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THE DATA WAREHOUSING INSTITUTE

TDWI Enterprise Metrics

Designing Integrated Business Metrics

TABLE OF CONTENTS

THE DATA WAREHOUSING INSTITUTE

Module 1

Concepts and Definitions

Anatomy of a Metric

Data, Measures, and Metrics

Data: A collection of facts from which information can be derived.

name
address
activity date
order quantity
order value

↓

Base Measure: A quantifying data value in context of the thing that it quantifies.

weight
length
time
speed
count

↓

Derived Measure: A complex measure deduced from multiple data points.

growth
decline
acceleration
attrition
frequency

↓

Metric: A system of measures based upon standard units.

retention rate
attrition rate
defect rate
lag time
frequency of returns

↓

Business Metric: A metric with the context of business goals.

customer retention rate
by product and location
product defect rate
by product and date
claim settlement lag time

Anatomy of a Metric

Data, Measures, and Metrics

INTRODUCTION

Applying measurement concepts to business activities helps managers gain insight into how their organization is performing and what decisions could lead to improved results. Measurements provide quantifiable information about key variables and factors in a form that can be interpreted and analyzed. Measurement signals usually originate from a sensing device as basic data elements. The data goes through several processing steps and become more refined as additional layers of context and meaning are added. This process makes them more useful for management decision making. A value chain model that describes the transformation of raw data through a series of steps to produce meaningful and useful business metrics is used to introduce some key terminology that will be used in this course.

DEFINTIONS

Raw data is produced from a measurement device and goes through a series of transformations until it is delivered as a business metric. Context is added to the data at each stage. The main stages that transform data into metrics are described below.

Data
Data in its basic form is a collection of facts from which information can be derived such as name, address and activity date

Base Measure
This is a quantifying fact in the context of the thing that it quantifies. The added context includes the unit of measure in the quantifying process. Unit of measure categories include weight, length, time and speed

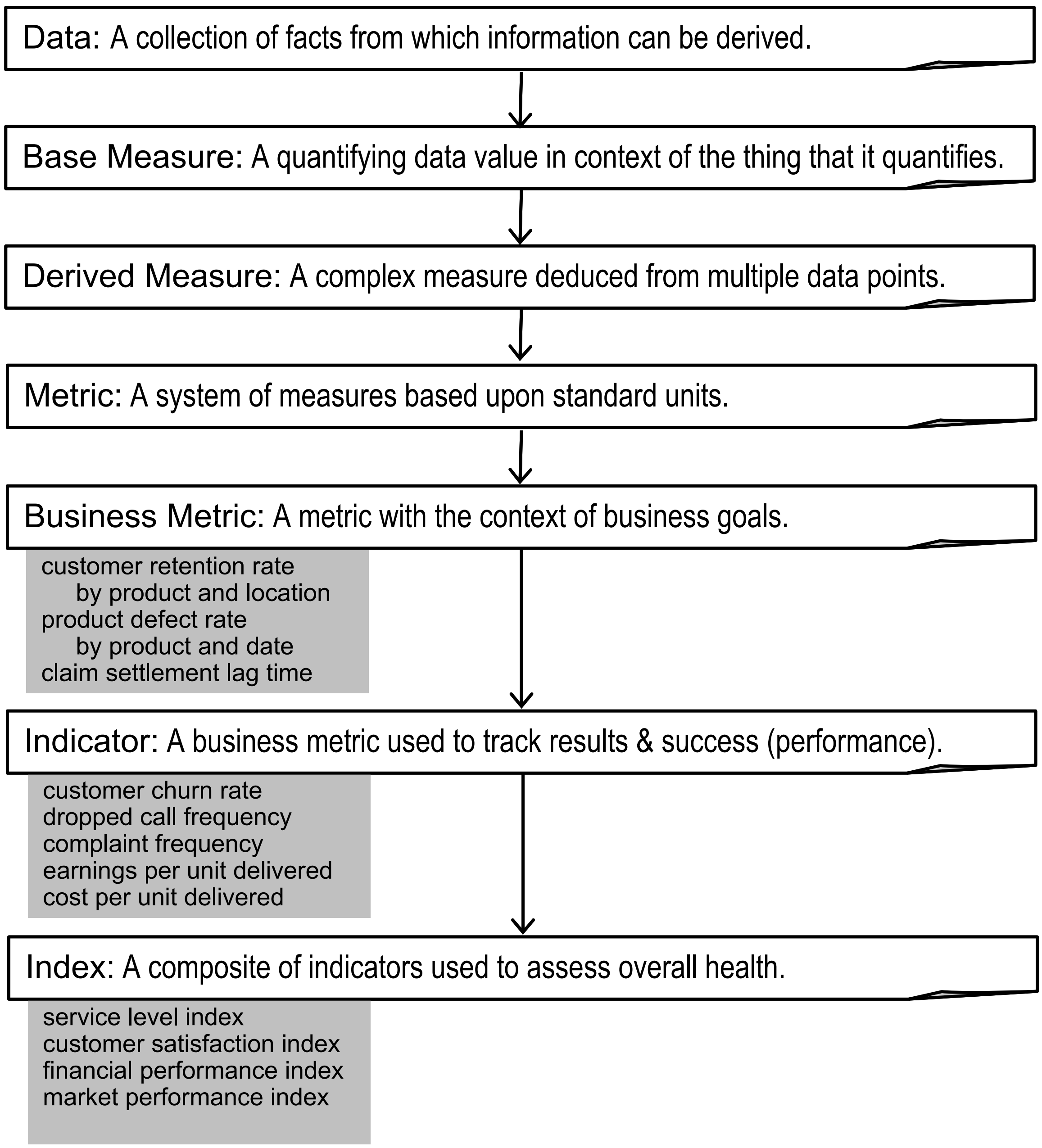
Derived Measure
This is a complex measure that is deduced from multiple data points or base measures. This includes growth, decline, acceleration and frequency.

Metric
This is a system of measures that are based on a standard set of units. These measures can then be manipulated using calculations to create items such as retention rate, attrition rate and return frequency

Business Metric
A metric with the additional context of targets, goals or references such as customer retention rate by product and location compared to a target level

Anatomy of a Metric

Indicators and Indices



Anatomy of a Metric

Indicators and Indices

DESCRIPTION

Business metrics provide useful information to managers because they contain information about a given measure or set of measures and one or many targets that the measures can be compared against. This is a powerful relationship in the data that is useful for decision making. However definitions can be further extended beyond business metrics to include additional elements that contain higher levels of meaning and context to make them even more useful to analysts and managers.

Extended definitions describe how some business metrics are transformed into indicators and then how indicators might be summarized in an index.

ADDITIONAL DEFINITIONS

Specific business metrics can be further transformed into indicators and multiple indicators can be summarized with an index. The following definitions describe these two items.

Indicator
An indicator is a business metric that has the special characteristic of indicating something special to the business. This is usually either an indicator of a desired result or a specific level of performance that is achieved. Two common forms of indicators are Key Results Indicators (KRI's) and Key Performance Indicators (KPI's). The former is a measure that informs managers about a result while the latter is used to indicate that some level of performance has been attained. Indicators are related to attaining specific objectives and goals.

Index
An index is a composite of multiple indicators used to asses overall health in a system or organization. An index can be created through a set of calculations that combine multiple indicators into a single index using some sort of weighting mechanism. An index provides a composite view of the performance, health or results from a given system or organization.

Module 2

The Challenges of Metrics

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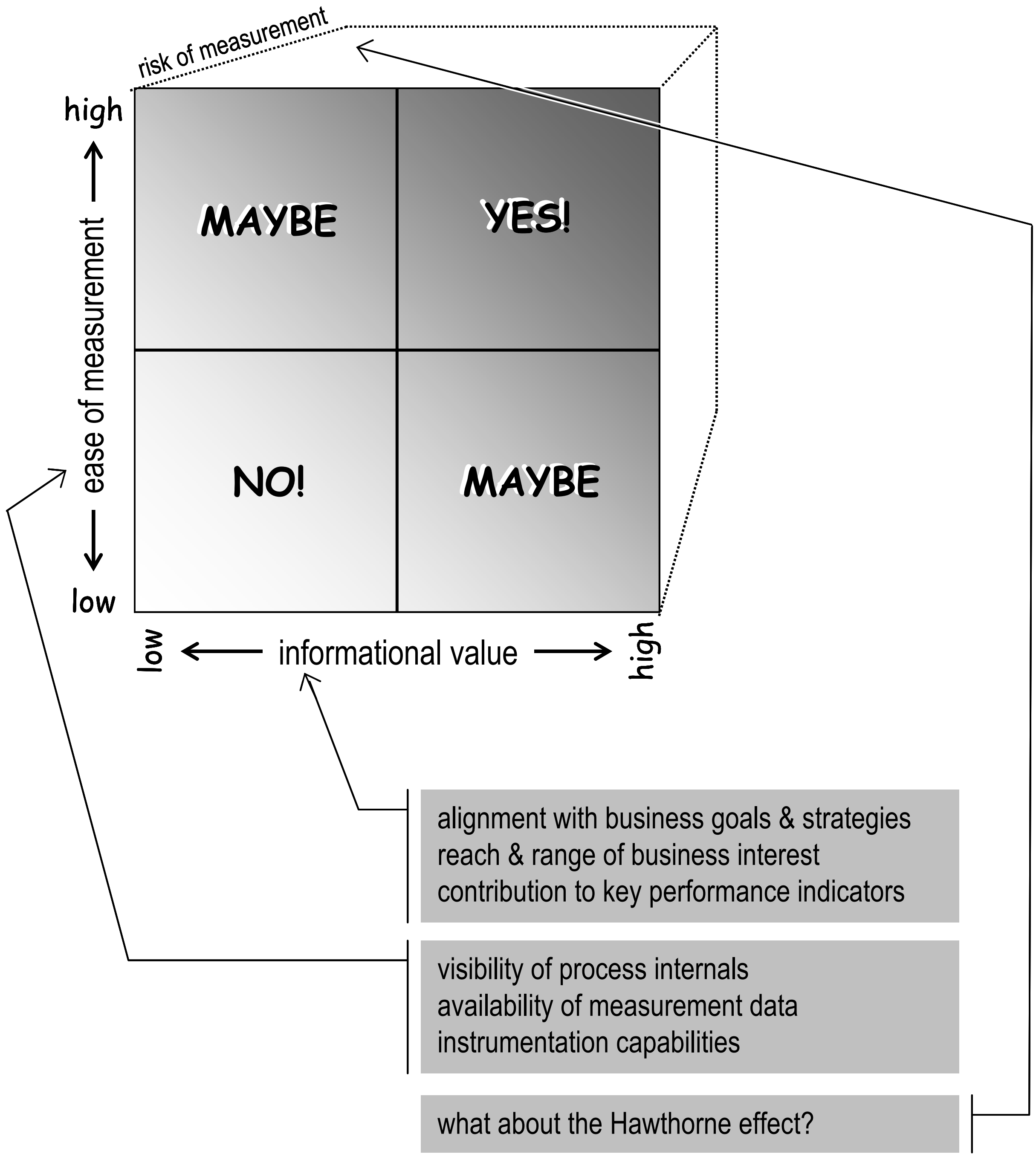
Defining the Right Metrics

Measuring What Is Useful



Defining the Right Metrics

Measuring What Is Useful

INTRODUCTION

When a business measurement program is initiated, one of the first tasks to be completed is to define what attributes of the business should be measured and what metrics should be implemented to monitor those attributes. Defining the right metrics is sometimes a difficult decision that may include making some design choices. The challenge of defining the "right" metrics is directly related to understanding why they should be implemented in the first place. It is essential to know what use the information provided by a metric will be to the various decision makers. How will the metric assist the decision makers in achieving their business objectives? Embrace the principle described by the slogan, *"Just because something is easy to measure does not mean that it should be measured."*

SELECTION CRITERIA FOR METRICS

The following criteria can be used to assess candidate metrics from a pro and con perspective. Suitable tradeoffs between "cost" to measure and expected "value" from the measure must be made.

Ease of Measurement – The ease of measurement assesses a candidate measure or metric based on available data, its quality and the infrastructure in place to support the ongoing data collection, storage, and presentation process. Another perspective related to ease of measurement describes how difficult the actual measurement process might be based on the complexity of the business subject. Ease of measurement can range from low to high for each possible measure or metric

Informational Value – The value provided by the information content of a metric is directly related to how it will be used in a decision process and how it supports the attainment of business goals. A candidate metric that supports goal attainment and enables positive business outcomes has a higher value to the organization. The information value also ranges from low to high on a scale.

Risks of Measurement – The Hawthorne Effect describes the risk of the thing being measured changing its performance simply because it is being observed and not for any reasons based on causality. This is another consequence that must be considered when selecting measures and metrics. The impact of the measurement process should be minimized to maintain credibility in the results and avoid the "Hawthorne Effect"

Defining the Right Metrics

Distinguishing Metrics from Measures

Measure: A single, quantifying data value in context of the thing that it quantifies.

Metric: A system of measures based upon standard units.

Business Metric: A metric with the context of business goals.

MEASURE	METRIC
data	information
fine-grained	aggregated
point-in-time	span of time
discrete	comparative
system/process context	business context
quantify	inform and act

Defining the Right Metrics

Distinguishing Metrics from Measures

BACKGROUND

When a measurement program is in its definition phase, analysts must identify the information requirements to be delivered by the new measurement system. Metrics and measures are related items both rooted in the measurement process. However, they have different characteristics and play different roles within a measurement system. It is important to distinguish these two items and apply them in the proper context when identifying the measurement system requirements.

DEFINITIONS

A measure is defined to be a single, quantifying data value within the context of the thing that it quantifies.

A metric is defined as a system of measures that is based on a standard set of units.

To extend this definition further, a business metric is a metric within the context of business goals.

COMPARING MEASURES TO METRICS

The following properties of measures and metrics provide further insight into how these items can be distinguished.

Properties of a Measure

- Exists as Data
- Fine-grained and Detailed
- Valid at a Point in Time
- Discrete Value
- Based on a System or Process Context
- Purpose is to quantify

Properties of a Metric

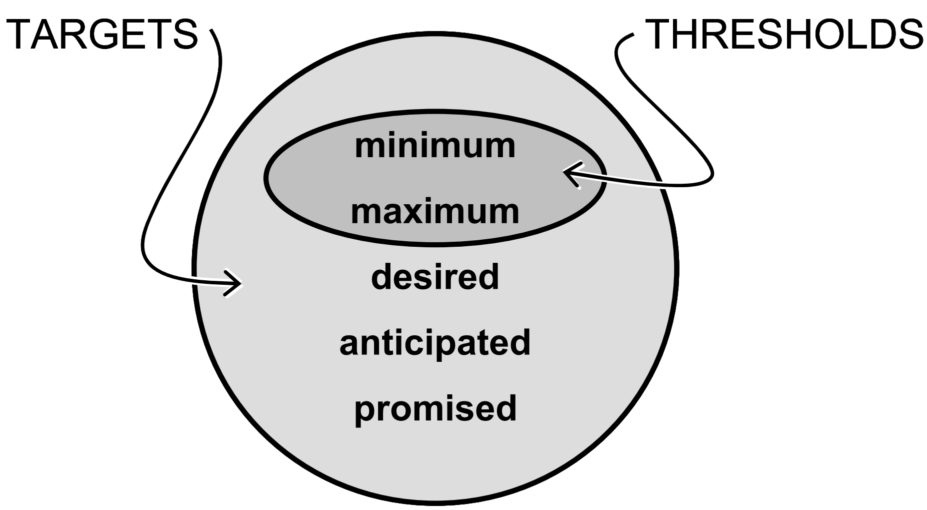
- Exists as Information
- Aggregated
- Tracked across a Span of Time
- Comparative Value
- Based on a Business Context
- Purpose is to Inform and Enable Action

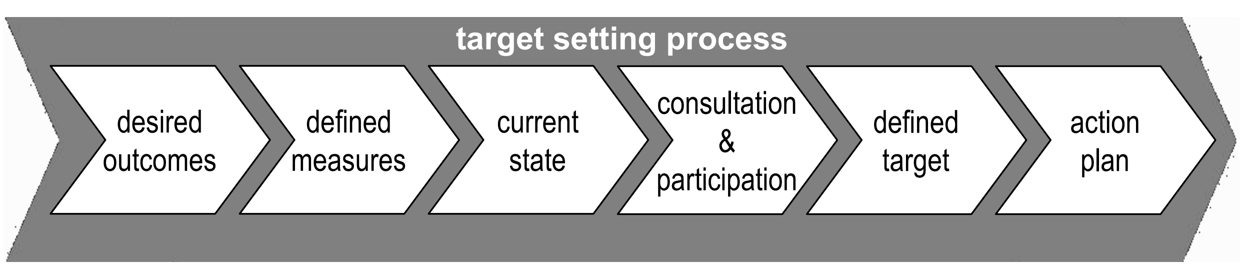
Measurement Characteristics

Setting Targets and Thresholds

Target: A specific, quantified, and time-bounded level of achievement. A target may specify a minimum, maximum, desired, anticipated, or promised level of achievement.

Threshold: A target that specifies a minimum or maximum acceptable level of achievement.





Measurement Characteristics

Setting Targets and Thresholds

INTRODUCTION

Targets and thresholds are data values that provide additional levels of meaning to raw measurement data within an integrated metric data structure. This additional context and business meaning helps decision makers to readily interpret measurement results by putting these values into a business context that can be translated into decisions and actions. A major reason why the application of well designed metrics has become a powerful business management tools is because actual observations are put into rich layers of business context defined by limits, thresholds, benchmarks and targets. By analyzing measured performance gaps as presented by the metric structure, decision makers are informed directly where corrective analysis and actions should be applied.

DEFINITIONS

Target
A target is a desired, specified, quantified, and time bounded level of achievement. It may specify a minimum, maximum, desired, budgeted, optimum, anticipated, or promised level of achievement. Targets may be calculated for analytical models or they may be manually defined and set by process managers.

Threshold
A threshold specifies minimum or maximum levels of achievement. This is useful for generating action oriented alerts and alarms with the objective of informing managers that corrective action is required.

SETTING TARGETS

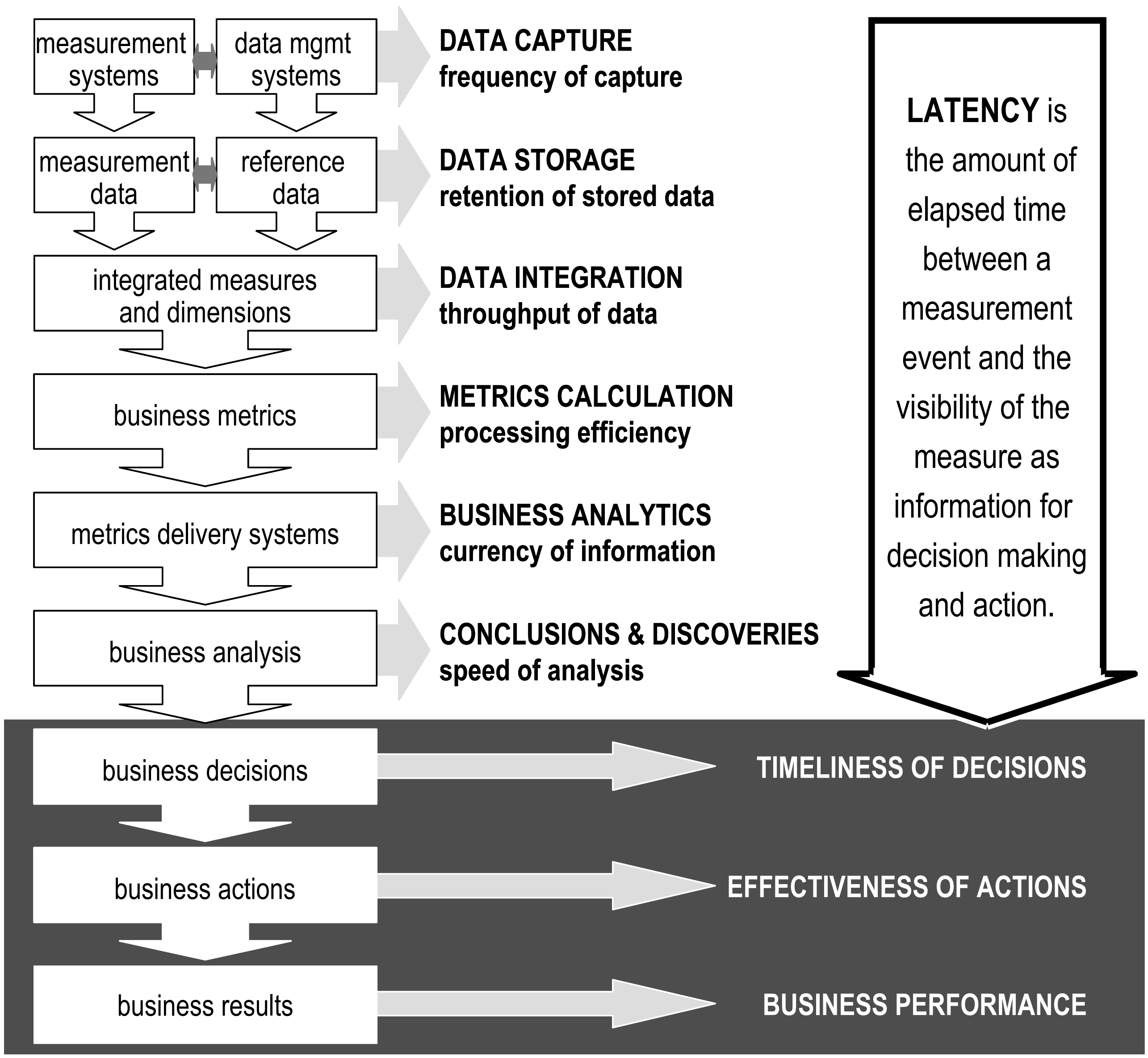
Targets are usually defined within a business or operations planning process. Levels of optimization may be applied to a business process during planning activities using analytical models that represent the process. Outputs of the planning studies may include a set of process variable targets that if achieved define an optimum set of conditions. The targets can then be implemented in the measurement system to support the business monitoring and feedback functionality.

The following steps can be used to define targets and thresholds.

1. specify the desired future process or business outcomes
2. define the measures that will indicate the outcome values
3. asses the current state of the process
4. consult and collaborate to define a set of process variables to be controlled
5. define the range of target and threshold categories and values
6. execute the action plan to move from current to future state

Measurement Characteristics

Timing and Latency



Measurement Characteristics

Timing and Latency

INTRODUTION

The impact of time is evident throughout the analytics supply chain. Each stage in the supply chain has different constraints and issues that originate from the impact of time. Time impacts the supply chain from two different perspectives. The perspectives are timing and latency.

DEFINITIONS

Timing
Timing is the characteristic that governs the logical flow and sequencing of the supply chain activities over time. Timing characteristics describe how often an event takes place, the duration of a given activity or event and the logical sequencing of events over time. The concept of timeliness is related to timing activities.

Latency
Latency is a different perspective related to the time domain. Latency is a measure of the amount of elapsed time between a measurement event and the visibility of the measure as information for decision making and action.

METRICS SUPPLY CHAIN CONSIDERATIONS

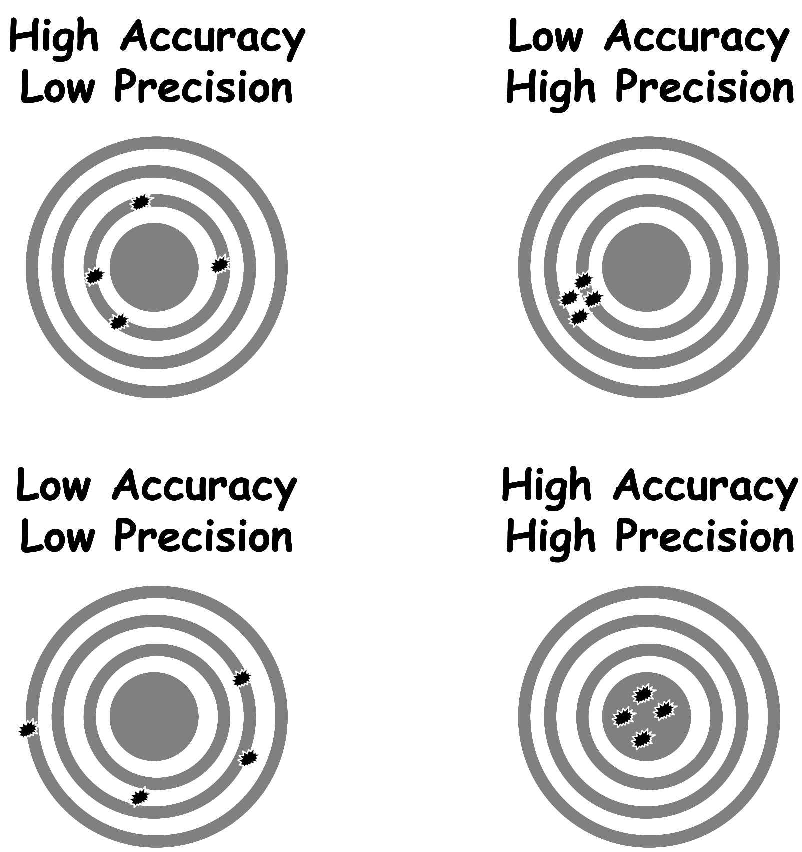
The following list shows impacts and issues related to timing at each stage of the analytics supply chain.

- Data Capture Stage – Frequency of capture
- Data Storage Stage – Data retention of stored data
- Data Integration Stage – Data throughput
- Metrics Calculation Stage – Processing efficiency
- Business Analytics Stage – Currency of information
- Conclusions and Discoveries Stage – Speed of analysis
- Business Decisions Stage – Timeliness of decisions
- Business Actions Stage – Effectiveness of actions
- Business Results Stage – Business Performance

Measurement Characteristics

Precision and Accuracy

> Accuracy is the degree of veracity while precision is the degree of reproducibility.
>
> Ideally a measurement device is both accurate and precise, with measurements all close to and tightly clustered around the known value. The accuracy and precision of a measurement process is usually established by repeatedly measuring some traceable reference standard.
>
> www.wikipedia.org



Measurement Characteristics

Precision and Accuracy

PRECISION

Precision is a property of a measurement system that is related to its consistency. The higher the degree of precision means that future measurements of the same phenomenon will produce similar results.

ACCURACY

Accuracy is a property of a measurement system that is related to how close the measured value is to the actual or true value. It is a characteristic of measurement systems that is related to the size of the standard error. With a smaller error the accuracy level is higher.

IMPLICATION

In the ideal case, a measurement device is both accurate and precise. This will produce results that are close and tightly clustered around a known value. The level of accuracy and precision of a given measurement system is usually established by repeatedly measuring some traceable reference standard. This process is also called calibration.

Measurement values can be precise or accurate or both. Values that are both precise and accurate are called “valid”.

Module 3

Data Modeling for Metrics

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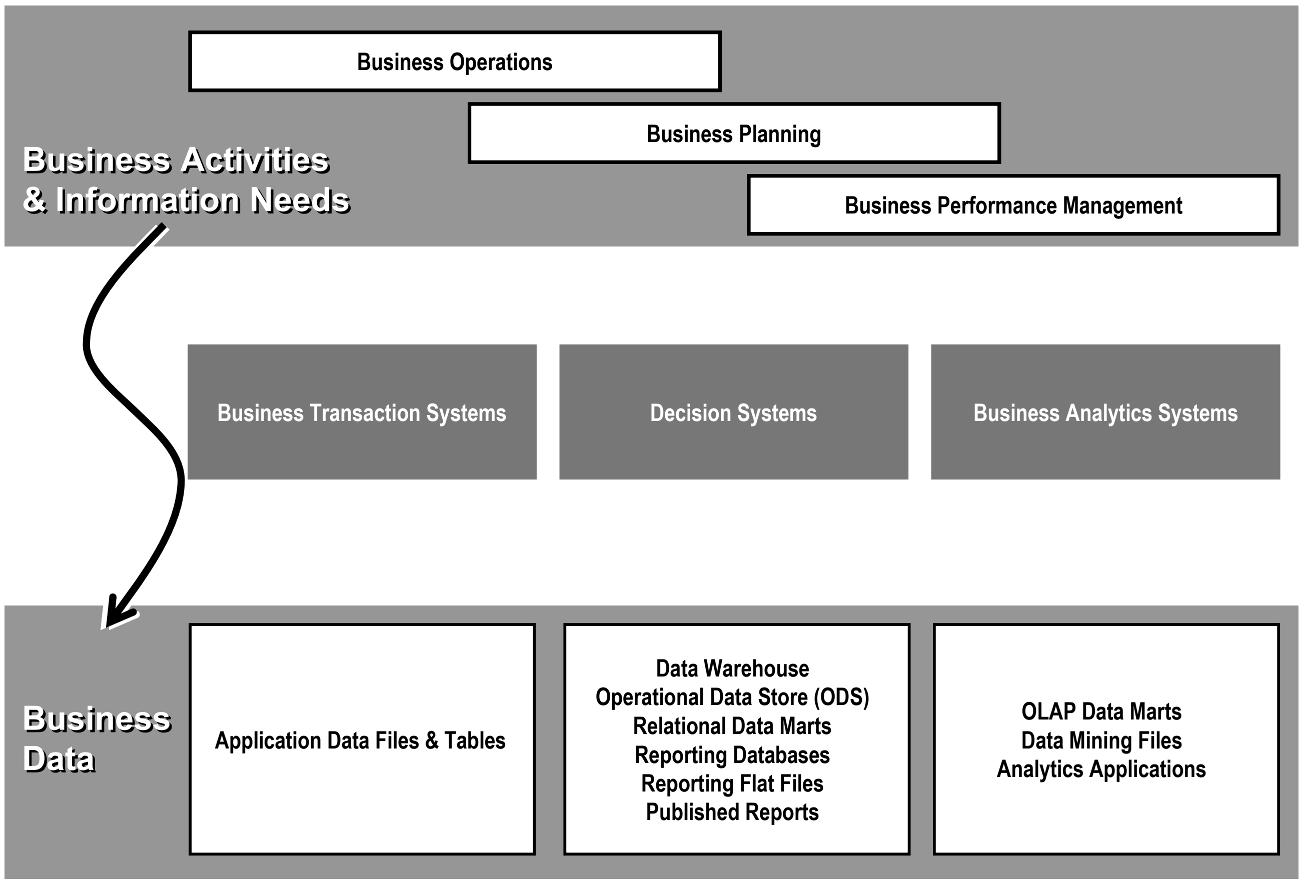
The Data Modeling Framework

Overview



The Data Modeling Framework

Overview

THE BEGINNING

A data model is an abstract representation of the data in an enterprise, or of the information that is derived from that data. Data and information can (and should) be represented at multiple levels of abstraction, each providing a different perspective and understanding of the data. The highest level of abstraction is a business context view with both external (outside looking in) and internal (looking from within) perspectives. Thus data modeling begins with business activities and the information needs of those activities. This view describes the scope of and the context for business information requirements—a sensible start to *modeling the right data*.

THE END

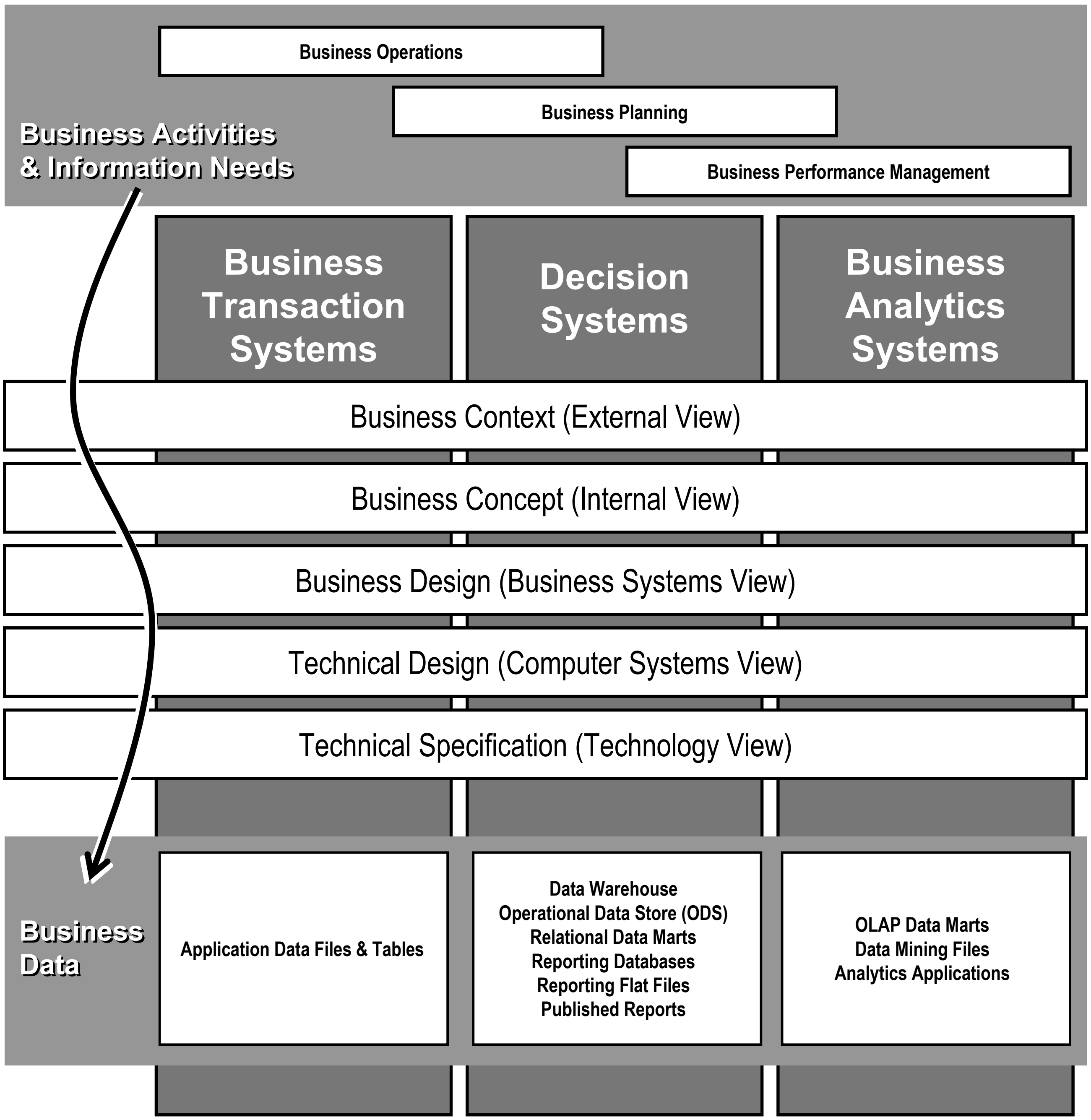
The natural conclusion of data modeling is implemented data—data files and database tables. Far from the top level of abstraction, implemented data is beyond the bottom tier; it is no longer abstract but real and physical. At this level attention turns to *the right implementation for the data.*

THE MIDDLE

The complexities and challenges of data modeling lie between the top layer of context and the bottom tier of implementation. Getting from the right data to the right implementation involves many information systems, ranging from those that capture data in the course of business activities to those that turn data into information and supply that information to the business.

The Data Modeling Framework

Framework Levels



The Data Modeling Framework

Framework Levels

BUSINESS AND SYSTEMS VIEWS

Business context alone is insufficient to describe business requirements for data and information. Similarly, implementation is not adequate to design and deploy information systems and databases. Multiple levels of abstraction are needed to manage complexity, understand and document from multiple perspectives, communicate effectively, and provide a natural progression from need to solution. The six layers of modeling abstraction are based on the Zachman Framework (*A Framework for Information Systems Architecture, IBM Los Angeles Scientific Center Report*, John A. Zachman, 1986). Zachman's framework addresses many aspects of information systems architecture. To learn more about the Zachman Framework, visit www.zachmaninternational.com. The six levels of data modeling include:

CONTEXTUAL

Context modeling provides a view of the scope of the planned data warehousing program. Context models communicate understanding of the business requirements, and establish a context for analysis. This level corresponds to the *Scope* level of the Zachman Framework.

CONCEPTUAL

Models at this level are about understanding the required set of data warehousing data stores. Conceptual models describe data requirements from a business point of view without the burden of technical details. This corresponds to the *Enterprise Model* level of the framework.

LOGICAL

Models at this level refine conceptual models by documenting entities, their attributes and their relationships. These models are technology oriented designs, although they are platform-independent. This level corresponds to the *System Model* level of Zachman's framework.

STRUCTURAL

Structural models move a step closer to implementation. They specify the design necessary for the warehouse / marts to maintain history, to distribute data, and to provide for ease of use. Structural modeling corresponds to the *Technology Model* level of the Zachman framework.

PHYSICAL

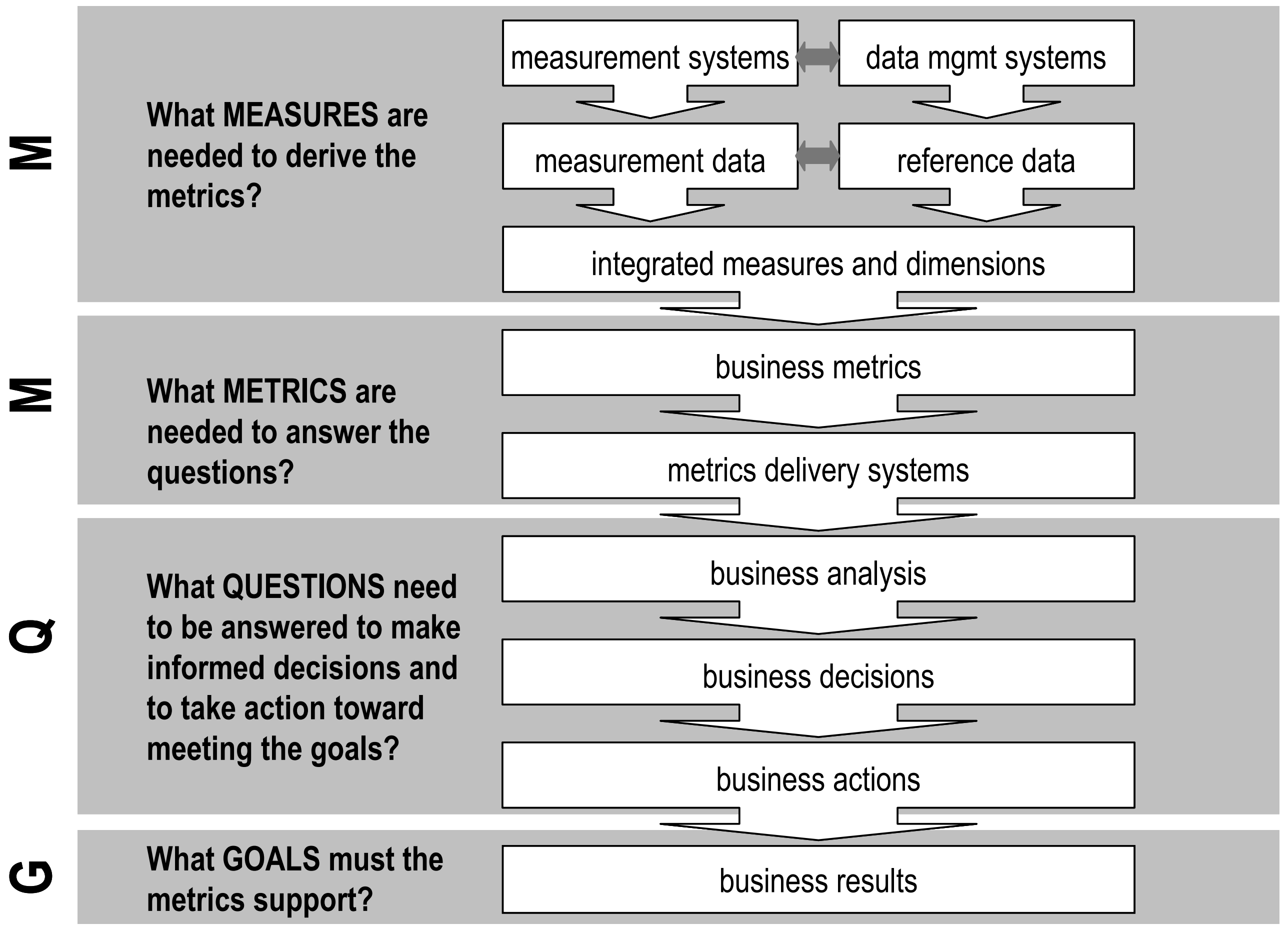
Physical models represent the detailed specification of what is physically implemented using specific technology. This level corresponds to the *Detailed Representation* level of Zachman's framework.

Module 4

Goal-Question-Metric-Measure

GQMM Models

Purpose and Description



GQMM Models

Purpose and Description

PURPOSE

The Goal-Question-Measure-Metric method is used to identify useful and relevant measures and metrics that will help an organization manage their activities to attain whatever goals they have set for themselves.

DESCRIPTION

The technique uses a structured approach that starts by defining the goals of the organization that has the need for a measurement system. Effective "SMART" goals have common characteristics: they are Specific, Measureable, Achievable, Relevant, and Timely.

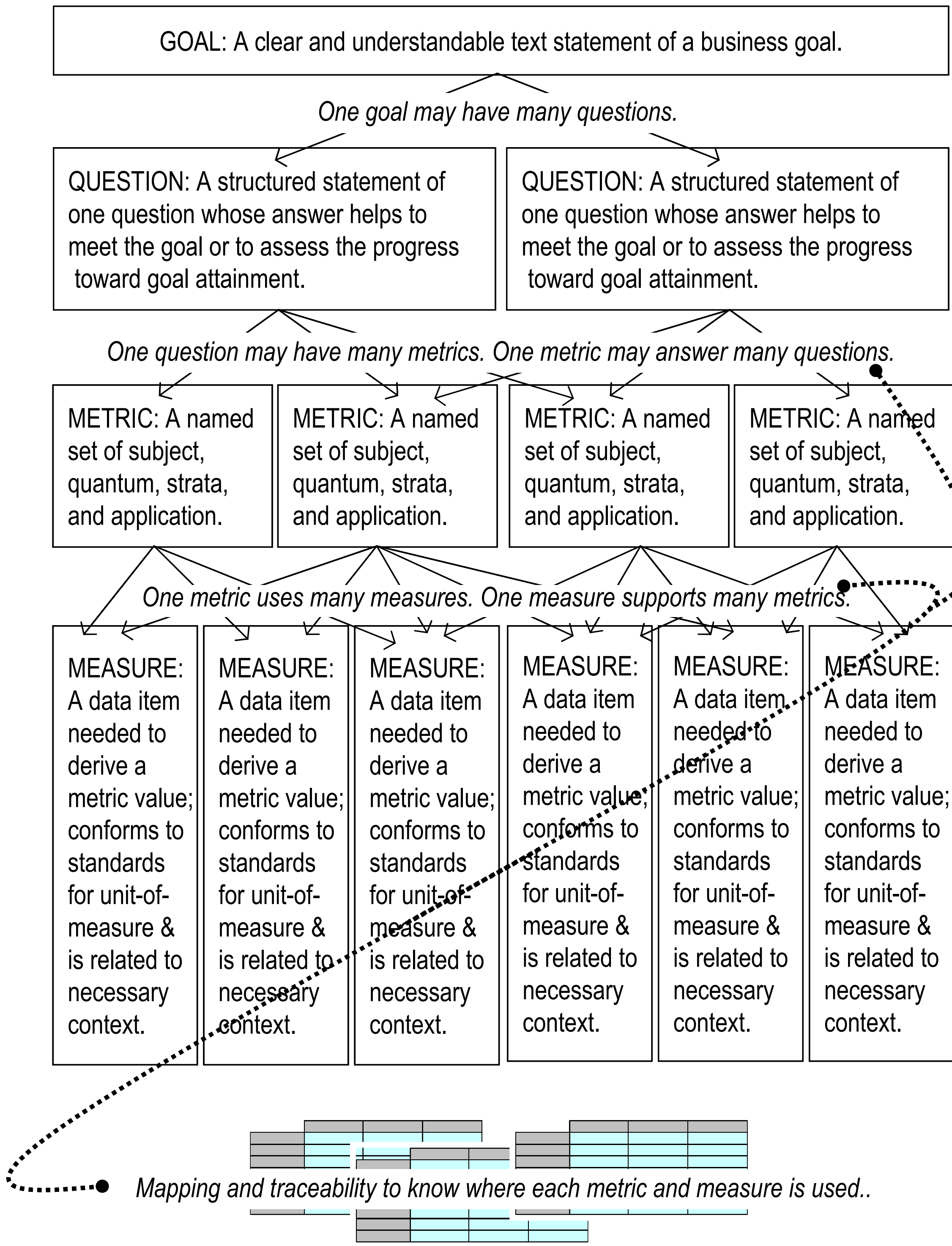
The next step in the GQMM process is to identify the questions that different types of stakeholders will ask as they manage towards goal attainment. Questions require answers. The answers are provided in the form of Metrics. Metrics provide information as answers to the questions being asked about goal management. Metrics may require multiple measures as input values. Measures are the fundamental data elements that will flow through the supply chain as raw material to help create relevant metrics for managers and decision makers.

The GQMM technique is related to the analytics supply chain. Different combinations of the supply chain stages provide a reference point for each of the four GQMM steps.

1. Goals are related to Business Results stage
2. Questions are related to the Business Actions, Business Decisions, and Business Analysis stages
3. Metrics are related to the Metrics Delivery Systems and Business Metrics stages
4. Measures are related to the Integrated Measures and Dimensions, Measurement/Reference Data and Measurement/Data Management Systems stages

GQMM Models

Approach and Deliverables



GQMM Models

Approach and Deliverables

APPROACH

The following rules should be followed to navigate between the steps of the GQMM process.

1. Clearly define a set of business goals that are aligned to strategy and objectives of the organization. The goals should have the characteristics of being specific, measurable, achievable, relevant, and timely.

2. For each goal, apply the GQMM process to identify the related metrics and measures. Each goal may have many questions associated with it.

3. Each question may have many metrics associated with it and each metric may assist in answering many questions.

4. Each metric may require the usage of many measures and each measure may support the implementation of multiple metrics.

5. Each metric and measure should be mapped to understand and document their usage and application.

DELIVERABLES

The following deliverables are created by the GQMM process.

Goals
Goals are clear and understandable text statements of what the business wants to accomplish.

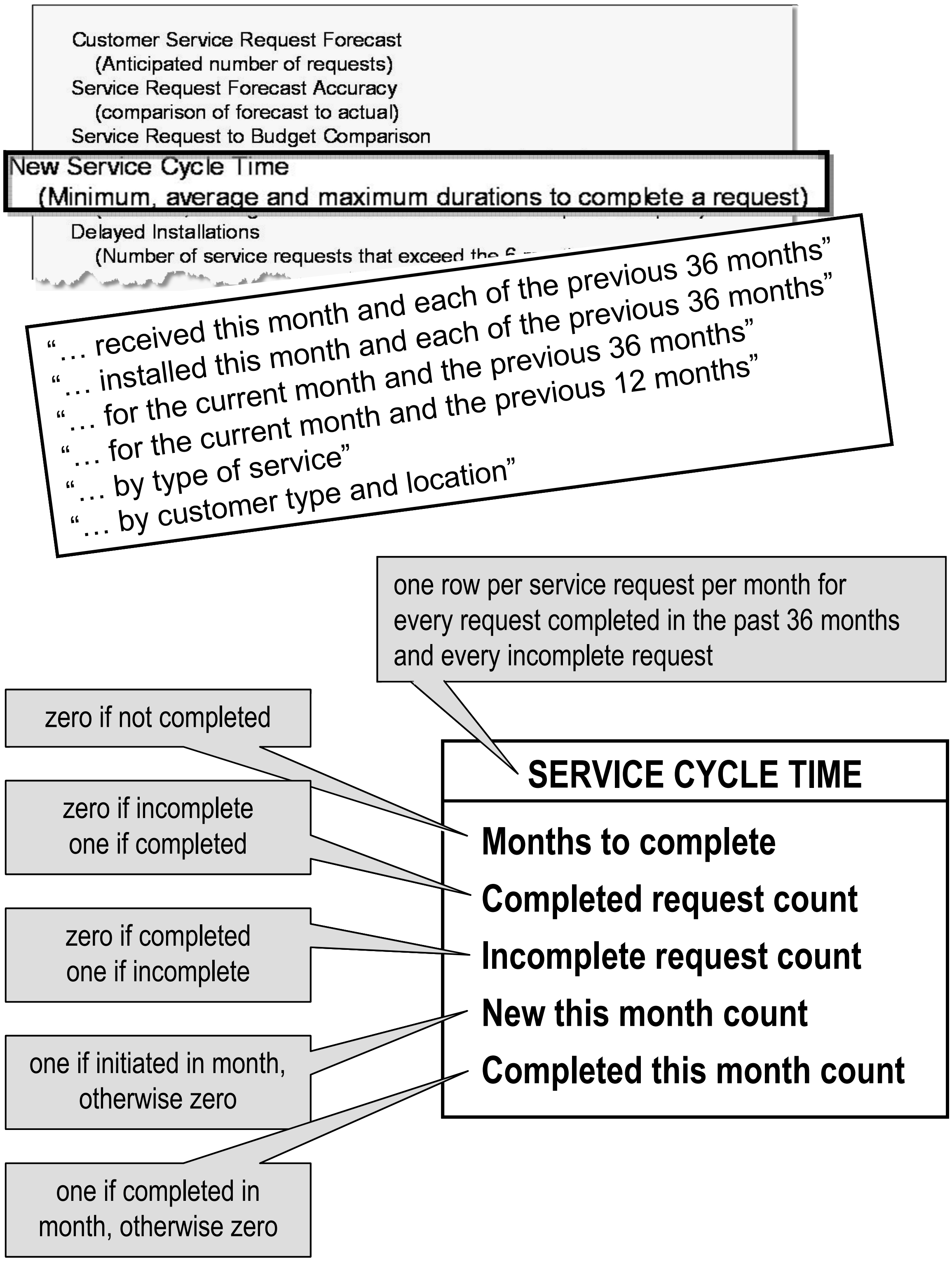
Questions
Questions are structured statements of individual questions whose answer helps to meet a particular goal or to assess the progress made toward goal attainment.

Metrics
Metrics are named sets of a specific subject, quantum, strata and application.

Measures
Measures are data items needed to drive a metric value. They must conform to standards for units of measure and any related and essential business context.

Logical Data Modeling

Modeling the Meter



Logical Data Modeling

Modeling the Meter

INTRODUCTION

The GQMM process is complete when the data requirements for the measures and metrics have been identified. The logical modeling activity follows the GQMM process to define a dimensional data structure that meets the data requirements.

NAMING THE METER

A meter is a group of related measures that can collectively be given a business name. With the GQMM approach the meter name typically reflects the name of the defined metric(s) to be implemented. In this example, the name of the meter is “Service Cycle Time”

DESCRIBING THE METER

Scope and granularity are important definitional characteristics of a meter. Scope describes the range of data (*every request completed in the past 36 months and every incomplete request)* and granularity describes the level of detail (*one row per service request per month)* for every business measure to be collected by the meter. Note that this activity is performed as the initial definition of the meter. Granularity is likely to be further refined as the data modeling process continues.

FINDING THE BUSINESS MEASURES

Business measures are the quantitative data elements to be collected by the meter. Note that the business measures may be at a higher level of detail than the process-level measures previously identified. They must, however, be quantities that can be calculated from the process-level measures. They are found by examining the questions on which the metric is based. In this example, five business measures are illustrated:

- Months to complete
- Completed request count
- Incomplete request count
- New this month count
- Completed this month count

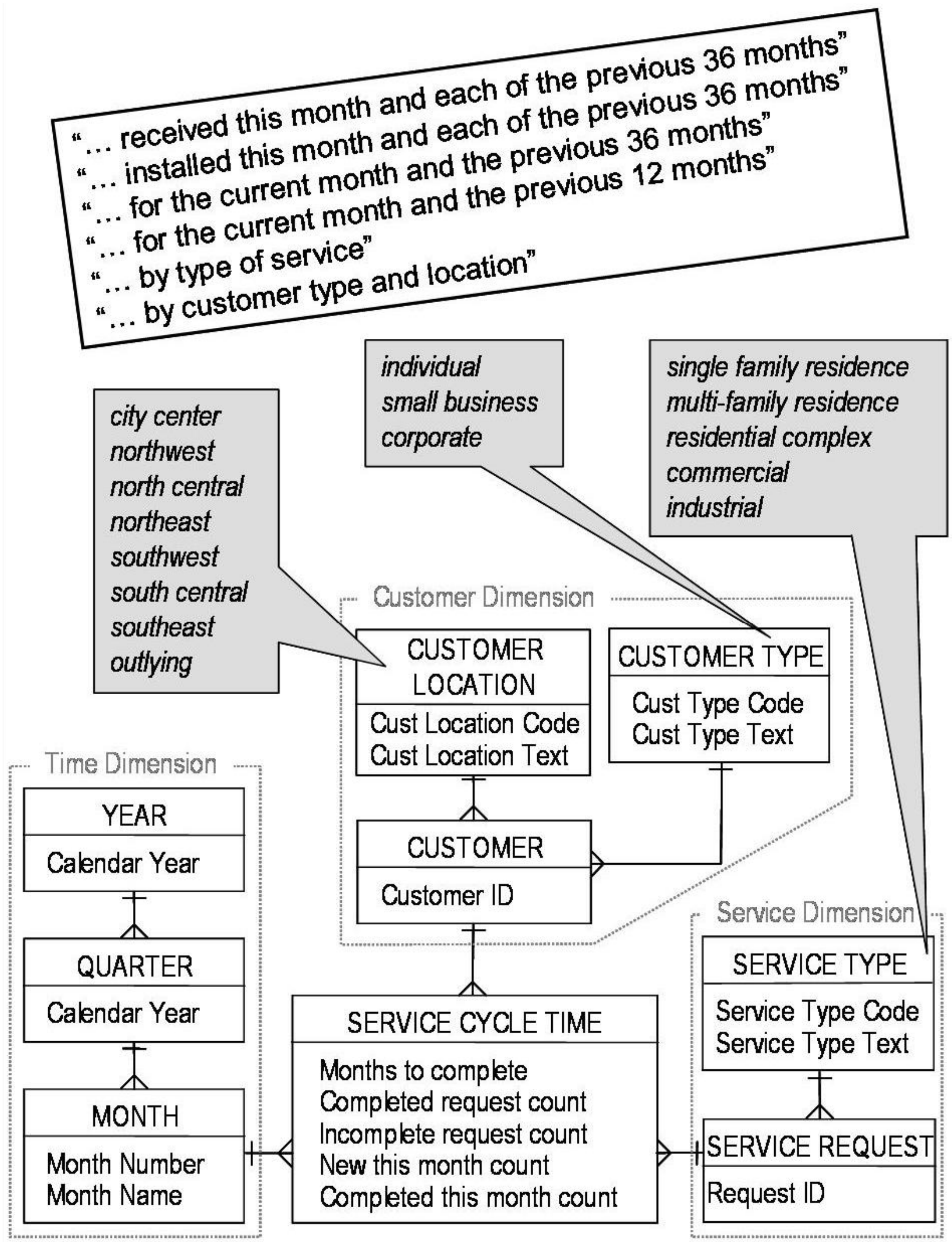
DESCRIBING THE BUSINESS MEASURES

Describing each business measure in terms of the expected values and the conditions under which those values are anticipated helps to fully understand the content of the meter, and serves as one method of verifying that the data model is properly designed to meet the metric requirements.

The expected values of each measure and the rules that govern their values are shown in the diagram on the facing page.

Logical Data Modeling

Modeling the Dimensions



Logical Data Modeling

Modeling the Dimensions

FINDING DIMENSIONS

Dimensions are the criteria by which measures are summarized, totaled, selected, grouped, sorted, etc. – implementing the metric strata. In this example, four strata were identified:

- month
- type of service
- customer type
- location

Each must be examined to determine if it is part of a hierarchy. The dimensions in the data model reflect how each business hierarchy is applied to the metric data structure.

DESCRIBING DIMENSIONS

Similar to describing the expected values of the measures, it is helpful to describe the values that are expected at each level of every dimension. This activity promotes understanding and serves as a check on the quality of the metric data structure design.

REVISITING GRANULARITY

The grain of the meter is now defined by the combination of the leaf level elements of each dimension. Each measure exists at the level of granularity (or grain) defined for the meter. In this example, every measure is for one service request, for one customer, and for one month.

It is important to verify that this declared grain does not conflict with the initial statement of granularity made when the meter was initially described. In this instance, more criteria have been added resulting in a finer grain. This does not create conflict as it is always possible to summarize.

Module 5

Causal Modeling

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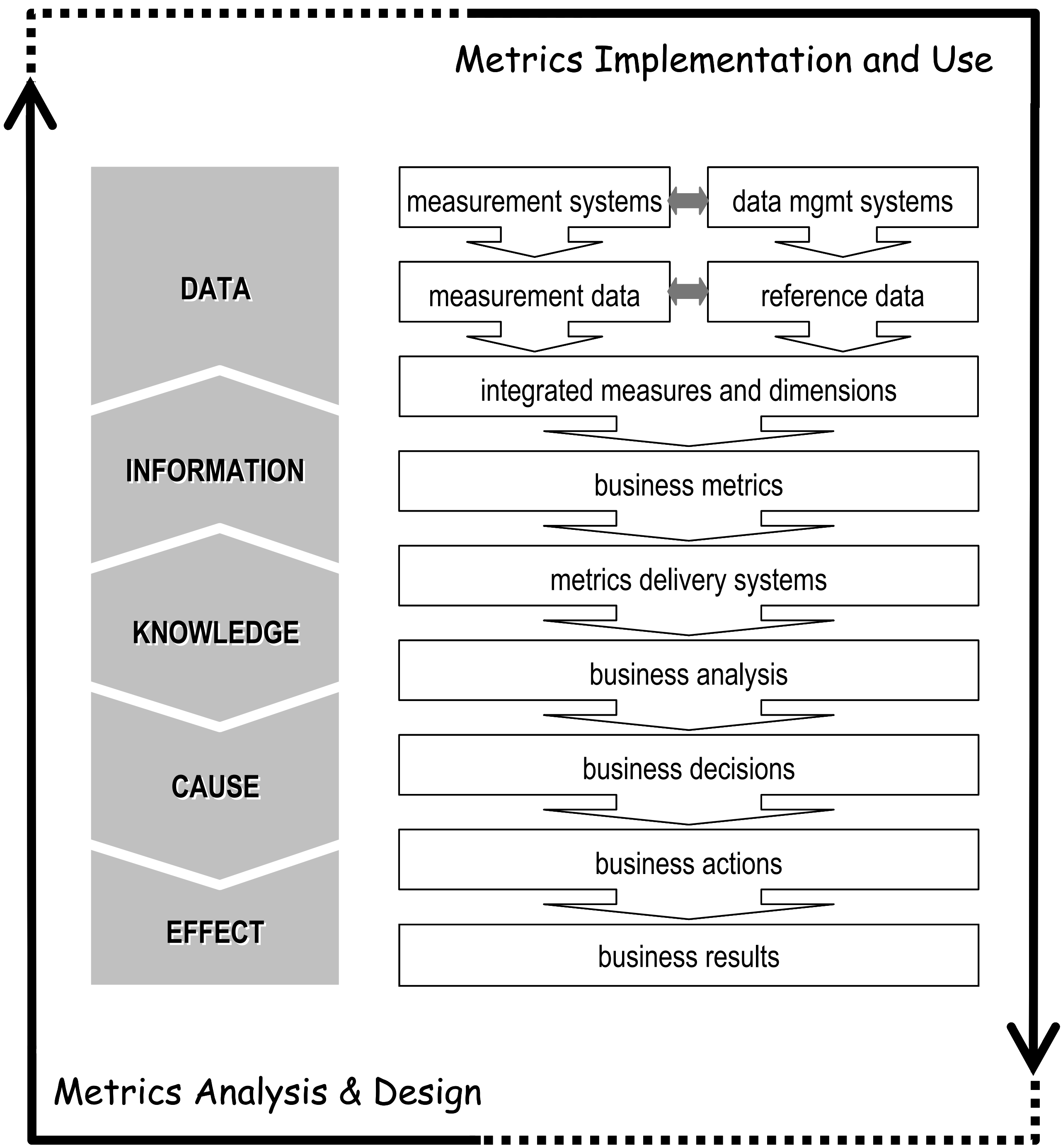
Causal Models

Purpose and Description



Causal Models

Purpose and Description

PURPOSE

Causal models represent a broad set of models that are used to understand cause and effect relationships in an organization or in a process. The models can also used to identify and understand logical relationships between elements that translate actions into results. Causal models are useful to the metrics modeler because effective measurement systems provide sets of metrics that are linked through causal relationships. This feature helps managers know and understand what variables are under their control that they can manipulate and what variables represent outcomes that will likely occur from their actions.

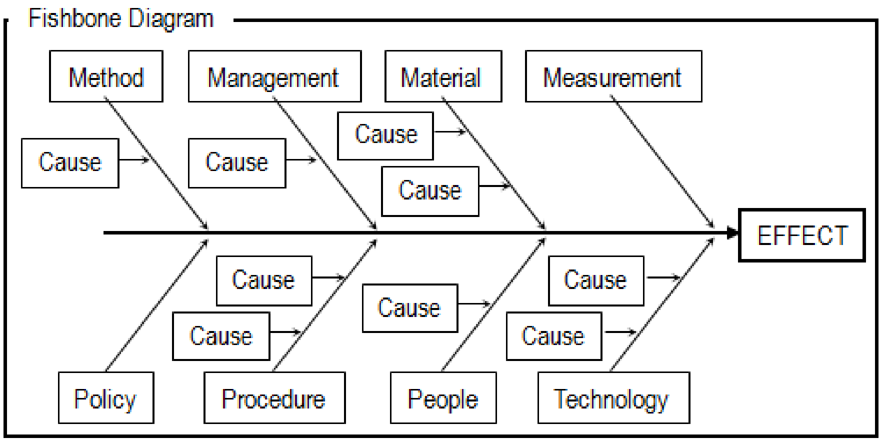
DESCRIPTION

Models that express causal relationships in an organization provide a linkage between data, information, knowledge, causes, and effects. At the analytics supply chain level, it is important to know which measures should be collected and delivered to ensure that the appropriate actions are taken in order to produce the desired business outcomes.

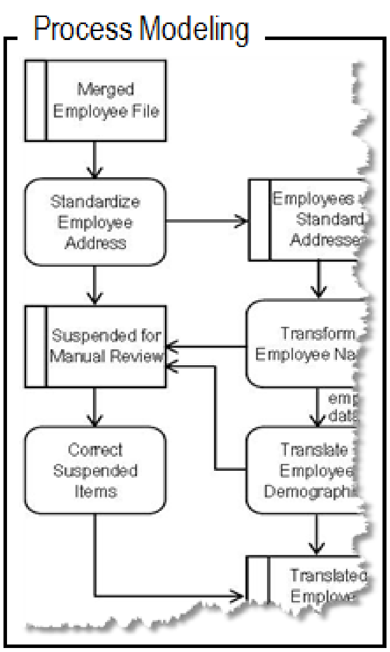
The diagram on the facing page shows how this data to effect (or outcome) chain maps and relates to the analytics supply chain. This type of modeling provides the necessary context to ensure the right metrics are being monitored to ensure the business goals are achieved.

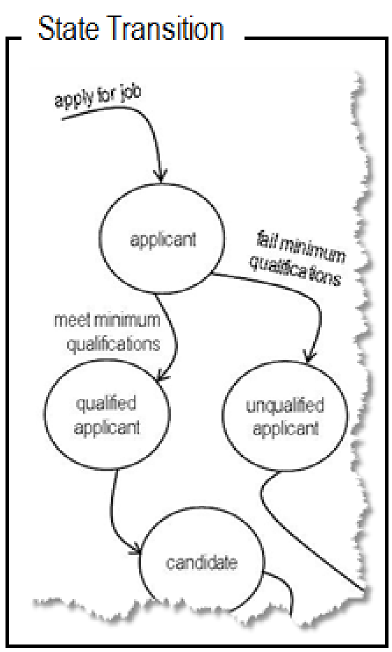
Causal Models

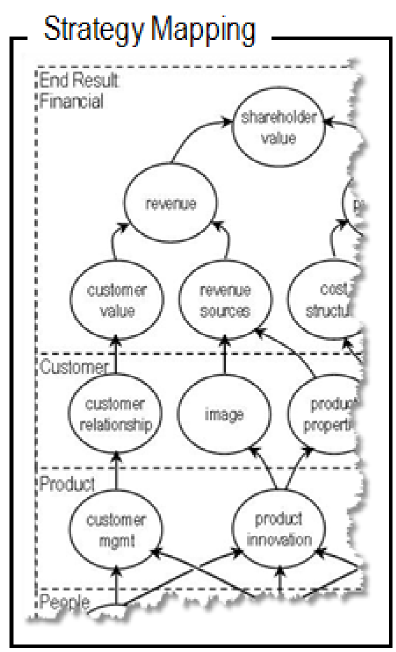
Cause and Effect Models



1. Identify the effect (real or desired outcome) to be analyzed.
2. Determine the causal categories (i.e., method, management, material …).
3. Identify the causes (actual or possible) for each category.







Causal Models

Cause and Effect Models

DESCRIPTION

There are several different modeling techniques in common use that analysts use to identify and analyze causal relationships. The major feature of all causal modeling techniques is their ability to state that when "something" happens or when a combination of "things" happen, then an outcome or result can be predicted. Simple models make their predictions of outcomes without considering the impact of probabilities on each of the events taking place. Their predictions will be in a form based on a qualitative view of certainty. This means that a simple model will conclude that either an outcome will take place for sure or an outcome will likely take place. More sophisticated models consider the details of a more quantitative approach to estimating the certainty or likelihood factors based on probability factors and statistical models. However, whether the models are simple or sophisticated they all make predictions about an outcome event taking place based on one or more input conditions occurring. Causal models become larger as the basic building blocks of single cause and effects are assembled in more complicated chains of events where intermediate results and dependencies across multiple events can be modeled. A common approach used to develop these models uses the following steps.

- Identify the effect to be analyzed. This can be a real or desired outcome.
- Determine the causal categories driving this effect, i.e. method, management style, material, people, technology, etc.
- Identify the actual or possible causes for each causal category

EXAMPLE

The following are examples of causal model types.

- Fishbone Diagram that links an effect with causal categories and then each category is populated with specific causes that drive the effect.
- Process Models define the logic, flow, sequence and dependencies in a process
- State Transition models that represent the business rules that drive a business entity through multiple states or status changes
- Strategy Maps are used in the Balanced Scorecard methodology to identify how a desired strategic outcome is enabled by and linked to multiple situations and conditions that are categorized by the four perspectives of finance, customer, process, and intangibles.

THE DATA WAREHOUSING INSTITUTE

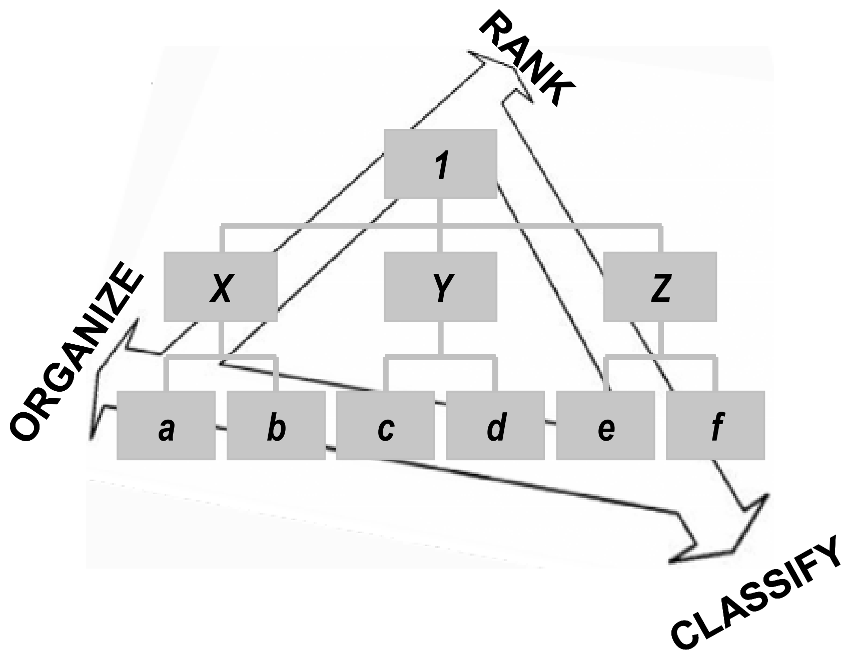
Module 6

Extending Data Modeling for Metrics

Hierarchy Models

Purpose and Description

> HIERARCHY: A a system of ranking and organizing things or people, where each element of the system (except for the top element) is subordinate to a single other element.
>
> www.wikipedia.org



Containment Hierarchy models things as strictly nested sets and subsets. *X* is a fully contained subset of *1,* and *1* is a superset that contains only *X, Y,* and Z. For example, a taxonomy.

Component Hierarchy models things as a structure of component parts. *X* is composed of *a* and *b*; *b* is a part of *X.* For example, a manufacturing bill of materials.

Social Hierarchy models people as a structure of reporting relationships. *X, Y,* and *Z* report directly to *1*; *a* and *b* report directly to *X.* For example, an organization chart.

Analytic Hierarchy is a specific variation of a containment hierarchy that is applied for structured decision-making processes. The analytic hierarchy process (AHP) uses a binary comparison of each pair of things at the bottom of every hierarchical branch to rank the relative importance of each thing in the hierarchy.

Hierarchy Models

Purpose and Description

PURPOSE

As defined in www.wikipedia.org, a hierarchy is a system of ranking and organizing things or people where each element of the system (with the exception of the top element) is subordinate to single other element. This definition describes the classic tree structure used to define “one to many” relationships useful for a variety of applications in organizations. Hierarchy models are used to organize, classify and rank specific things in organizations.

DESCRIPTION

The following four types of hierarchy models exist and can be applied as required.

Containment Hierarchy
This form of hierarchy is used to model things strictly as nested sets and subsets. An example of this is a taxonomy used to classify elements of a set such as a technology category grouping. This is useful to categorize technology into groupings and break these groupings down into more detail.

Component Hierarchy
This form of hierarchy is used to model things as a structure of component parts. An example of this is a manufacturing bill of materials. This describes all of the input materials needed to manufacture or assemble a final product.

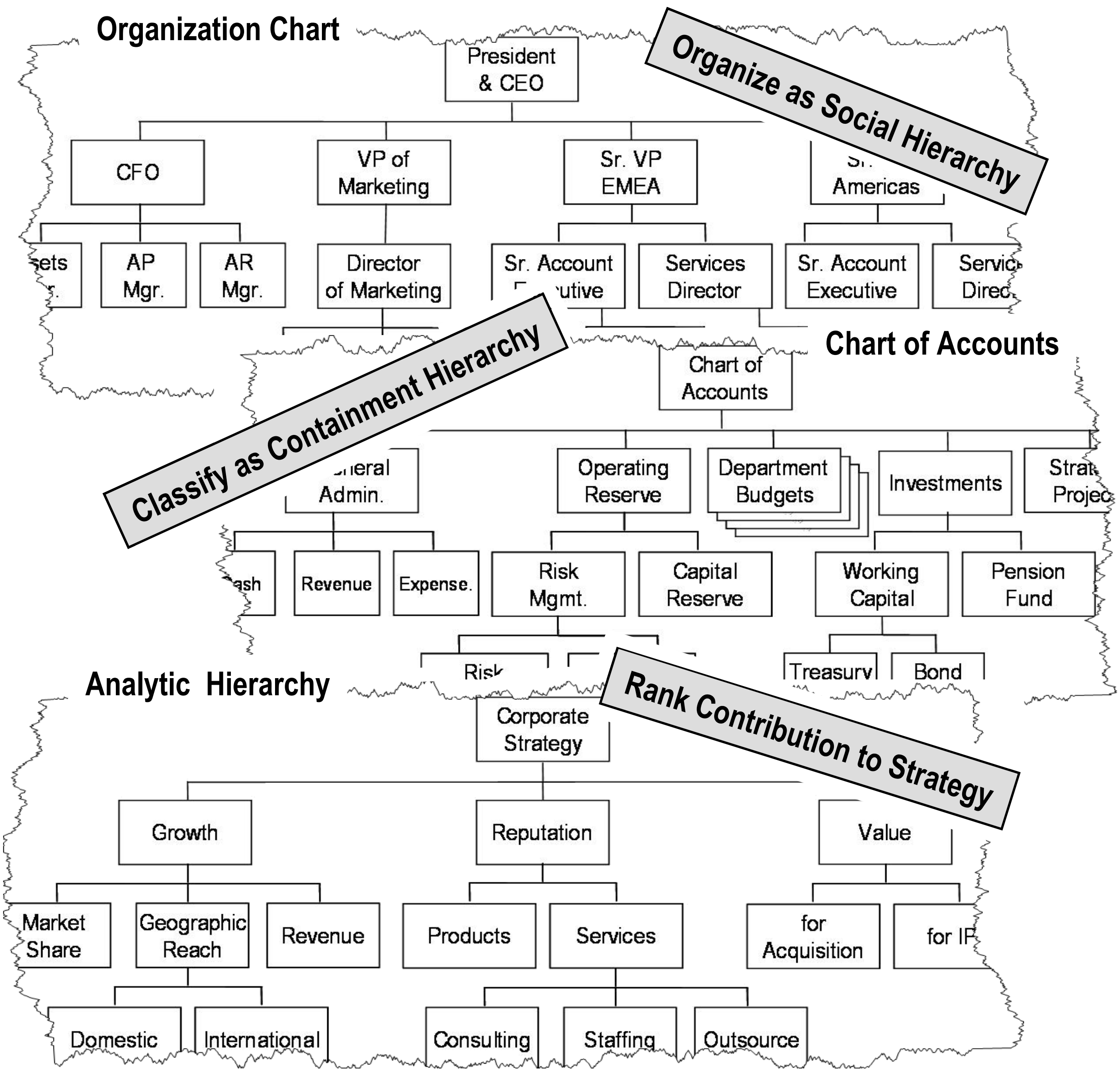
Social Hierarchy
A social hierarchy models people as a structure of reporting relationships. An example of this is an organization chart.

Analytic Hierarchy
This form of hierarchy is a specific variation of a containment hierarchy that is applied for structured decision making processes. The analytics hierarchy process (AHP) use a binary comparison of each pair of things at the bottom of every branch in the hierarchy to rank the relative importance of each thing in the hierarchy.

Hierarchy Models

Approach and Deliverables

- Identify the purpose of the hierarchy model (organize, classify, rank)
- Identify the kind of hierarchy (containment, component, social)
- Identify the top of the hierarchy
- Decompose each branch, repeating until the next level is insignificant
- Know implied relationships – "a kind of," "a part of, "reports to," etc.



Hierarchy Models

Approach and Deliverables

APPROACH

The following approach is used to develop hierarchy models.

- Identify the purpose of the hierarchy model (organize, classify, rank)
- Identify the kind of hierarchy (containment, component, social)
- Identify the top of the hierarchy
- Decompose each branch, repeating until the next level is insignificant
- Know implied relationships such as “a kind of”, “a part of”, “reports to”, etc

DELIVERABLES

Three hierarchy model examples are shown on the facing page. Each model represents a different application of a hierarchy.

- An organization chart is used to Organize as a Social Hierarchy
- A chart of accounts is used to Classify as a Containment Hierarchy
- An analytic hierarchy is used to Rank Contributions to a Strategy

The deliverables from hierarchy models are shown below.

- Purpose of the hierarchy
- Name of the hierarchy
- Description of the root or top level of the hierarchy
- Number of Branches
- Number of Levels
- Name and Description of each branch
- Name and Description of each level
- Descriptions of the Relationships between hierarchy levels