a cost-cutting initiative the manager might compare Destination X with Destination Y. Managerial costing information compiled based on the framework principles and concepts will clearly highlight the avoidable costs for each – for example, the respective business-class lounge costs. Had the modeler resorted to traditional full-absorption costing he or she would have, at best, spread all business-class lounges' costs to business class passengers obscuring this crucial insight. Often the method employed to spread costs determines which product or segment will be a candidate for elimination. The selection of method can hide the real operational characteristics that ultimately drive profitability.
3. All avoidable costs for a particular decision alternative are also always causal costs on the managerial objective under consideration. Stated differently, non-causal cost allocations are arbitrary and defeat proper analysis to determine their behavior as it relates to a particular decision alternative. Arbitrary full absorption to the customer level for the airline creates not only the illusion of causal costs but also the illusion of potential avoidability. As pointed out, flight costs are simply not avoidable at the customer level, so what purpose does it serve to allocate flight costs in this way? From a managerial costing perspective, none. Departing from the framework principles compromises managers' decision-support information and their ability to optimize enterprise operations.

Part IV.C: Implementation Factors

Implementing a managerial costing approach requires much more than understanding and applying the principles, concepts, and constraints articulated in this framework. The management accountant will need to lead or serve as part of a cross-functional team to address a wide variety of technical, managerial, and social/cultural issues that can impact the effectiveness of an organization in using managerial costing to improve its information for decision making. Cost information is a critical component of an organization's performance information and the decisions made with improved cost information will have an impact on everyone and every aspect of the organization.

A comprehensive discussion of all the implementation factors is beyond the scope of this section; however, a brief overview of some key factors is provided as a guide toward planning an effective project and building an implementation team. Further research and the acquisition of greater expertise in each of these areas are recommended for any organization planning a managerial costing initiative. As will be obvious by the breadth and diversity of issues, the introduction and implementation of a managerial costing approach in an organization requires expertise that is normally only available from a team effort.

Conceptual Design of the Managerial Costing Model and Solution

While managerial costing ultimately requires a software solution, it cannot be emphasized strongly enough that software selection is not the way to start implementing a managerial costing project. As discussed in Part IV.A, the first step is to understand the types of decisions the managers in your organization need to make in order to optimize their operations and achieve the organization's strategic objectives. This requires gaining a deep understanding of your organization's operations and helping managers and organizational leadership look beyond the financial information they currently use. What cost information is needed to drive the organization's performance?

Conceptual design for managerial costing models must recognize that managerial costing is fundamentally different from its cousin, financial accounting. Managerial costing is an analytic application, while financial accounting is transaction- and regulatory standards-driven. This means managerial costing must adapt to an organization's decision needs, its processes, and its resource composition rather than a specific prescriptive external reporting standard. As mentioned earlier, financial accounting is about *valuation*, and in contrast managerial costing is about *creating economic value*. The principles, concepts, and constraints identified in this framework are reference points to consider when designing a managerial cost model for an organization.

The basic approach to conceptual design is as described in Section IV Parts A and B:

- Gain an understanding of your organization's strategy and operations.
- Identify the optimization decisions that are regularly made at the various managerial levels throughout the organization.

- Identify the resources and their application to be optimized in the key productive processes in your organization related to those core decisions.
- Identify the support resources that interact with and enable the productive resources.
- Group resources into homogeneous resource pools, define their output quantities, and if required based on manager's analytical and decision support needs, express some of these resource outputs using activities.
- Map resource costs to each resource pool and capture the resources' cost characteristics in cost classifications.
- Use the concepts in this framework to streamline the model of the resources used and the monetary values that flow from them through the various consumption relationships to outputs.

Managing the Introduction of a Costing Approach

Project management is rapidly achieving a level of professionalism thanks to its growing importance in today's complex and competitive business environment. Implementation of a managerial costing approach is complex and touches most components of the organization in a significant way. Without constant pressure on a managerial costing project's balance between cost, schedule, and performance, the project runs the risk of getting swamped by requirements growth, scope creep, or stonewalling.

Managerial costing initiatives, like most well-designed projects, should be segmented into smaller phased deliverables that can be assessed and approved by senior management on a regular basis. This keeps both the project staff and the rest of the organization focused on completing segments of the project. It is easy for managerial costing efforts to become trapped by escalating requirements and complexity or idealistic demands of managers who do not appreciate the cost of information. The improved information from more incisive managerial costing will lead to more sophisticated questions and demands for more in-depth modeling efforts. The project team and organizational leadership need to be prepared for this and focus on ensuring that the entire organization gets the benefit of the improved information before the project gets stuck in any one area.

Management is a process of continual change and improvement, and the cost system will also need to change over time. The objective of project management is to ensure improvement efforts are achieved, implemented, and become part of new business practices.

Software

As mentioned earlier, it is extremely important that the selection of software not be the initial step in a managerial costing project or that the software's capability not dictate the conceptual design. The development of a conceptual design for an organization's managerial costing must always precede an evaluation of software alternatives. This is true even if you already have an enterprise resource planning (ERP)

suite in place. Managerial costing has historically suffered from two substantial impediments:

1. It has been implemented primarily to support external financial reporting costing requirements, what the framework defines as cost accounting. The problems associated with the differing principles, objectives, and audiences for external financial reporting were discussed in the Introduction to the framework. Managerial costing is focused on providing information for use inside the company to create competitive advantages in the marketplace. This requires significantly more granular and analytically supportive information.
2. Managerial costing solutions have been software-driven. This has inhibited the conceptual design phase of managerial costing because the tendency has been to move toward software implementation and making the organization's needs "fit" the selected software capability.

Software will be needed for managerial costing, but it is critically important to first examine your organization's use of the principles, concepts, and constraints outlined in this framework. Evaluate and consider how they may apply to your organization's strategy and for your optimization needs, build a conceptual design, and then start to examine software alternatives to support your conceptual design—whether you own software or must acquire it.

Managerial costing is typically done using three general types of software:

1. Enterprise Resource Planning (ERP) Software—Large-scale software with integrated modules. For managerial costing, an ERP system used in both logistics and finance may serve as an effective foundation for cost information. An ERP system used only for financial accounting and reporting may not have the resource and logistical information this framework considers a necessary foundation for managerial costing. However, operational systems such as manufacturing enterprise solutions in the manufacturing industry may be a rich source of the necessary operational data.
2. Best-of-Breed Managerial Costing Software—A number of specialized software solutions exist for specific managerial costing approaches. Most integrate with ERP, financial, logistics, and operational systems. Over the years, many of the large ERP software vendors have purchased one or more of these solutions and they may be usable as independent modules.
3. Business Intelligence Software—This software focuses on integrating data across the enterprise and typically requires creating calculation engines to support managerial costing. This class of software works well for organizations that are small with simple needs or are large with unique needs and the expertise to develop solutions.

Whichever path is chosen, software will likely constrain the management accountant's conceptual design and model for a costing solution. It is important to understand your requirements so that you can assess the constraints and benefits of the software tool you select.

Data

This framework places a great deal of emphasis on operational data about the processes and resources within your organization. Implementing a managerial costing approach based on this framework requires gaining familiarity with the operational and logistics data and supporting systems in your organization. Such an effort has a significant benefit because it demonstrates for the operational and logistics areas that your approach is to listen and learn about their work environments and challenges.

The types of systems and data vary widely depending on the nature, size, and sophistication of the organization. You may be dealing with highly sophisticated manufacturing enterprise solutions, customer management solutions, or logistics management solutions, or with locally created databases and spreadsheets. The challenge is to apply the principles, concepts, and constraints in this framework to create decision-support information that will be used to improve optimization and performance. This means the implementation team must discover what data is being used as managers at all levels make decisions.

Source data quality is often an issue in managerial costing implementations. The inherent challenge for managerial costing and its extensive use of operational data is that financial accounting information is subjected to an audit in public companies and many other organizations. Logistics and operational data simply isn't; however, the financial data needed to reflect an organization's operations at the level of detail required to achieve causal relationships may need to be more discrete than what is typically available in the general ledger. The implementation team and its sponsor need to understand the different focus of managerial costing as described in Sections I and II, Objective and Scope of Managerial Costing, of this framework. The real test is for the model to build its own credibility by providing information that accurately reflects operational resources and their monetary value and that allows for quicker, more accurate, and more profitable decisions throughout the organization.

Major ERP and business intelligence software vendors with strong integrated data orientation capabilities will make this easier by creating different views of the organization—a financial reporting view, a logistics/supply chain view, an operations control view, and a managerial costing view. These views allow different types of costs to support the different views; for example, different depreciation approaches could be used. The views will clearly identify the differences and allow reconciliation for the differences between them. No matter what your level of sophistication, it is a good idea to document the different assumptions between your managerial costing approach and other financial views of the organization. The differences will become an issue for which a confident and concise explanation should be readily available whenever senior financial or organizational leadership changes.

There is often concern that a cost system that isn't closely tied to the financial accounting system will require a great deal of labor-intensive maintenance. On the contrary, given the importance of operational information, the concern should be with a lack of operational information generally available to financial personnel. However, the maintenance concern can be overcome by the extensive use of operational and logistics data and tight integration with those systems, a trait inherent in most ERP systems. When operational personnel trust and use the cost information, they will provide more complete and accurate data to keep relevant operational information up-to-date in stand-alone systems. The use of standard cost rates that are regularly reviewed and updated will allow operations to achieve near real-time data at very discrete levels. Most financial processes are relatively slow compared to the real-time nature of operational data that must detect problems before they multiply and create waste and lost customers.

Leadership and Change Management.

The first step in a successful managerial costing implementation effort is to recognize it is not a technical accounting exercise. You are undertaking to change the decision-support—and to a great extent—the performance information throughout the organization. Well over 50%, arguably as much as 90%, of the effort will involve making people feel comfortable and confident about the changing information and the practices to produce the information.

This management of change requires a strong leadership commitment from an executive sponsor in the organization's senior management and also requires the implementation team to think and act like leaders in everything they do. Leaders communicate a vision of a better future—and with inspiration. The first step in communication is to listen to the organization, from top management to first-line supervisors, and understand how the vision of a better future you present can support their vision of a better future. People are normally easier to convince of needed change when they are confident they are understood by someone with (1) the organization's best interest at heart, and (2) clarity about their contribution to the organization's success.

Technical prowess in managerial costing will defeat the team if it is lacking, but it will not ensure success by itself. This framework was written to provide the managerial costing practitioner with a range of options and explanations about how managerial costing principles and concepts can improve decision making in an organization. Creatively applied, these explanations should be useful in explaining the range of choices to users of decision-support information and should allow you to lead them to the choices that make sense for your organization. But again, this can only be done when they have confidence that you understand their needs and objectives.

The topic of leadership and change is obviously far too broad and complex to be covered in a brief overview such as this; however, the topic of overcoming resistance to change faces nearly every managerial costing initiative. Resistance to change is particularly acute for managerial costing because many people in the company, including accountants, simply aren't aware of the problems poor managerial costing is creating. Users and accountants tend to think only about cost accounting, and hence

they view what costing they do as a necessary compliance activity. Often, even accountants don't have the experience or knowledge to generate alternative solutions and improve managerial costing beyond the minimum cost accounting requirements.

One often overlooked but effective approach to addressing and overcoming the natural human tendency resistance to change is to focus on creating discomfort with the status quo. A simple formula to overcome resistance to change is:

$(D \times V \times F) > R$, where R stands for Resistance

Do not underestimate how large the R is; it can be enormous, even if it is relatively passive. Change is hard to get started. Therefore, if any of D, V or F in the equation is zero or small, then their combination will not exceed R. You will need all three factors in great abundance. What do D, V and F stand for?

- **D is dissatisfaction** with the current state. Unless people have discomfort, they will rarely be interested in changing anything. People like the status quo.
- **V is a vision** of what "better" looks like. When people see a different view of their circumstances or a solution that can lead to an improved condition, they will consider changing.
- **F is often neglected** – it stands for "**first practical steps.**" Some may think that having a lot of dissatisfaction (D) with a solid vision (V) is sufficient to overcome that large resistance (R) variable. But large amounts of D and V are not enough. If people think the vision is overly theoretical, complicated, costly or impractical, they will not pursue changes to realize that vision. You need F to make the vision attainable.

So how do D, V, and F apply to gain buy-in for costing reforms? This Conceptual Framework enthusiastically promotes the vision of robust costing methods—the V in the equation. The authors' advice is to also place emphasis on the D. Here is why.

Change will only result when people feel compelled to change. Having high levels of dissatisfaction and discomfort, the D, may likely be the best lever to use to influence your organization. But dissatisfaction is often latent, not overt. It may not be obvious to many in your organization that traditional costing methods are flawed. They presume that since external CPA auditors attested that financial reports are in compliance with regulatory laws, nothing is wrong. But that audit is of the financial accounting system, and we are addressing the managerial costing system. You will need to create discomfort by explaining that there can be cost inaccuracy and lack of visibility of the individual products, services, channels, and customers even though the total costs are accounted for with financial accounting. Again as mentioned, financial accounting is for *valuation* (e.g., inventory costs). It is ruled by GAAP. In contrast, managerial costing is about *creating economic value*—with better analysis, insights, decisions, and actions.

Our suggestion is to create discomfort—the D. We suggest applying the Socratic method of questioning, named after the classical Greek philosopher Socrates who stimulated rational thinking and illuminated ideas by posing questions to his students, such as Plato. Imagine asking your executive team and colleagues questions like these: Are our more complex products with high technical support being subsidized by our costing method by the simple products that use relatively little indirect and shared

expenses? Are our largest customers presumably our most profitable ones? Are any of them so demanding of us that the extra effort erodes our profits—but we do not measure those costs? How do we know? How do we know which types of customers to retain, to grow, to acquire as new or to win back? How much is optimal to spend on each customer type with deals, offers, and promotions to retain, grow, acquire, and win back those customers? Won't any spending amount above or below the optimal for each customer type lead to destroying shareholder wealth?

In many cases, the executives and colleagues will not have good answers. That is when you can hit them with the knockout-punch questions. When they respond that they do not know the answers, ask them, "Is that a good thing? How long can we keep making decisions without knowing these answers?" If you ask these types of thought-provoking and deliberately disturbing questions in the right way, you will not need to spend much time on promoting your vision (V) of the equation, the variable that many project champions typically prefer to begin with. By converting and exposing latent problems into ones that are evident to your executives and colleagues, the solutions become more obvious and understandable.

And what about the F in the equation—the first practical steps? Many organizations embarking on the journey to reform their managerial costing struggle with how to get started. Consider pilots and rapid prototyping with iterative re-modeling techniques to demonstrate value and prove concepts. Pilots and prototypes should produce directionally correct results. What they accomplish is accelerated learning and buy-in. They are engaging because the models are of your organization and not of a fictitious one from a training course.

Always remember that in the absence of facts, anybody's opinion is a good one. And usually the biggest opinion wins—which is likely to be that of your boss or your boss's boss. So to the degree your executives and managers are making decisions based on intuition, gut feel, or flawed and misleading information or politics, your organization is at risk.

Part IV.D: An Organization's Acceptance of Managerial Costing

A well-designed, causal, and accurate managerial costing system that leverages all of the aspects of the framework will support informed users who understand and trust the information the cost system gives them; however, those users must be nurtured and developed by the organization. Invariably, the success of a managerial costing initiative depends on how the organization responds to and uses the new cost information. This section considers the organizational elements and the factors that are central to broad user acceptance and the adoption of the managerial costing system as a key managerial tool.

What is different for organizations with high-quality managerial costing in place? How is management different? What difference does it make for operations and nonfinancial personnel throughout the organization? Clearly, the availability of high-quality, trusted cost information will change communications, particularly those pertaining to economic decision making, in organizations. The impacts of having highly usable cost information on analysis, decision making, communications, and managerial alignment throughout the organization are important factors in the ultimate success of a managerial costing initiative.

Organizations that achieve highly effective managerial costing focus on business issues much quicker because:

- They spend less time debating managerial costing practices, the quality of cost information, and efficacy of the underlying systems.
- A wider range of employees can be empowered to use cost information to make decisions, because the information will be widely understood and trusted.

An underlying criterion for achieving this state is that cost information be constantly available, along with the related operational and resources' capacity information. Cost information must be in continuous use and under constant observation and evaluation in the organization.

Usable Cost Information

The usability of cost information derives from the transparency of the information, its defensibility, and its timeliness as perceived by users. "Transparency" means that users understand how the cost figures were calculated. But it goes beyond that—cost information is only truly usable if it represents the operations and the cause and effect relationships within operations. "Defensibility" means that the cost information can be used by both financial and nonfinancial personnel to build and evaluate business cases, explain results, support and explain decisions, and advocate ideas. Finally, the information must be there to use; collection cannot start at the time the need for the cost information is identified. These three criteria for adoption by users are supported by some of the constraints in the framework. In particular, the framework constraints of accuracy and verifiability should be employed extensively to demonstrate transparency

and defensibility in a concerted change management effort that pursues broad adoption of the managerial costing system.

Transparency in operating and maintaining a managerial costing system is essential to maximizing the value of the information for managers. For example, an aggregate “overhead” cost as part of a product’s cost is often described as a “hidden” cost. Lacking transparency of the calculation and causal insight to any specific operation, most managers will ignore, to the extent possible, such cost figures. The relevance and reliability of a costing system’s information must be clear and demonstrable. Peter Drucker (1955, 116) in his seminal writings about management science (Reay, Berta, & Kohn, 2009, p. 16) and evidence-based management noted that “the manager should know how reliable the facts are.” Drucker’s admonition is particularly appropriate for managerial costing facts. Drucker went on to add that the manager should “know what degree of precision in the decision can be supported by the validity of his factual knowledge.”

Lacking transparency of cost data, managers will tend to second-guess the cost information provided. This distracts attention from critical analysis of other important decision factors. Debates about costing systems undercut efforts to improve decision-making processes within organizations. By making the costing system transparent in its calculations and by showing causal relationships within operations, an organization can address the challenge of managers demanding evidence (Pfeffer & Sutton, 2005) while quickly supplying accurate costs.

Transparency in managerial costing is achieved by using:

- Operational data with which managers are familiar and is produced by information systems that have been verified, validated, and adequately controlled
- Models that reflect cause and effect operational relationships
- Appropriately controlled software applications

For at least the first and second items above, the framework ensures a foundation of transparency for a managerial costing initiative.

Defensibility is both a necessary attribute of cost information and an important use of the information. Transparency will tend to make cost information defensible to challenges about its accuracy for any given purpose. But this type of defense is most often mounted by finance, as the creator of cost information. Cost information produced purely for external financial reporting is defensible in that it meets the standards required of it; however, it may not be usable for decisions in most parts of the organization. Defensibility is truly achieved when managers and employees outside finance can readily apply cost information when investigating operational problems or evaluating operational solutions without worrying that finance will find fault with the cost figures used in their analysis. At that point, managerial costing becomes an enabling tool for a wide range of managers seeking to make better decisions about the employment of the resources under their control and make investments that will improve the organization’s performance. The key to making costing information defensible throughout the organization is applying the principle of causality and its supporting concepts when designing the processes and systems to create the information. Cost information must reflect the cause and effect relationships experienced by managers to achieve this level

of usability in the organization. The defensibility of cost information gets a significant boost if managers can clearly relate their insight into operations with the cost information they are required to use.

Timeliness refers to cost information that is recent and consistently available. First, the cost information must be recent. Depending on the situation, this may be minutes, hours, or days to reflect current and ongoing operations. In this regard, the concept of real time should be the default objective. Second, and more importantly, cost information must be consistently available as a measure. Usability requires an effective managerial costing system be in place to generate the information for managers and employees. A cost study—no matter how effectively done, no matter how quickly completed, no matter how well guided with policy and procedures—is never as useful as having information available for day-in, day-out measurement and evaluation. Only through continuous observation and evaluation will cost information be understood and allow managers to gain confidence that it reflects the cause and effect relationships of the resources, processes, and operations they manage.

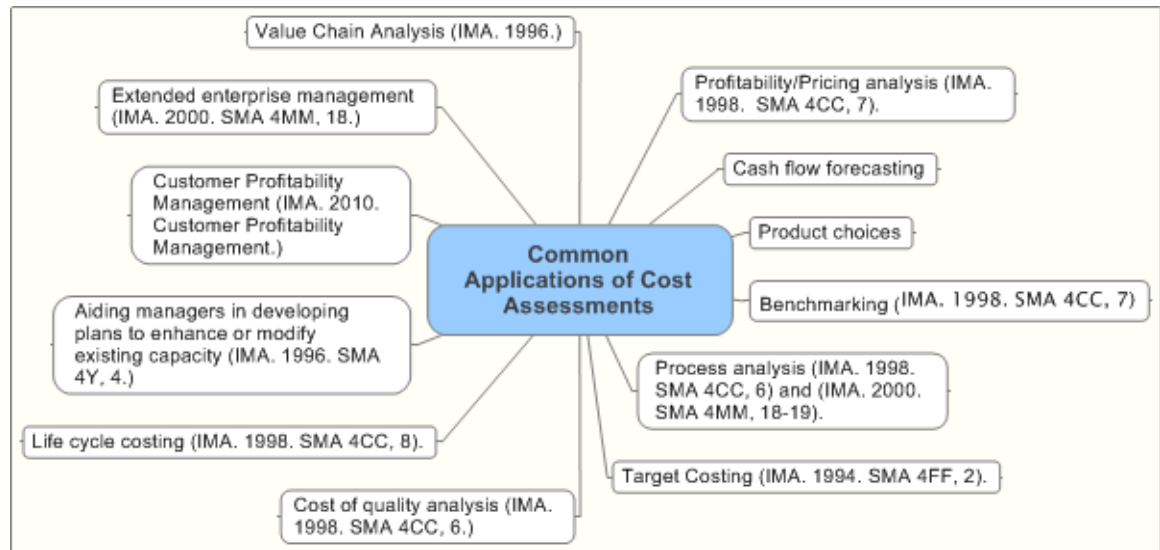
Decision Making and Managerial Alignment

The most significant benefit of highly usable cost information is that it provides the ability for managers at all levels to align with the organization's objectives for enterprise optimization. A well-designed managerial costing system eliminates the mismatch between cost information and operations by causally connecting them at the resource level to managerial objectives. This clarity will allow the cost information to be used more effectively and more widely for planning, investing, risk management, performance evaluation, profitability analysis, and myriad marginal decisions.

Clearly, cost is only one component of organizational information that is considered in decision making and planning, but it is a part of the information puzzle that can achieve a relatively greater certainty than many other planning factors. A new resource will almost certainly incur the planned costs, but the achievement of the expected benefits will be far less certain and be dependent on less controllable external factors. This characteristic of cost information can have a significant positive impact on an organization's risk management and overall decision making. Improving the certainty around analysis and decision making with good cost information in relation to operational changes can clarify the areas where the mitigation of risks needs greater managerial focus.

Cost information is a vital input for many organizational activities and assessments. Figure 18 identifies a number of organizational activities that highly usable cost information will improve or enhance.

Figure 18: Common Applications of Cost Assessments



Maintaining and Supporting a Managerial Cost System

A managerial cost system requires organizational resources to support and operate it. The effort associated with ongoing maintenance can undermine the value of the information if the cost exceeds the benefit or if the information cannot be produced for routine use throughout the organization. One solution is to design and build the solution with these characteristics in mind and integrate the collection of the necessary operational and financial data. This is an excellent solution, but it can also be very expensive. It is also important to consider the dynamic nature of organizational information and the supporting systems, because changes can also be extremely expensive for highly integrated solutions.

A cost information system, however, can achieve a high degree of usability with substantially less than full system integration. Consider the following points:

- People will support systems they consider valuable tools and that are used to measure their performance in a fair and productive manner.
- Collecting and evaluating data for a cost system that is important to users builds understanding and confidence in the information output.
- Participation in the design and evaluation of a cost system builds understanding, confidence, and commitment.

Thus, as far as organizational adoption is concerned, the important point is that the acceptance of a costing system's information and the associated effort to create that information is not fundamentally about the quality or sophistication of the IT solution

used. Acceptance is based on engaging the managers in the organization on the need for the information and its value in creating success for the organization and everyone in it. The usability of the information will sustain the operation of an effective managerial cost system.

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Conceptual Framework for Managerial Costing

Section V: Call to Action

Call to Action for Improving Managerial Costing

This managerial costing conceptual framework presents principles, concepts, and constraints to guide the profession in providing managers with the cost models and decision-support information they need to be effective. As the authors conclude this document, a valid question is, “Why should management accountants adopt, foster, and promote the framework?” In this section, key aspects of the framework are summarized to show why the framework is important, not just to the profession and its customers (that is, managers) but to the larger business community and beyond.

Managerial Costing and Customer Focus

Over the last three decades, management accounting’s costing practices have seen a number of innovations. These included activity-based costing (ABC), resource consumption accounting (RCA), and extensions of either operational scheduling (e.g., theory of constraints, TOC) or manufacturing strategies (e.g., lean accounting, LA). In retrospect, these advances now seem to have been inevitable as the profession came to terms with its stagnation, confined as it was to the narrow area of cost accounting. That is, product costing, transfer pricing, and inventory valuation that marked more than half a century (before the late 1970s and early 1980s) of domination by financial accounting and its focus on external reporting for regulatory compliance.

However, upsetting the traditional standard costing apple cart, in the United States at least, brought new opportunities to the profession. Where there once was a dominant way of doing things, the managerial costing landscape was suddenly in turmoil. This is nowhere more evident than in management accounting’s discourse during this time, which became at times less than civil as proponents of now-competing approaches jockeyed for position; competing approaches often contradicted each other. Small wonder that research reveals the real casualty of the profession’s foray into an “anything goes” landscape was its customers.¹⁴

Purely from an internal perspective, the profession has a compelling need for a framework to consolidate the experience and learning that now span three centuries, and, in particular, to consolidate the expansion in developments in recent decades. Such a framework has never been successfully deployed, and at this point there is an obvious need for management accounting to get its costing house in order. Management accountants need to provide their customers a logical, structured, and orderly way to go about managerial costing or the profession will find its customers indifferent. The result will be that managerial costing is viewed as a minefield where the narrow needs for cost accounting to support financial reporting is the only safe path. Other approaches to costing will be viewed as high-risk endeavors. Managers need what managerial costing can provide. This is clearly illustrated by the stand-alone manufacturing initiatives (e.g., TOC and LA) where production and operations managers have sought to generate the

¹⁴Garg, Ashish; Ghosh, Debashis; Hudick, James; Nowacki, Chuen. 2003. “2003 Survey of Management Accounting and Benchmarking Tool,” Ernst & Young LLP. 1-21; and Garg, Ashish; Ghosh, Debashis; Hudick, James; Nowacki, Chuen. 2003. “Roles and Practices in Management Accounting Today,” *Strategic Finance*. (85):1, July, 30-35.

information they needed largely on their own. If the profession fails them, managers will find alternative sources for solutions.

Notwithstanding this compelling case for the framework from within the profession, the authors see far greater and wider-ranging benefits when adopting a customer focus with the managerial costing framework as the foundation. Using the framework with primarily an inward focus will solve the problems created by a process of innovation that was improperly managed in the first place. But overt introspection, whether to come to terms with infighting or to clean up after the brawl, loses sight of the profession's primary purpose. The profession has not been adding value to its customers as it should have. Asking for a time-out to fix what the profession had managed poorly will just further delay real and tangible contributions to our customers.

The authors explore below the case for adding more substantive value to our customers starting now. The motivation for applying the framework is discussed from the perspective of managerial costing's scope and the need for optimization in business and the larger community.

What Managerial Costing Can Achieve

The Introduction, Sections I, and Section II described the benefits, objective, and scope of managerial costing as all those areas of business activity and managerial processes in which costing and operations play a key role. In the principles section and the Appendix on truth, the foundation for managerial costing, the authors spotlighted the pivotal role of managerial cost information in all managerial actions.

Without relevant and useful operational and corresponding cost information, managers at best fly blind and at worst are misled. If managers have good operational information but lack corresponding cost insights, they can only guess the net impact on the bottom line of alternative courses of action. High-quality managerial cost information is vital to managers' predictive needs—from strategic envisioning and organizational planning to simulation, profitability analysis, setting cost and performance standards, and making cost estimates. Additionally, tactical and operational decisions such as controlling cost and performance, evaluating opportunities, making investments, and supporting continuous improvement and organizational learning require a clear causal relationship between cost and operations, which is the purpose of managerial costing.

Management accounting's sphere of influence is undeniably extensive, and the managerial costing framework, solidly grounded in the laws of logic and principles of decision science, can yield significant improvements in supporting analysis and decision making. But these benefits for the profession's customers reveal only part of what stands to be gained. The authors propose that more significant benefits can be realized.

Optimization

Optimization refers to the need to do more with less or, ideally, do the most with the least. This process starts with applying optimization thinking to every decision made. Managerial costing's role in this regard is unique because money serves as a common denominator allowing for the evaluation of incomparable alternatives in decision making. Management accounting is the only discipline with the explicit objective, know-how, and

experience—as reflected in the managerial costing framework—that can provide such comparative information at the point of decision making. Managerial costing stands alone in its ability to enable optimization from the bottom up (one decision at a time) in all the areas of its scope.

When the need arises to make trade-offs between conflicting locally optimal outcomes, managerial costing's unique strength comes to the fore yet again. On the topic of optimization, managerial costing has no peer, and it is here where the much broader and more significant benefits of the managerial costing framework can be found for the management accounting profession.

Consider the need for optimization not merely at the operating division or company level but also at the national or even global level. Resources are always limited and clear signs are even more evident, such as upward trends in major commodity prices, that natural resource scarcity will become a major 21st-Century challenge. The magnitude of this challenge becomes evident when considering that both the Chinese and Indian economies have the potential to each be three times the size of the U.S. economy. Just by considering energy resources alone, the 21st Century clearly will require not only prudent but also optimal use of natural resources.

Is there a quantitative justification for better costing?

Consider how you would measure the impact of better decisions resulting from having more accurate and explanative information from a good managerial costing system. You might eventually conclude that the many improvement and change initiatives organizations pursue (e.g., total quality management, lean management, process reengineering) are occurring simultaneously. As a result, it is nearly impossible to trace benefits, such as cost savings or cost avoidance, directly to an individual change program.

One step removed from this quantitative measurement challenge is the measurement of qualitative effects that better information from improved costing can have. Improved costing serves to enable all improvement programs and the operational decisions managers make with those programs in place. Continuous improvement is now part of most companies' DNA, and providing appropriate cost measurements is vital to a company's success. Adapting a common set of costing principles and criteria with a strong focus on truth as outlined in the framework is key to providing the needed cost measurement support.

The Call to Action

This is not a call to action based on altruistic motives. It instead recognizes that a house is built from the bottom up—brick by brick, frame by frame, whether that house is your career, the company you work for that you and other stakeholders are vested in, or your nation's economic well-being. No profession rivals management accounting in determining how efficiently and effectively that house is built and maintained.

As manifested in the principles anchoring the managerial costing framework, the accounting profession holds one of the keys to enable better decision making. Every decision that managers, companies, and governments make is a resource application

decision. Will the management accounting profession rise to the challenge to have a real and substantive impact on cost methodology in an environment in dire need of sound guidance? An adapted Albert Einstein quote expresses the profession's challenge appropriately: "*The management accountant must not merely wait and criticize, he must embrace, defend and promote the cause the best he can. The fate of the profession will be such as the profession deserves*".¹⁵

¹⁵ Adapted from Albert Einstein: "[The individual must not merely wait and criticize, he must defend the cause the best he can. The fate of the world will be such as the world deserves.](http://thinkexist.com/)" <http://thinkexist.com/>

Conceptual Framework for Managerial Costing

Appendix: Truth as a Foundation for Managerial Costing

The Foundation of Truth for Managerial Costing

The concept of truth is something every management accountant is familiar with, not only at a personal level, but also as far as our discipline is concerned. We can all spot a wayward allocation from a mile away, in fact every manager can, particularly when it looms large on a cost report with no clear causal relationship to the outputs. The statement that the managerial costing framework is based on a foundation of truth captures this reality. That is, there are wrong ways to do costing and therefore there must be better ways to provide decision-support information. It is this foundation of truth that will be the focus of this appendix.

The framework anchors this pursuit of truth by using the principles of one branch of the scientific method (that is, origin science) as the principles for managerial costing. The principles of the framework, causality and analogy, enable scientists to deal with causes and their effects in different time frames (such as in forensics). This is not to say that managerial costing is a science; it clearly is not. But decision science—which managerial costing supports with the information it provides—is a science. Managers make inferences about future outcomes of decision alternatives they are considering based on cause and effect insights. The information managerial costing provides therefore needs to be compiled using principles that support managers' application of decision-science practices.

However, a healthy dose of caution should accompany any insistence on absolute truth in managerial costing. This is because you can be off by mere pennies and reflect a profitable customer or product as unprofitable; the world is just not that simple and practice defies such outright idealism. Therefore, the first order of business is to define what is meant by the statement: Truth is the foundation for managerial costing. This will be done by pointing out what the statement does not mean, and then by a more in-depth discussion of what it means.

The Ultimate Objective is Not Precision

In line with the need for caution noted above, the first objection one commonly encounters on the topic of truth in managerial costing is the following: Consistently obtaining an absolutely truthful number in managerial costing is cost-prohibitive, if not impossible. And without any fear of contradicting our assertion of the existence of an underlying truth in managerial costing, we agree; an absolutely precise cost number is often an unrealistic objective.

First, a customer who is only marginally profitable or marginally unprofitable is almost always unwanted. Neither the capital markets nor the entrepreneur seeking ample reward for the risk taken tolerates a business that squeezes out a return measured at the second decimal. The reality is that managers do not need an absolutely precise number to select the optimal outcome from among the alternatives under consideration.

Second, the objection mischaracterizes the statement concerning truth in managerial costing. *Truth is the foundation for managerial costing and not an idealistic and precise number that must be achieved at all cost and at all times.* In the framework, accuracy is a constraint of managerial information and not the overarching objective. As

discussed, the degree to which this attribute should approach the absolutely accurate cost number will vary based on a variety of factors for each company. For example: For a company with very thin margins, a highly competitive environment, and a diverse product portfolio, accuracy will be more important than it would be to a company with 80% gross margins and very little competition. Materiality and measurability constraints discussed in the framework allow ample room to evaluate degrees of accuracy, and the principle of analogy guides the management accountant toward management's decision support needs.

In considering the need for truth, the reality of imprecision or the degree of accuracy achieved in managerial costing is not an argument against it. Using the framework to guide managerial cost model design will result in information that is more representative of the underlying absolutely accurate cost number. This is due to the framework's inherent recognition of truth as the foundation for managerial costing, and not as the explicit objective of the framework or the proposed truth statement. When it comes to accuracy, it is better to be approximately right than completely wrong in a very precise manner.

The Meaning of Truth as the Foundation of Managerial Costing

Having identified what is not meant by truth as a foundation for managerial costing, it is important to define what is meant by truth as a foundation for managerial costing.

Tying Truth to the Essence of Managerial Costing

Understanding what truth means as the foundation of managerial costing starts with recognizing the essence of what managerial costing sets out to achieve. That is, it is a discipline that provides managers with insight into their organization's operational resources, their consumption, and their outputs in monetary terms. As reflected in IMA's definition of management accounting, this information is essential for various managerial and organizational processes.

Managerial costing is tasked with providing a monetary reflection of the resources and their application that managers use to achieve strategic objectives. The reflective nature of managerial costing information is paramount for two reasons: (1) it highlights how managers use managerial costing information, and (2) it points to an appropriate definition for truth in managerial costing. These two aspects are discussed in the next two sections.

The Laws of Logic

Managerial costing communicates to managers the state, capabilities, application, and outputs of an organization's resources in monetary terms. As with all communications, certain ground rules apply. These rules ensure the information communicated is logical and well understood. For example, consider the statement: "We are going out of business because of a superseding technology; therefore, we will be investing \$5 million in the old technology." Also consider the following: "We sold zero of

Product 123 last month but our gross sales for Product 123 last month was \$1 million.” These examples each violate one of the two laws of logic that underlie managerial costing’s ability to provide accurate reflective insights to managers. The first example violates the law of rational inference; (that is, the reasoning is simply irrational). The second example violates the law of non-contradiction; (that is, the first part of the statement is contradicted by the second part).

The need for the managerial cost model to be a logical representation of the enterprise’s operations is obvious; managers cannot and should not be misled or misguided in their attempts to understand the financial implications of a particular decision alternative or operational outcome. Managerial costing is a crucial tool in the manager’s toolbox that aids in optimization endeavors. For example, managers often observe a result, such as an unprofitable product, and attempt to understand the reason or cause behind it (that is, managers reason inductively—from an effect to its cause). Or in decision making, managers evaluate a number of alternatives and select the one with the optimal outcome (that is, managers reason deductively—from the cause (decision) to its effect).

This understanding of how managers use managerial costing information crystallizes what it means for the cost model to be reflective of operations. Managerial costing must reflect operational cause and effect relationships and value them with money in order to support managers’ inductive and deductive thinking processes. These processes include all aspects of planning, simulation, analysis, control activities, and decision making. The law of rational inference (that is, the relation between a cause and its effect) determines the structure of managerial costing information, and in the framework, it is embodied in the principle of causality.

This is the limit of how far the law of rational inference will take us in demonstrating managerial costing’s foundation of truth. It falls to the law of non-contradiction to anchor managerial costing to the bedrock of truth.

The Foundation for Managerial Costing

In presenting managers with cause and effect insights, managerial costing should provide financial information that accurately reflects the reality (the operational facts) that managers seek to understand. The requirement is simply this: Managerial costing information must be a true reflection of the underlying operational facts it represents. In epistemology, the branch of philosophy that deals with the theory of knowledge, such a definition of truth has existed for more than two millennia. Aristotle (384–322 BC) is credited with the correspondence definition of truth:

*To say of what is that it is not, or of what is not that it is, is false;
while to say of what is that it is, and what is not that it is not, is true
(Morris, 1999, 46).*

This definition comes across as verbose, but it can be more succinctly expressed as: *telling it like it is*. A modern version of the correspondence definition of truth is: A statement or opinion is true if what it corresponds to is a fact (Angeles, 1992, 317). For managerial costing, this means corresponding to the facts of the operations that it strives to provide insights into. The law of non-contradiction, epitomized in the

correspondence definition of truth, serves to bridge the gap and anchor managerial costing to a bedrock of truth.

The recognition of the need for truth is so fundamental that it often goes without saying. Above, we have used a philosophical basis (the laws of logic) to show that truth in managerial costing is indispensable. But one finds truth permeating the profession throughout its history. For example, Church in the early 1900s said the following concerning managerial costing:

*It is very important that costs should not be regarded as something that may be manipulated, nor should they be thought of as representing anything but the cold **truth**, however unwelcome that may be (Church 1910, 37. Emphasis in the original).*

A concerted effort in the 1940s and 1950s by the Committee on Cost Accounting Concepts and Standards (CACCS) to define principles for management accounting culminated in a number of principled statements. A foundational aspect recognized by CACCS was that:

...the cost accountant was concerned not merely with the presentation of facts, but his objective was, in so far as possible, a presentation of the truth of the facts (Benninger, 1954, 35).

In the current business environment, truth finds even more forceful application in accounting generally. For example, when CEOs and CFOs certify a company's financial statements—for which MA provides key inputs—with the declaration that the information “does not contain any untrue statement” and is “not misleading” and “fairly represents ... the financial position”—truth can hardly be more in the forefront.¹⁶ The law also ties clear punitive consequences to any misstatements (untruths) in accounting information. The basis of truth upon which C-level executives are prosecuted and imprisoned (as has happened) is in plain view and recognized by all.

Objections to Truth in Managerial Costing

As fundamental and necessary as truth is to managerial costing, it could be argued that objections border on the bizarre and should be summarily dismissed. However, answering a number of common objections to truth as managerial costing's foundation serves three purposes: (1) to better understand truth in managerial costing, (2) to clarify truth's application in managerial costing, and (3) to preemptively defend the managerial costing framework by pointing out weaknesses and fallacies in common objections to truth as its foundation. For these reasons, this section will address a number of commonly encountered objections.

The objections to truth as the foundation of managerial costing span the gambit. They include a highbrow disdain for truth in general, confusing the subjective nature of the agent in managerial costing (that is, the management accountant) with the profession's overarching objective, and perpetuating cultural relativism. The latter refers to the denial that absolute truths exist at all. We will address all of these.

¹⁶ The Sarbanes-Oxley Act. 2002. Section 302-2.

The Highbrow Objection: *“Insisting on truth as the bedrock of managerial costing is pious, arrogant, and hypocritical.”* The framework, of course, is none of these things. On the contrary, acknowledging—as the bedrock of truth does—that there is something bigger to managerial costing than each of us, or even all of us, is humbling. It is the exact opposite of arrogance, highbrow piety, and hypocrisy to admit that the best we can do is to strive to attain a completely accurate cost. In this regard, the framework acknowledges the many compromises that must be made in applying its concepts and constraints.

The Subjective Agent Objection: *“Accountants are subjective ‘constructors of reality’ presenting and representing the situations in limited and one-sided ways”*(Morgan 1988, 478). In other words, the notion of truth in managerial costing is indefensible since each management accountant brings his own biases, preferences, and motivations to the cost model constructed. The subjective nature of the agent in managerial costing is no doubt the case, and this is one of the aspects that the managerial costing framework seeks to address. The subjective agent aspect inherent in managerial costing is a prime *reason* for having a framework with a clear foundation based on truth and corresponding principles—not an objection!

The Ruse Objection: *“Truth in managerial costing is a ruse since everything is based on assumptions.”* This objection usually surfaces with cost estimates or other predictive uses of managerial costing information. The objection is, of course, itself a ruse because much concrete, factual information is known about the organization—its resources, their capabilities, the company’s products and services, and related strategic objectives. Such known facts form the basis upon which assumptions in managerial costing are logically formed; no manager will be tolerated for assuming they were in the bread business, and purchased tons of flour, when the company has been solely focused on making computer chips right under his nose for fifteen years. Assumptions require a basis of truth, and a structure within which to be accommodated to produce useful predictive information. Like the previous objection, the ruse objection is an argument in favor of the need for a managerial costing framework based on truth and logic.

The Dumbing Down Objection: *“Truth cannot be absolute because knowledge is ever growing and expanding.”* Or, what is true today may be false tomorrow. For example, ABC broke the standard costing truth-mold and revealed the pitfalls of assigning indirect costs based on volume. This objection fails to note that it is not the truth that changed, but management accountants’ understanding of it. ABC’s insight was not a case of moving from an old truth to a new one; it was instead forsaking an old error for a more complete insight into an existing truth.

The Stifling Objection: *“Adopting an absolute truth perspective stifles progress and innovation.”* But knowledge expands on the back of truth. As indicated above by the ABC example, this objection has no leg to stand on. Adopting an absolute truth view does not prevent new facts from being uncovered nor more complete insight into the

truth. On the contrary, truth provides a foundation for critical evaluation and real progress.¹⁷

The Progression Objection: “*Approaches in managerial costing are not equals, but merely stages in the development to a mature/ultimate solution.*” The fact that pundits do not readily admit the inferiority of their respective approaches in a comparative discussion should not be lost on the reader. Moreover, when it comes to managerial costing solutions, managers, the consumers of solutions, seem to have lost interest as they have grown confused. The many methods and claims concerning managerial costing solutions must appear to them not as progress but as endless spin. Nevertheless, this objection has merit insofar as a mature/ultimate solution can be known. The framework is meant to provide the foundation and structure for understanding the path toward a mature/ultimate solution and the compromises in striving for such a managerial costing solution.

The What Works Objection: “*You take what works for you and I will take what works for me.*”¹⁸ This is an objection predicated on relativism in which people attempt to come to terms with the anomalies in a relativist environment by adopting the pragmatic view of truth. The problem with this view is that dishonesty has been known to *work* at times; for those who don't get caught it even *works* to fudge the numbers for the company's financial statements. Obviously *what works* is not the same as what is true or right.

The Feel Good Objection: “*Just do what you feel is right, or just do what makes you feel good.*” This is another relativist reduction of truth. However, the consequences of such a subjective view in a discipline like managerial costing (where objectivity is essential) should be sufficient to severely discount this approach. Even the term “discipline” seems to imply a contradiction here. The complete disconnect between “what feels good” and truth is illustrated by the fact that bad financial results do not make the executive or the management accountant feel good, but are nevertheless true.

Disadvantages of the Relativist View in Managerial Costing

As stated above, relativism is the opposite of acknowledging the existence of truth. At a very fundamental level, relativism's claim that there are no absolute truths also precludes its own claim from being true. The relativist's claim needs itself to be true to refute the existence of truth (that is, it violates the law of non-contradiction). Therefore, relativism is self-defeating and as an alternative to the bedrock of truth generally it is scoffed at in epistemology.¹⁹ In its managerial costing disguise, relativism fails for the same reason; one cannot claim that there is no single right approach while in the same breath establishing an approach—that considers all views valid—as *the one approach*.

Going beyond the pure philosophical argument against relativism, the following are undesirable consequences that result from applying the relativist view in managerial costing:

¹⁷ Ibid. Morris p. 103. “Truth is the raw material for creativity.”

¹⁸ Angeles, P.A. 1992. *HarperCollins Dictionary of Philosophy*. Harper-Collins Publishers, Inc.: New York, NY. Second Edition. p. 317.

¹⁹ Ibid. Morris p. 47.

- I. Ambiguity, confusion, and frustration are the order of the day. If anything goes, a statement like “My company is a going concern and making money but we are out of business now,” has to stand. Of course, this is an absurd statement; only one of the claims can be true. There is an obvious need to stifle certain views and assertions.
- II. If there is no standard or truth, on what basis are *rogue* theories challenged? Therefore, not only does relativism allow for a cacophony of contradicting theories and practices but there is no way to right the ship as long as relativism is deemed a viable view.
- III. The frequent bias resulting from those protecting vested interests causes the discourse within the profession to swing wildly from factual statements to character assassination.
- IV. If there is no truth, there is also no lie—no error. A manager can commit the blended cost concept error (that is, confuse operational costs of fixed/variable with the decision concepts of unavoidable/avoidable) all day long and be none the wiser for it—ever.
- V. Real progress is stifled under relativism; practitioners cannot see the forest from the trees to identify causes worthy of further pursuit. Moreover, critical thinking—a key ingredient to progress—is diminished in a relativist-oriented discussion. Who is to say that any one approach is better than any other?
- VI. The lack of a recognized common frame of reference makes it difficult for the profession to effectively communicate with those looking in from the outside (that is, managers).
- VII. Management accountants are not able to make a convincing case for and demonstrate how they add value to the enterprise beyond the limited application established in standards for financial reporting.

The foundation of truth for managerial costing is absolutely essential, and its essence must guide every aspect of managerial cost modeling. This is the premise upon which the managerial costing framework is based as it strives to provide the structure and the guidance to create information that will better support managers.

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