Measuring the Impact of PLM – Phase II

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Agenda

- Objectives
- Review Metrics Model
- Methodology
- Survey Results
- Phase III

Project Goal

The development of a metrics tool and process that organizations can use to assess the impact of PLM

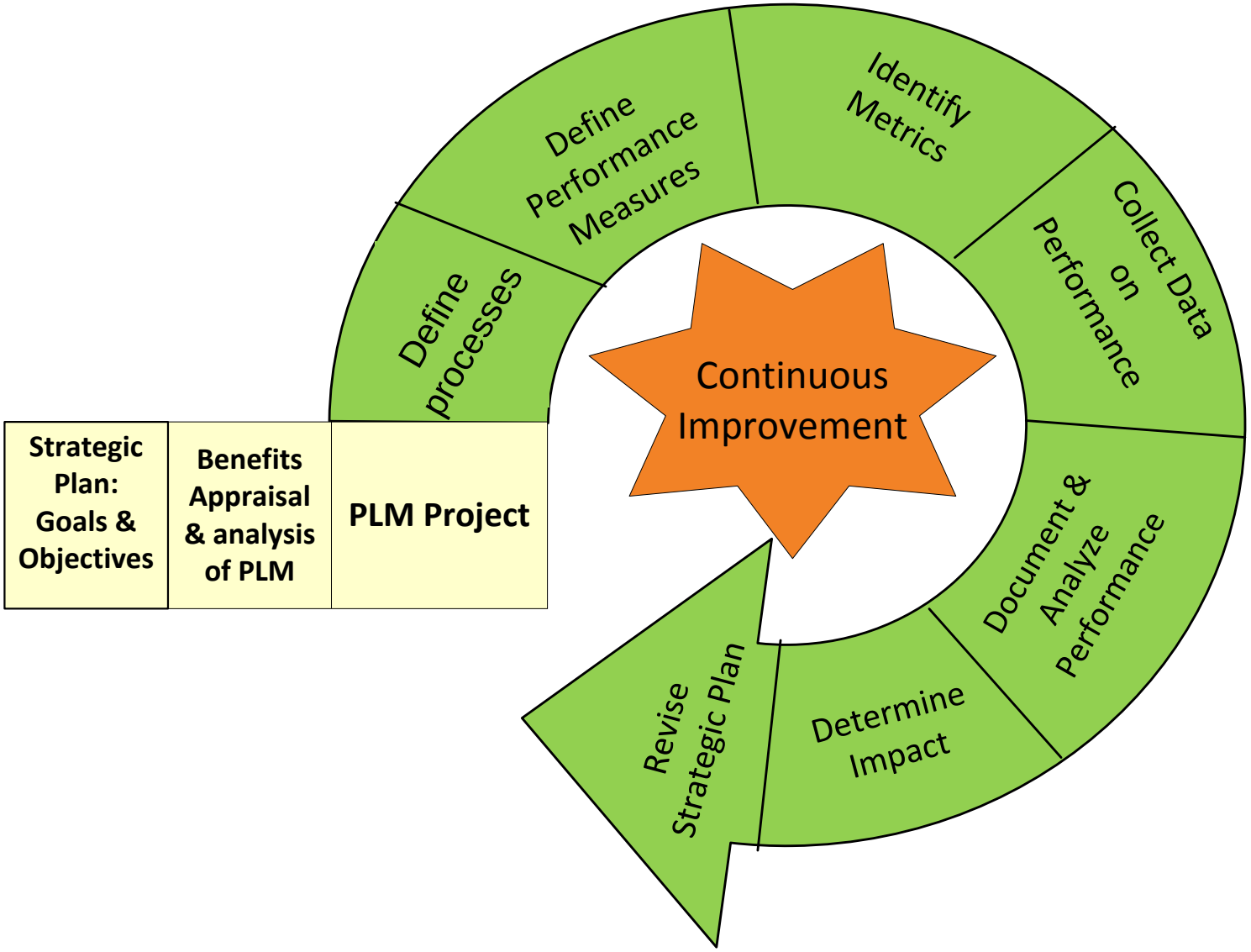
Project Objectives

Provide a Access / and Analysis
- Provide Roll up Capability of Metrics
- Provide Analysis models across the Data/ Information
- The ability to bring Metrics a Live.
- Powerful Client Layer to Access Data

Provide an Application Model That Promotes:
- Hierarchical modeling of Manufacturing
- Provides a Consistent PLM Metrics Model
- Provides the ability to build Standards of Metrics and Approaches to Apply

Provide a System Platform on Which Metrics can be managed, and sustained. Integrated with Manufacturing.

PLM Assessment Model



Methodology

- Survey Development
  - 65 item online survey
    - 8 organizational variables
    - 57 PLM metrics
- Data collection
  - 150 participants
  - 65 (43%) respondents
- Analysis
  - Descriptive Statistics
  - Frequencies
  - Factor Analysis

THE PLM LOGIC MODEL

How of PLM Program				*Results from Program*			
Resources/ Inputs *(What we invest)*	**Activities /Processes** (*What we do*)	**Outputs**	**Customers** *(Who we reach)*	**Short-term outcome/ Objectives** *(Change in: knowledge, skills, attitudes, motivation, awareness)*	**Medium-term outcomes/ Objectives** *(Change in: behaviors, practices, policies, procedures)*	**Long-term outcomes** *(Change in situation: environment, social, economic, political conditions)*	**I m p a c t**
Time **Energy** **Materials**	Initial ideation	Ideas & Concepts	Design Collaboration Team	Design reuse	Generation of new business	Waste reduction Innovation/ New Products Continuous Improvement Sustainable Green manufacturing	RETURN ON INVESTMENT
	Concept design	Design Capture & Accessibility	Engineers/ Designers	Virtualization	Improved corporate communication		
	Product design	Change Control & Change Capacity Configuration Management Metrics Commercial Cost of Risk	Engineers/ Designers	Faster time to production	Software integration		
	Manufacturing design	Product Development & prototype	Suppliers/ vendors	Cost reduction	Globalization		
	Production	Resource Optimization Product Quality	Engineers, Manufacturers	Cost performance Larger market share	Product quality		
	Delivery to the customer	Completion Performance	Wholesalers/ merchants/ vendors/ retailers	Premium pricing Increased profitability	Improved business cycle time Customer satisfaction Error reduction		
	In-service support	Portfolio Management	Customers	More efficient service to customers	Service quality Knowledge/ document management		
	Retirement from use.	Portfolio Management	Government Agencies: EPA	Environmentally friendly product disposal mechanisms	Sustainability		

EXTERNAL FACTORS INFLUENCING PERFOMCENCE (+/-)

PLM Logic: Elements of the Model

- Inputs Metrics: measure the quality of
  - Tactical investment in the existing business (balance optimization)
  - Strategic investment in new businesses (innovation) (Simmons 2000).
- Process Metrics: measure the quality of the company's PLM activities
  - Plan
  - Design
  - Build
  - Support

PLM Logic: Elements of the Model

- Outputs Metrics: are the product or service delivery/implementation targets for PLM:
  - Completion Performance,
  - Resource Optimization,
  - Change Control & Change Capacity,
  - Configuration Management Metrics, etc.
- Outcomes are the changes and/or benefits resulting from PLM activities and outputs:
  - waste reduction,
  - innovation and new products,
  - continuous improvement and
  - sustainable green manufacturing.
- Impact is the return on investment in strategic innovation of the PLM project.

RESULTS

FACTOR ANALYSIS

Factor 1: Input metrics

Ave manufacturing cash expense per product/project	0.83	Ave planning/design development cost per product/project	0.68
Ave manufacturing engineering capital cost per product/project	0.77	Ave manufacturing engineering development cost per project/product	0.60
Ave manufacturing development cost per project/product	0.76	Ave cash expense cost per product/project	0.60
Ave manufacturing engineering cash expense cost per product/project	0.75	Ave manufacturing capital cost per product/project	0.59
Ave planning/design cash expense cost per product/project	0.74	# of responses to RFP's	0.55
Ave planning/design cost per product/project	0.72		

Factor 2: Process Metrics

Ave capital cost per project/product	0.74	# of business processes re-engineered	0.53
Cost per manufacturing error	0.73	Amount of time required for manufacturing	0.53
Cost per manufacturing engineering error	0.61	# of parts re-used	0.51
Cost per planning and design errors	0.60	Amount of personnel output	0.48
Ave development cost per project/product	0.59		

Factor 3: Output Metrics

# post-production design changes	0.78	Time to market for new products	0.63
# of suppliers meeting requirements	0.78	Time to market for product inprovements	0.61
Amount of time required for product planning and designing	0.76	# of manufacturing errors	0.59
# of engineering change orders	0.75	Amount of inventory	0.53
# of planning and design errors	0.69	Time for break-even for new product introductions	0.51
Amount of time required for maufacturing engineering	0.68	# of RFP's won	0.51
# of manufacturing engineering errors	0.66	Revenue from new products less than 3 years old	0.47
# of product prototypes built	0.64	Cost of tool design/redesign	0.41
# of pre-production design changes	0.64		

Factor 4: Short & Medium Term Outcome Metrics

Reallocation of saved manufacturing process time	0.82	# of simulated tests	0.56
Reallocation of saved manufacturing engineering processs time	0.81	# of collaborative research ventures	0.56
Reallocation of saved planning and designing process time	0.78	# of new product ideas evaluated	0.56
# of product recalls	0.73	Hours of many downtime	0.56
# of simulated prototypes	0.65	# of warranty claims	0.55
# of applications, operating systems, and DBMS integrated	0.64	# of processes documented in regards to the "support" of products	0.53
# of new product functions or features	0.60	# of product failures	0.52
Amount of time to develop new ideas	0.60	# of new products	0.50
# of processes documented in regards to the "disposal" of products	0.59	# of new industry initiatives supported	0.49
# of liability lawsuits	0.57		

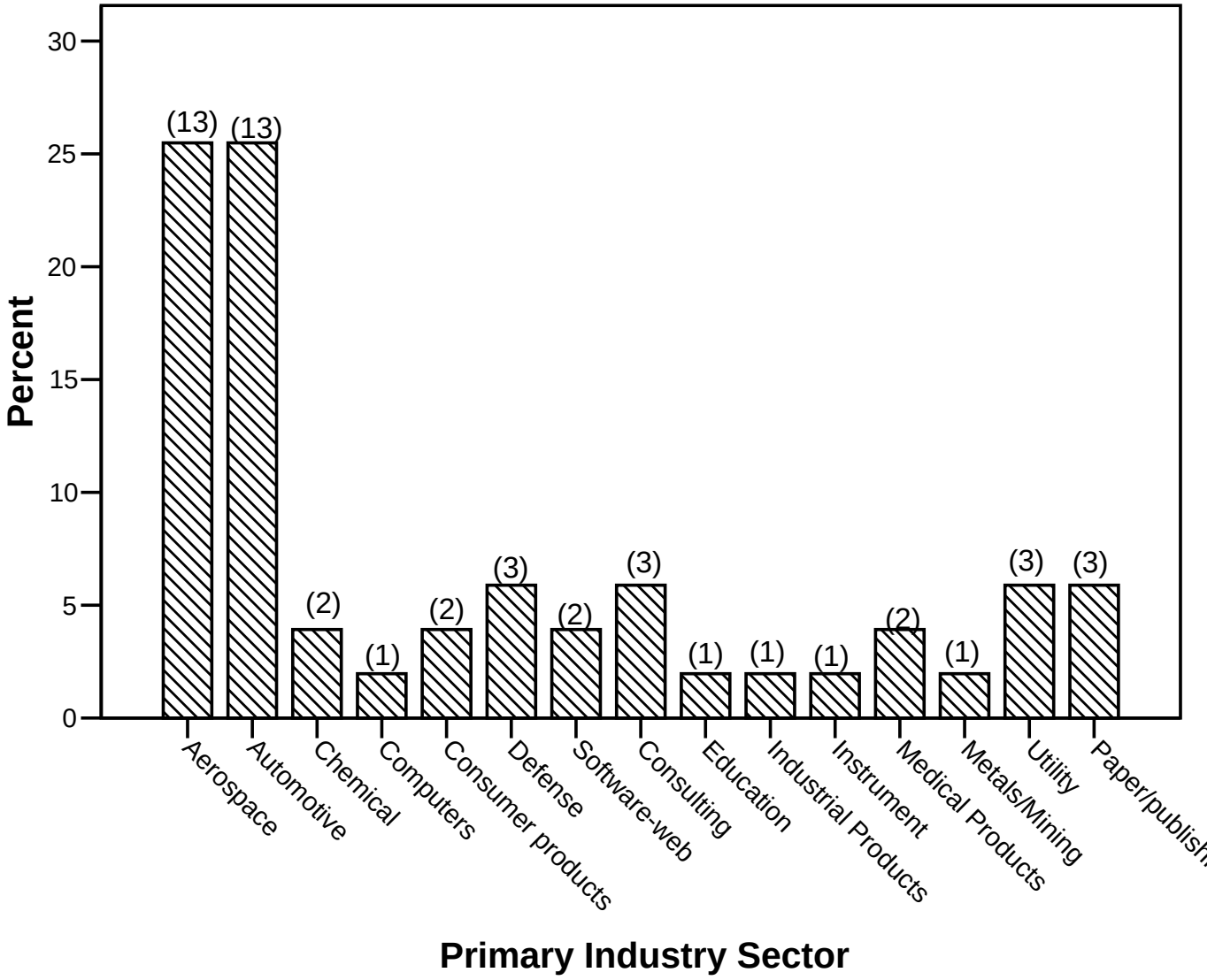
Impact Metrics

- Overall Revenue
- Market Share

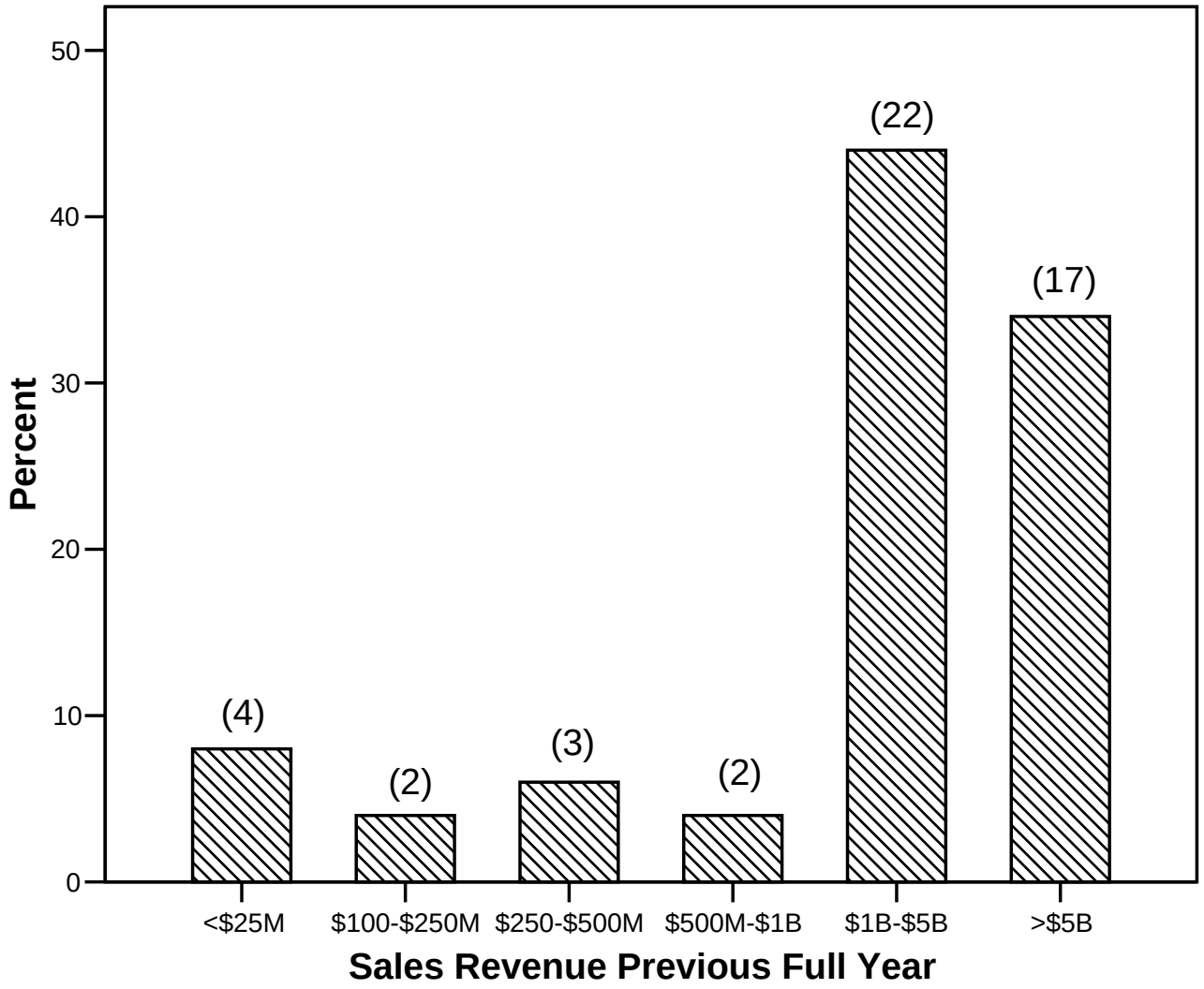
RESULTS

FREQUENCIES

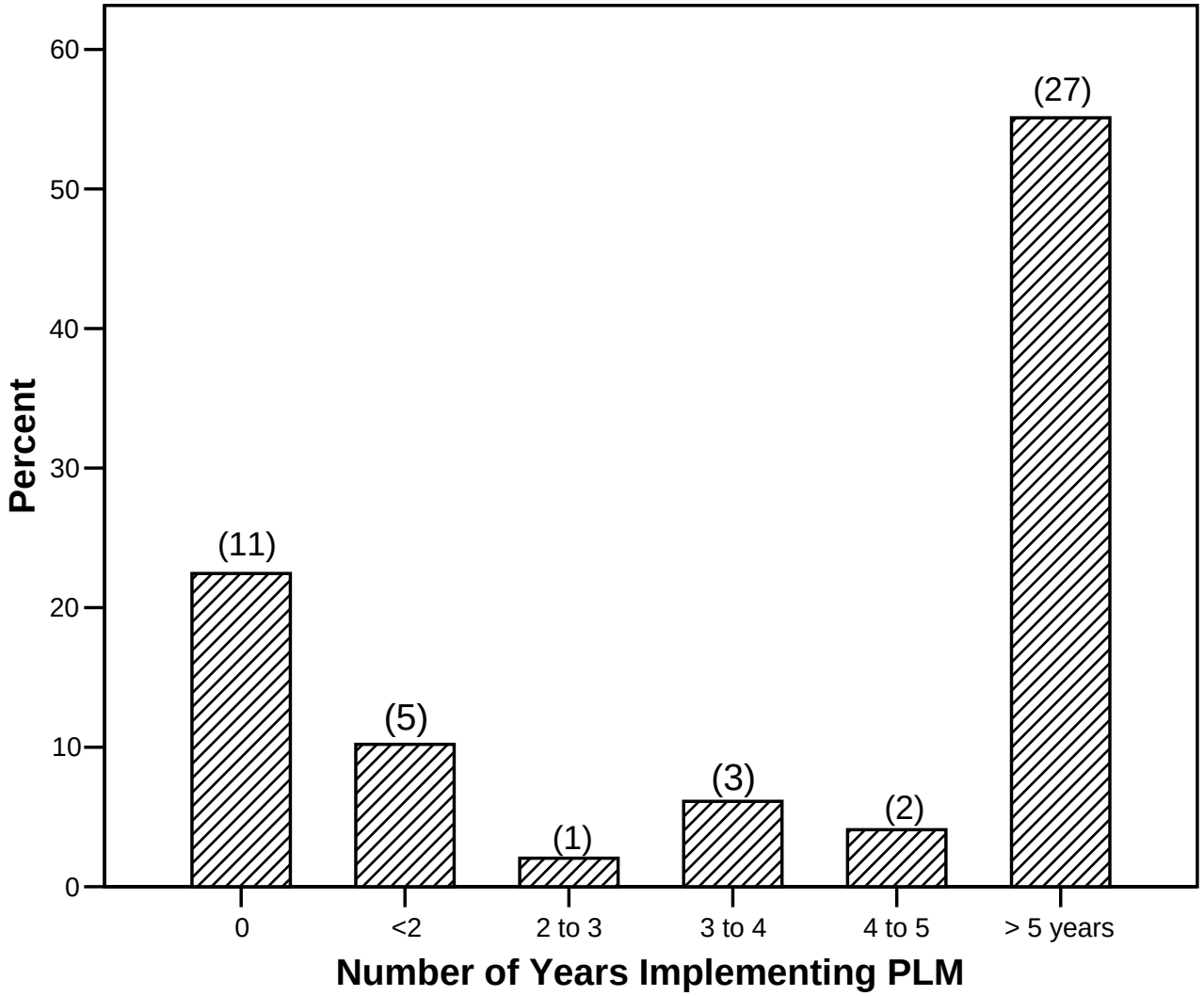
Primary Industry Sector



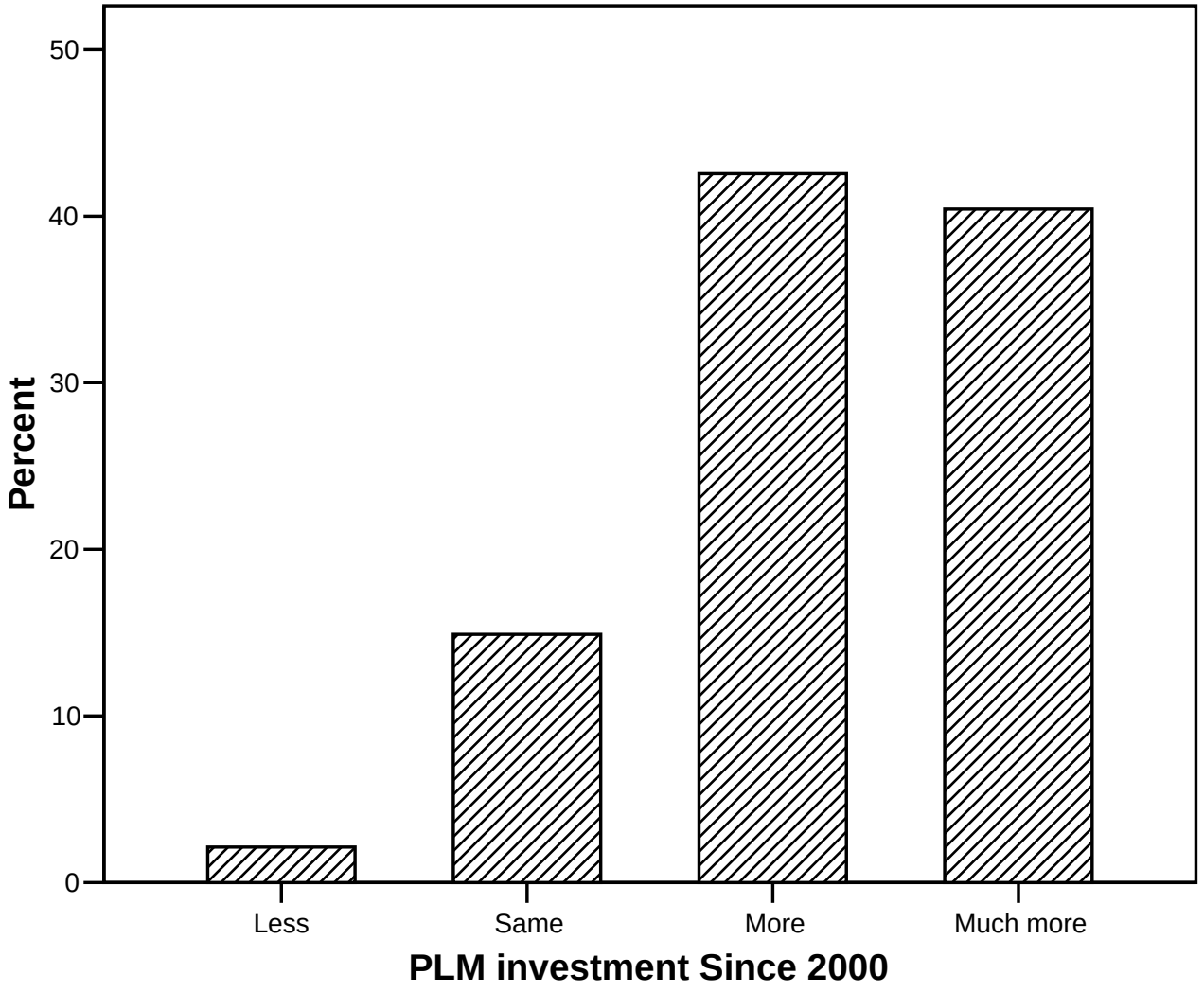
Sales Revenue from Previous Year



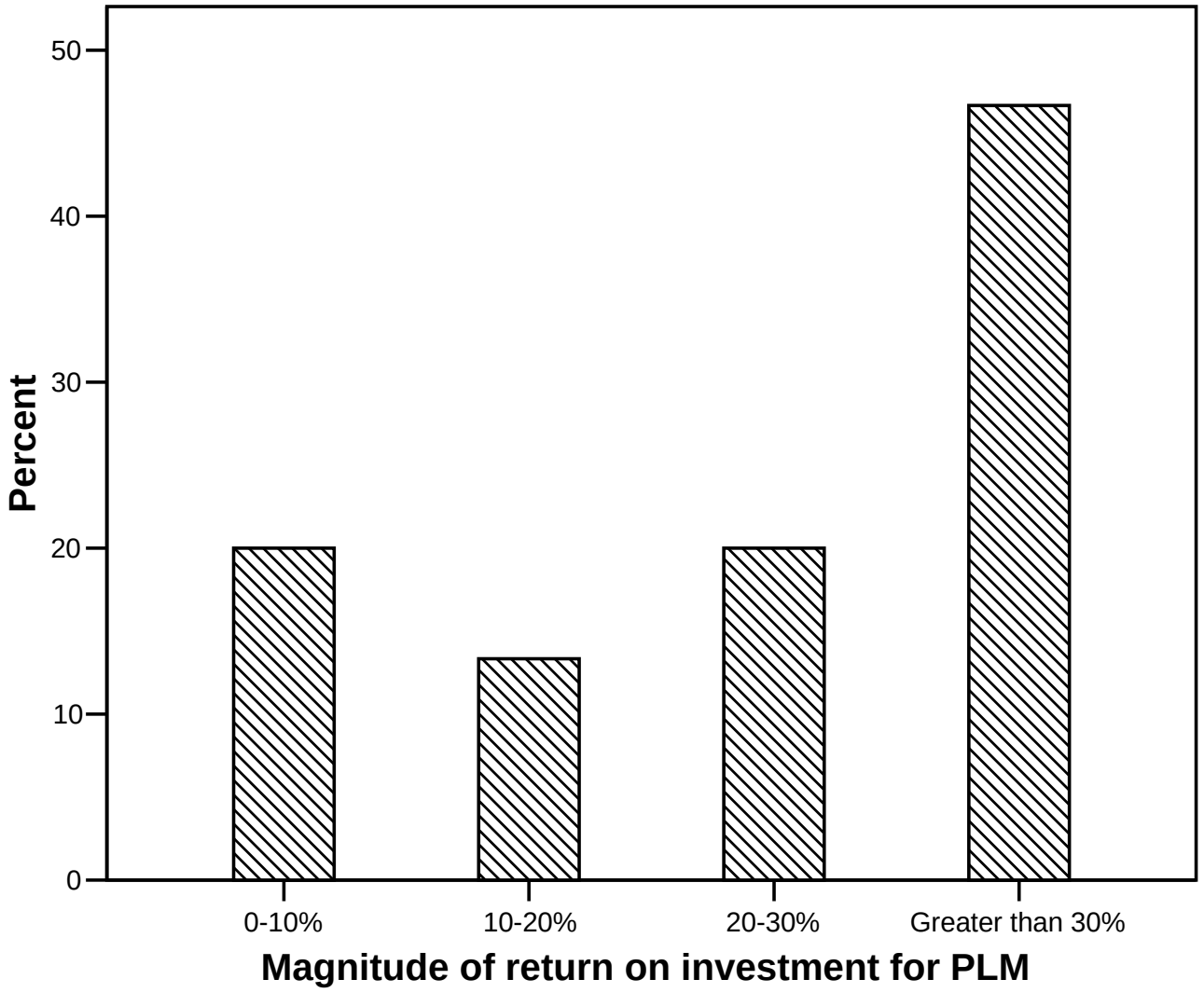
Number of Years Implementing PLM



PLM Investment Since 2000



Magnitude of Return on Investment for PLM



Response Criteria

- In order for a participant to consider the metric “in use”, the item had to pass the following criteria:
  - be collected at least on an annual basis;
  - be utilized by all members of top management;
  - be stored in a manner that ensures availability to numerous appropriate people in the organization;
  - have a standard method for calculation

Response Options

- Used, Important
- Not Used, But Important
- Not Used, Not Important

Metrics Used & Important

Metric	% of respondents using metric		Metric	% of respondents using metric
Overall revenue	71.4		Ave manufacturing engineering development cost per project/product	48.0
Market share	69.4		# post-production design changes	48
Amount of inventory	66.0		# of engineering change orders	46
Ave capital cost per project/product	56.9		Amount of time required for manufacturing	44.0
Ave development cost per project/product	54.9		Amount of time required for product planning and designing	44.0
Amount of personnel output	52		# of manufacturing errors	44.0
Revenue from new products less than years old	51		# of warranty claims	44.0
Time to market for new products	50			

Metrics Not Used, But Important

Metric	% not using the metric, but important
Cost per manufacturing engineering error	72
Amount of time to develop new ideas	67.3
Cost per planning and design errors	64
# of manufacturing engineering errors	60
Ave planning/design cash expense cost per product/project	58
Ave manufacturing cash expense per product/project	56
# of applications, operating systems, & DBMS integrated	55.1
Cost of tool design/redesign	55.1
Reallocation of saved manufacturing process time	54
# of liability lawsuits	54
# of new product ideas evaluated	53.1

Metrics Not Used, But Important

Metric	% not using metric, but important
# of new product functions or features	53.1
# of simulated prototypes	53.1
Reallocation of saved planning and designing process time	52
Ave manufacturing engineering cash expense cost per product/project	52
# of pre-production design changes	52
# of parts re-used	52
# of planning and design errors	52
Reallocation of saved manufacturing engineering process time	52
Ave planning/design development cost per product/project	51
# of simulated tests	51
# of customers captured by new products	51

Metrics Not Used & Not Important

Metric	% not using & metric unimportant		Metric	% not using & metric unimportant
Length of CEO approval time	44		Reallocation of saved manufacturing process time	32
Number of RFP's won	40.8		Reallocation of saved manufacturing engineering process time	32
Number of responses to RFP's	38.8		Number of business processes re-engineered	32
Number of processes documented in regards to the "disposal" of products	38		Number of new industry initiatives supported	32
Reallocation of saved planning and designing process time	34			

PHASE III

Next Steps

- Increase Sample Size
- Model Confirmation
  - Confirmatory Factor Analysis
- Dashboard
- Balanced Score Card
- **PHASE IV**

What is a Dashboard?

- Definition/use:
  - Both a *process* and a *tool*
  - Looking for unfavorable trends or patterns and focusing energy on improving priority areas
  - A (diagnostic) means for monitoring performance to ascertain what is working well and where additional attention is needed
  - A few (4-6) sets of indicators, representing the most central areas related to high performance

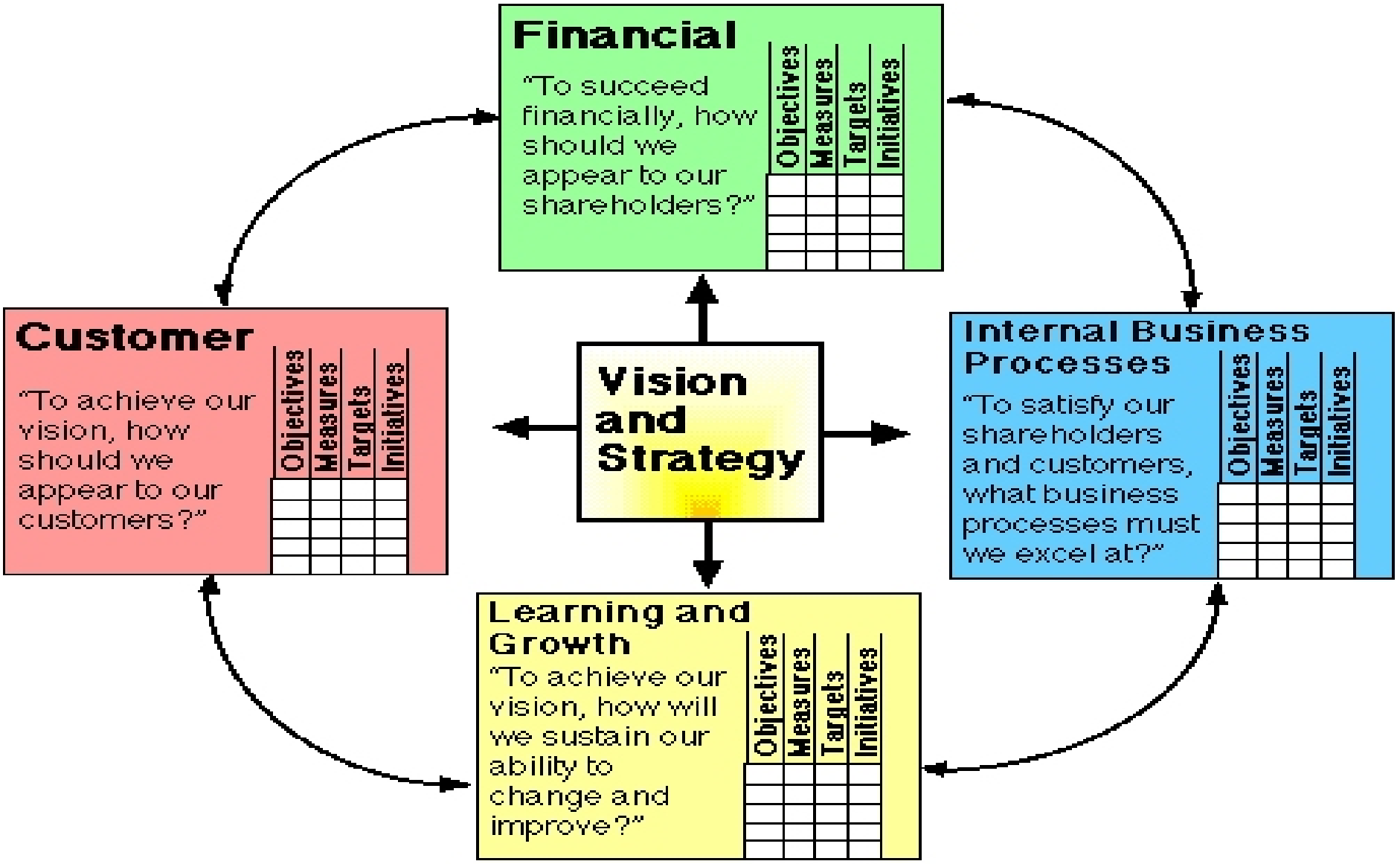
Three Types of Dash Boards

- Operational – monitor core operational processes
  - Frontline workers & supervisors
- Tactical – track departmental processes & projects, measure progress
  - Managers and analysts
- Strategic – monitor execution of strategic objectives – BSC approach, TQM & Six Sigma
  - Executives, mangers, staff

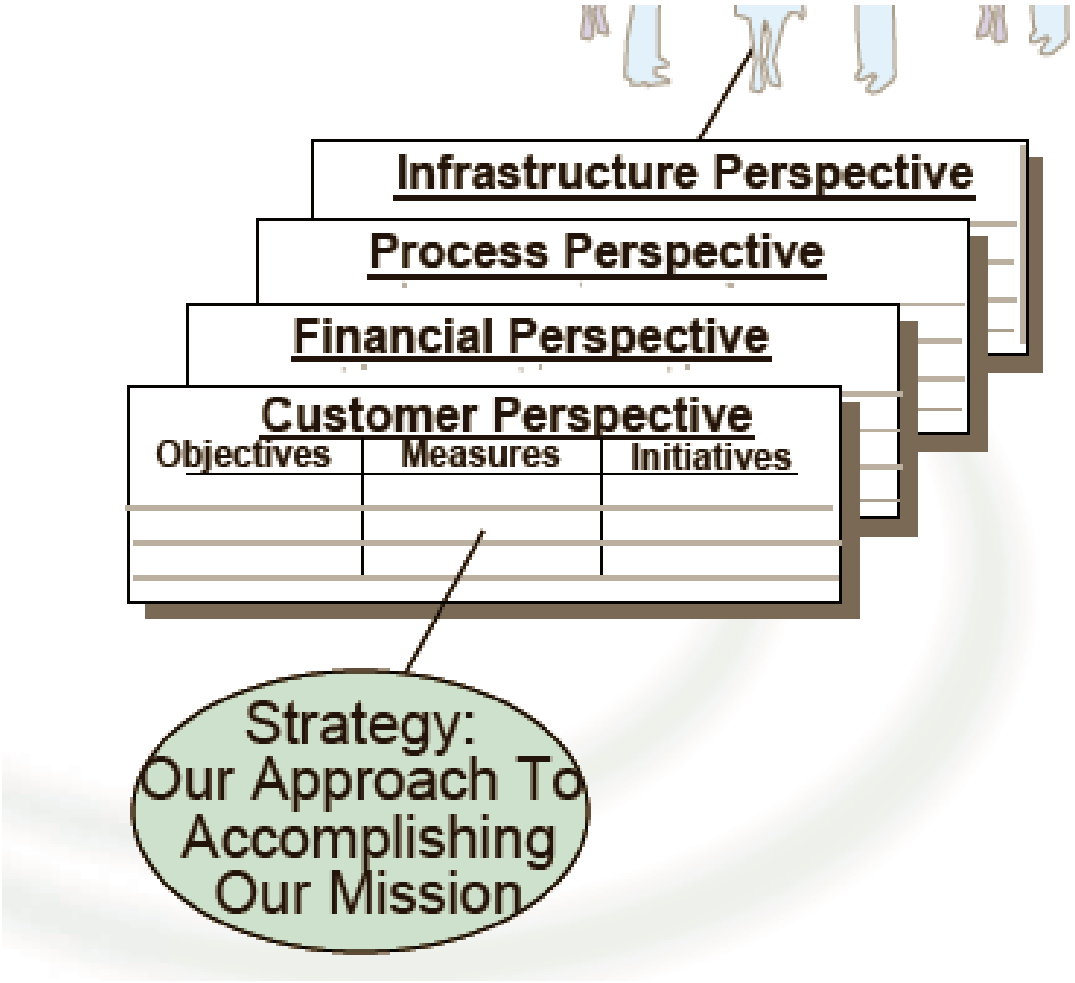
What Metrics are in a Dashboard?

- The Dashboard includes a balanced view of an organization
  - Learning and Growth
  - Customer Relations
  - Internal Processes
  - Financial Measures

The Balanced Scorecard Model



The Finished BSC Tells Our Story

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