Product Lifecycle Management Metrics

Project Update

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Project Scope

- Initiate study on PLM metrics
    - Review PLM literature
    - Develop protocol – categories and items
    - Define sample
    - Conduct interviews

PLM Literature Review Highlights

☐ Strategic business approach
   - Integrates people, processes/practices, technology
   - Across product's lifecycle - design through manufacture, deployment, maintenance, culminating in the product's removal from service and final disposal
   - Trading product information for wasted time, energy, and material across the entire organization and into the supply chain
   - Driving the next generation of lean thinking

Michael Grieves, *Product Lifecycle Management: Driving the Next Generation of Lean Thinking* (New York: McGraw-Hill, 2006), 39.

PLM Lifecycle Model

External Drivers

- **Scale** – companies have gotten larger
- **Complexity** – variation in products have increased
- **Cycle time** – manufacturing timeframe has decreased due to competition for first to market
- **Information technology** – digital information is mobile and price of technology has decreased
- **Globalization** – worldwide manufacturing arena and markets
- **Regulation** – increasing scope of governmental regulations worldwide

Michael Grieves, *Product Lifecycle Management: Driving the Next Generation of Lean Thinking* (New York: McGraw-Hill, 2006), 95-109.

Internal Drivers

- ☐ **Productivity** – quest for increased productivity
- ☐ **Innovation** – product and process
- ☐ **Collaboration** – within and between organizations
- ☐ **Quality** – meeting specifications and standard of usage
- ☐ **Return on investment** – ratio of input to output

Michael Grieves, *Product Lifecycle Management: Driving the Next Generation of Lean Thinking* (New York: McGraw-Hill, 2006), 109-120.

Technology as Driver

- ☐ Leading cause of transformation in business
- ☐ Geographical barriers less relevant
- ☐ Cultural barriers lowered through information
- ☐ Boosting productivity
- ☐ Data sharing
- ☐ Video- teleconferencing

B. Delong, "Globalization means we share jobs as well as good," Financial Times, August 27, 2003.

Globalization as Driver

- ☐ Network of international linkages
- ☐ Highly competitive global marketplace
- ☐ Interdependent global economy

T. Morrison, W. Conaway, and J. Bouress, *Dun & Bradstreet's Guide to Doing Business Around the World* (Upper Saddle River, NJ: Prentice Hall,1997).

Concurrent Engineering Practice

☐ Pro
- ■ Increased innovation
- ■ Quicker to market

☐ Con
- ■ If significant changes are required, results in costly and time consuming rework to manufacturing process and/or tooling

Koufteros, X., Vonderembse M., $ Doll, W. (2001). Concurrent engineering and its consequences. Journal of Operations Management, 19 (1), 97-115.

Krishnan, V. (1996). Managing the simultaneous execution of coupled phases in concurrent product development. IEEE Transactions on Engineering Management, 43 (2), 210-217.

Concurrent Engineering Reduce Risk

- Improve communications
  - PDM
- Engage in collaborative design
- Capture all product and process data through out the lifecycle
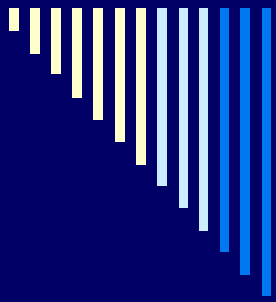 - PLM

PLM Benefits/Values

- Efficiencies
    - Time
    - Energy
    - Materials
- Innovation
    - Product
    - Processes
- Revenue

PLM Advocates and Software Vendors

- Solve problems *more*
  - Quickly
  - Effectively
  - Efficiently
- Bring products to market *more*
  - Quickly
  - Lower costs
- Seize market opportunities *more*
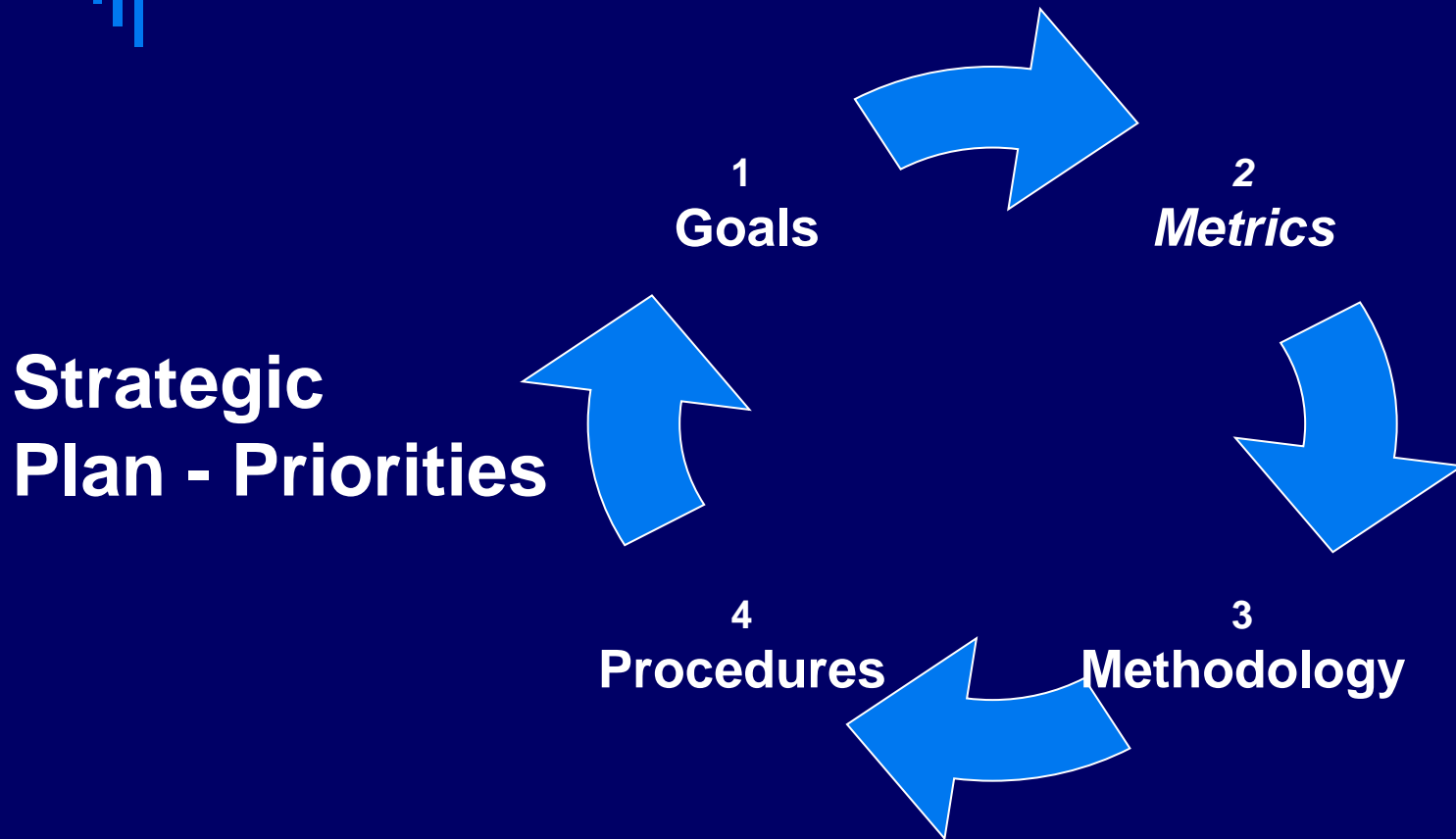
Assessment Model

PLM and Alignment with Strategic Plan

- Strategic Plan
  - Organizational Values, Culture, Principles
  - Mission
  - Vision
  - Signature Areas
  - Peer Organizations
  - Priorities
    - Goals
    - Action Plans

Assessment Process

1
Goals

2
Metrics

**Strategic
Plan - Priorities**

4
Procedures

3
Methodology

PLM Metric/Measure

- Valid –measures what is intended
- Reliable – repeatable
- *Defined by two values*
  - Baseline – current state
  - Target – future state

PLM Methodology

- ☐ Defines data collection process
- ☐ Lines of responsibility
- ☐ Timelines

PLM Procedures

- Defines how data is used, implemented, or fed back into the system
- Lines of responsibility
- Timelines

Metrics

Types and Levels of Metric

- ❑ Type
  - ■ Business
  - ■ Product
  - ■ Processes
  - ■ Other

- ❑ Levels
  - ■ Organizational level
  - ■ Functional level

Matt Symonds (2005). PLM Metrics.
Energizing Enterprise Conference, Purdue
University.

Stark, J. (2005). Product Lifecycle Management:
21st Century Paradigm for Product Realisation.
London: Pringer.

PLM Impact Business Metrics

- ☐ Revenue growth
- ☐ Market share
- ☐ Margins
- ☐ Operating costs
- ☐ Cash flow
- ☐ Market capitalization (share price)
- ☐ Number of employees
- ☐ Overhead hours/direct hour

PLM Impact Product Metrics

- ☐ Technical performance
- ☐ Requirements met
- ☐ Product reliability
- ☐ Unit costs
- ☐ Defects

PLM Impact
Process Metrics

- ☐ Time to profitability
- ☐ Change process cycle time
- ☐ Design error rate
- ☐ Development flow time
- ☐ Work-in-progress
- ☐ On-time delivery
- ☐ Percentage design reuse
- ☐ Non-recurring hours per design release
- ☐ Manufacturing per unit
- ☐ Quality rejections

PLM Impact
Other Metrics

- ☐ Employee morale
- ☐ Customer satisfaction
- ☐ Supplier relations
- ☐ Brand awareness
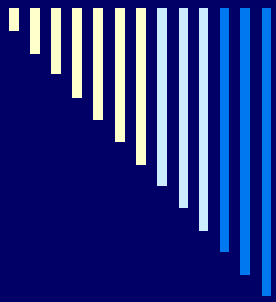
Levels of Measures

PLM Impact Organizational Level

- Improvements in effectiveness and efficiency throughout the entire lifecycle
  - Meeting customer requirements better
  - Improving sales process
  - Improving rate of production
  - Meeting production and delivery schedules
  - Preventing future product failure through knowledge of past performance
  - Improving product maintenance and service through retirement

PLM Impact Organizational Level

☐ Revenue increases
- Number of new customers captured by new product and new product support
- Product price paid by customers
  - Increasing product quality
  - New functions and features
  - Charges due to first-to-market (premiums justifies price increases)
  - Range of product variation based on customer demand
  - Frequency of purchase due to first-to-market
  - Range of support services

PLM Impact Organizational Level

☐ Cost savings
- Direct labor costs
- Indirect labor costs – administration
- Material and energy consumption
- Costs associated with purchasing of designs and parts
- Costs of housing inventory

PLM Impact Organizational Level

☐ Organizational Improvements
   - Number of innovations
   - Customer response time
   - Management of product retirement
   - Integration of new technologies into production
   - Defining baselines and targets
   - Rebaselining when appropriate

PLM Impact Functional Level

☐ Product and Process Definition
- Defining, analyzing, simulating products
- Identifying service and process definition data
  - CAD
  - Rapid prototyping
  - Routing
  - Simulation

PLM Impact Functional Level

- ☐ Product Data and Configuration Management
  - ■ Managing product, service and process definition data throughout the product lifecycle
    - ❑ Engineering document data
    - ❑ Product data management
    - ❑ Configuration management
    - ❑ Regulatory management
    - ❑ Compliance management
    - ❑ Quality management systems

PLM Impact Functional Level

- Collaborative Software
  - Identifying processes that allow people to work together over the Web or product and process data
    - E-mail
    - Electronic whiteboards
    - Discussion and chat rooms
    - Intranets
    - Extranets
    - Shared product spaces
    - Portals
    - Project directories

PLM Impact Functional Level

☐ Customer-oriented Applications
- Capturing from and presenting product and process definition data from customers
  - Systems for presenting product catalogues
  - Systems for capturing requirements and orders

PLM Impact Functional Level

- ☐ Visualization/Viewing
  - ◼ Identifying technologies for visualizing, viewing, and printing product and process data
    - ❑ Virtual prototyping
    - ❑ Digital mock-up systems

PLM Impact Functional Level

□ Data Exchange
- Transferring product and process definition data from a format that is usable in one system to a format this is usable in another, e.g., DassaultSystems to UGS PLM Solutions

PLM Impact Functional Level

- Supplier-oriented Applications
  - Capturing product and process definition data from and presenting to suppliers
    - Component/supplier data management system

PLM Impact Functional Level

- ❑ Project Management
  - ■ Managing a company's individual product-related projects
    - ❑ Phase/gate systems
    - ❑ Risk management systems

PLM Impact Functional Level

☐ Portfolio Management
- Managing a company's portfolio of existing products and parts, and those under development

PLM Impact Functional Level

- ☐ Integration
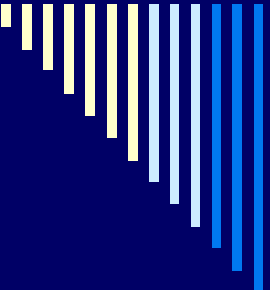 - ■ Integrating PLM components from one system to another, e.g., CRM, ERP, SCM

PLM Impact Functional Level

- ☐ Systems Changes
  - ■ Managing updates in PLM methodologies and procedures, implementation, and impact system-wide

Preliminary Results

Agreement – "in Principle" with Purpose of PLM

- ☐ **Substitute Information for Wasted Time, Energy, Materials**
- ☐ **Capture and Reallocate Resources**
- ☐ **Results in Product and Process Innovation**
- ☐ **Increase Revenue Stream**

Varying Degrees of "Belief" in and Implementation of PLM

- ☐ Panacea ?

- ☐ Implementation ?

- ☐ Phase one – Stuck in design - manufacturing

- ☐ …..next ?

Frustration Within Functions

- ☐ Level of granularity – drill down, when to stop

- ☐ Reporting formats – lots of data, little information

- ☐ Lack of time to use data/information collected

Frustration Between Functions

- ☐ Difference in vocabulary
- ☐ Difference in perceived importance of information
- ☐ Difference in perceived timeliness of information
- ☐ Differences in reporting formats

Frustration Between Management Levels

- ☐ Middle Management
- ☐ Upper Management

Middle Managers - Functional Level

- ☐ Product and process definition
- ☐ Product data and configuration
- ☐ Collaboration software
- ☐ Customer-orientation
- ☐ Visualization/viewing
- ☐ Data exchange
- ☐ Supplier relationships

Upper Management – Organizational Enterprise Level

- ☐ Return on Investment
  - ☐ Hardware
  - ☐ Software
  - ☐ Training
- ☐ Market Shares
- ☐ Increased Revenue

Results

- Different level of understanding and sense of urgency between middle and upper management
  - PLM stuck at design phase, e.g., vaulting for CAD models and creation of Bill of Materials
- Middle managers express lack of support
  - No champion in upper management
  - Lack of financial support to continue phasing in PLM as initially agreed upon in plan
- Upper management express frustration with lack of evidence to justify further expenditures

Recommendations

- ☐ Improve communications enterprise-wide
- ☐ Translate impact of PLM between functional and enterprise levels
- ☐ Increase education and training on PLM enterprise-wide
- ☐ Champion at the highest levels
- ☐ Continue development of PLM metrics

Observations of Project

- ☐ Satisfied with project's personnel development of PLM expertise
- ☐ Satisfied with protocol development
- ☐ Satisfied with assessment model
- ☐ Question methodology and sample
  - ■ Interviews versus survey
  - ■ Variation in PLM experience within sample
  - ■ Size of sample
- ☐ Project requires continued funding

Thank you

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