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EVM World 2016

Title: EVM Research – Past and Future

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Learning Objectives

- At the completion of this session, the participant should have:
  - A better understanding of the management practices and theory that provided the foundation for EVM;
  - An appreciation of current EVM research and related research from other fields of study; and,
  - Within the context government contracting, a recognition of opportunities for future research

Introduction

- Vicki Frahm, PhD
  - PhD in Organization & Management, Specializing in Project Management
- 36 years in project management, 31 in EVMS
  - Boeing
    - Modifications to the B52
    - International Space Station
  - Honeywell
    - Future Combat Systems (FCS)
  - Sandia Corporation
    - Facilities Project Controls and EVMS Lead
    - Site EVMS subject matter expert (SME)

EVM Research – Past and Future

- Theoretical Roots of EVM
- EVM Research
- Organizational Research

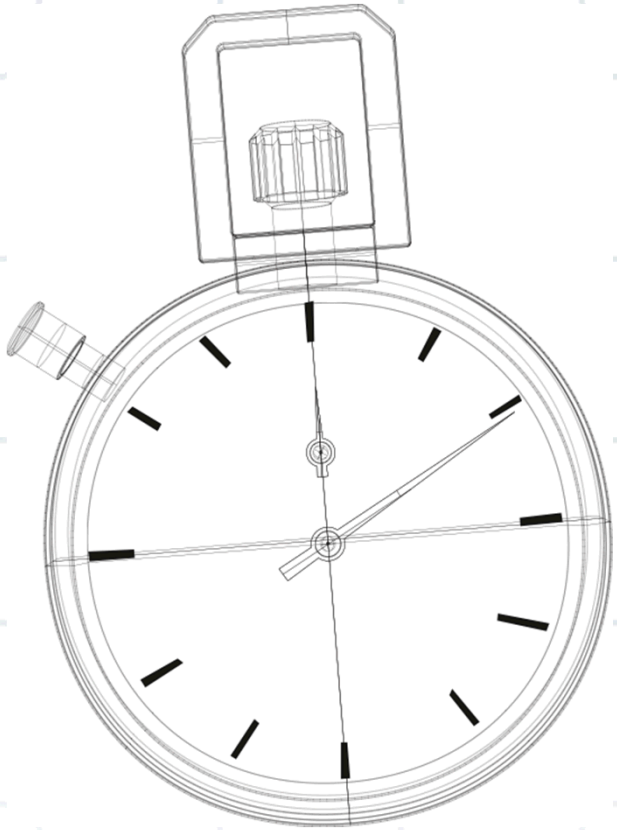
THEORETICAL ROOTS OF EVM

Scientific Management

- Frederick Taylor
- Frank and Lillian Gilbreth
- Henry Gantt

Frederick Taylor (1856-1915)

- Task management
- Process time reduction
- Father of Industrial Engineering
- *"The Principles of Scientific Management"*

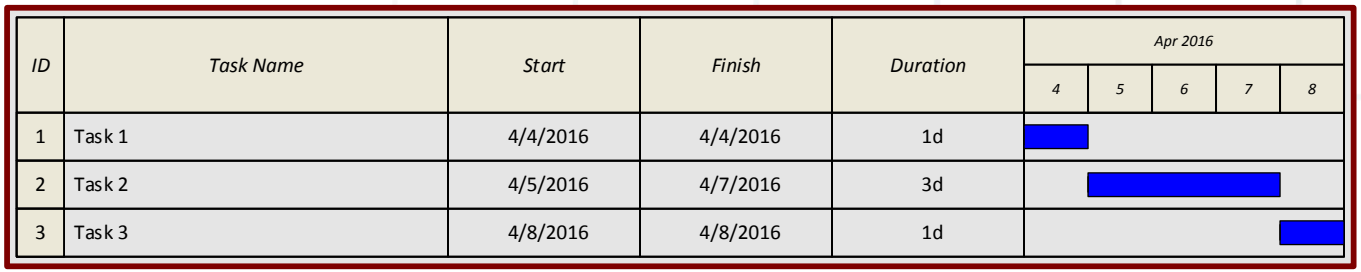


Frank (1868-1924) and Lillian (1878-1972) Gilbreth

- Standardize processes
- Eliminate wasted motions
- Time and motion studies
- *"The Writings of the Gilbreths"*

Henri Gantt (1861-1919)

- Work planning
- Work efficiency
- Gantt chart
- *"Organizing for Work"*



ID	Task Name	Start	Finish	Duration	Apr 2016				
					4	5	6	7	8
1	Task 1	4/4/2016	4/4/2016	1d					
2	Task 2	4/5/2016	4/7/2016	3d					
3	Task 3	4/8/2016	4/8/2016	1d					

Application to Projects

- The problem:
  - Management control methods applied to DoD projects did not provide adequate visibility of project schedule performance or enable effective forecasting of final cost and schedule.

	Scientific Mgmt.	Earned Value
Context	Production	Project
Ecology		
	Stable	Dynamic
	Repetitive	Innovative
	Linear	Non-linear
	Localized	Distributed
	Simple	Complex
Quality Objective		
	Incremental improvement	Unique product / service to meet defined scope
	Time & motion studies	Lessons learned
Tasks / activities		
	Well-defined steps	Activities specific to project and functional type
Forecasting		
	Based on standards; learning curves	Based on estimates: expert opinion, past performance
Variance		
	Eliminate variance	Understand & mitigate variances

Earned Value

- A. Ernest Fitzgerald
  - Applied work measurement methods to project management
  - Integrated cost, scope, and schedule
  - Established set of criteria to define the project performance measurement system

Morin, J. B. (2009). How it all began: The creation of earned value and the evolution of C/SPCS and C/SCSC. *The Measurable News*(4), 1, 9-12.

EVM - Since 1967

- EVM criteria has not changed significantly
- **Interpretations/rules have been added**

Interpretations/Rules

- Interpretations/rules established to
  - Promote consistent understanding and ensure consistent application
  - Ensure traceability
  - Ensure auditability
- If the EVMS does not work
  - Add more rules
  - Tighten interpretation of existing rules

EVM - Since 1967

- EVM criteria has not changed significantly
- Interpretations/rules have been added
- **EVM recognized best practice**

Best Practice

- Established as a better alternative than a previous method
  - ➔ EVM provides better information than the alternative method of tracking actuals to budget
- Determination of best practice based on experience, expert opinion and, potentially, research
- Best practices change or may be shown to be ineffective
  - –Total quality
  - –WBS level of detail

EVM RESEARCH

What Does Research Include?

- Theoretical basis
- Hypotheses that are tested (quantitative research)
- Valid methodology for testing hypotheses
- Valid qualitative approach

Research Methodology

- Quantitative
  - Surveys
  - Experiments
  - Computer simulation
- Qualitative
  - Case studies

Review of Research

- Two dominant themes in EV research
  - Estimate at completion
    - Christenson
  - Project duration
    - Lipke
    - VanHoucke
- Practical orientation

Willems, L. L., & Vanhoucke, M. (2015). Classification of articles and journals on project control and earned value management. *International Journal of Project Management, 33*(7), 1610-1634.

Why Should We Care About Research?

- Research validates and confirms best practices
  - Projects have become more complex
  - EVM is applied to a more and different types of projects
  - Organizational structures are changing
  - Project success rates have not changed over past 20 years

An Example

Per Shenhar and Dvir, DoD project management standards should not be used on Array Projects.

Assembly
Collection of elements
Single function
Toaster
CD player

System
Complex
Interactive
Meet specific operational need
Automobile

Array
Large
Widely dispersed
Collection of systems
Mass transit infrastructure

Shenhar, A. J., & Dvir, D. (2007). *Reinventing project management: The Diamond approach to successful growth and innovation*. Cambridge, MA: Harvard University Press.

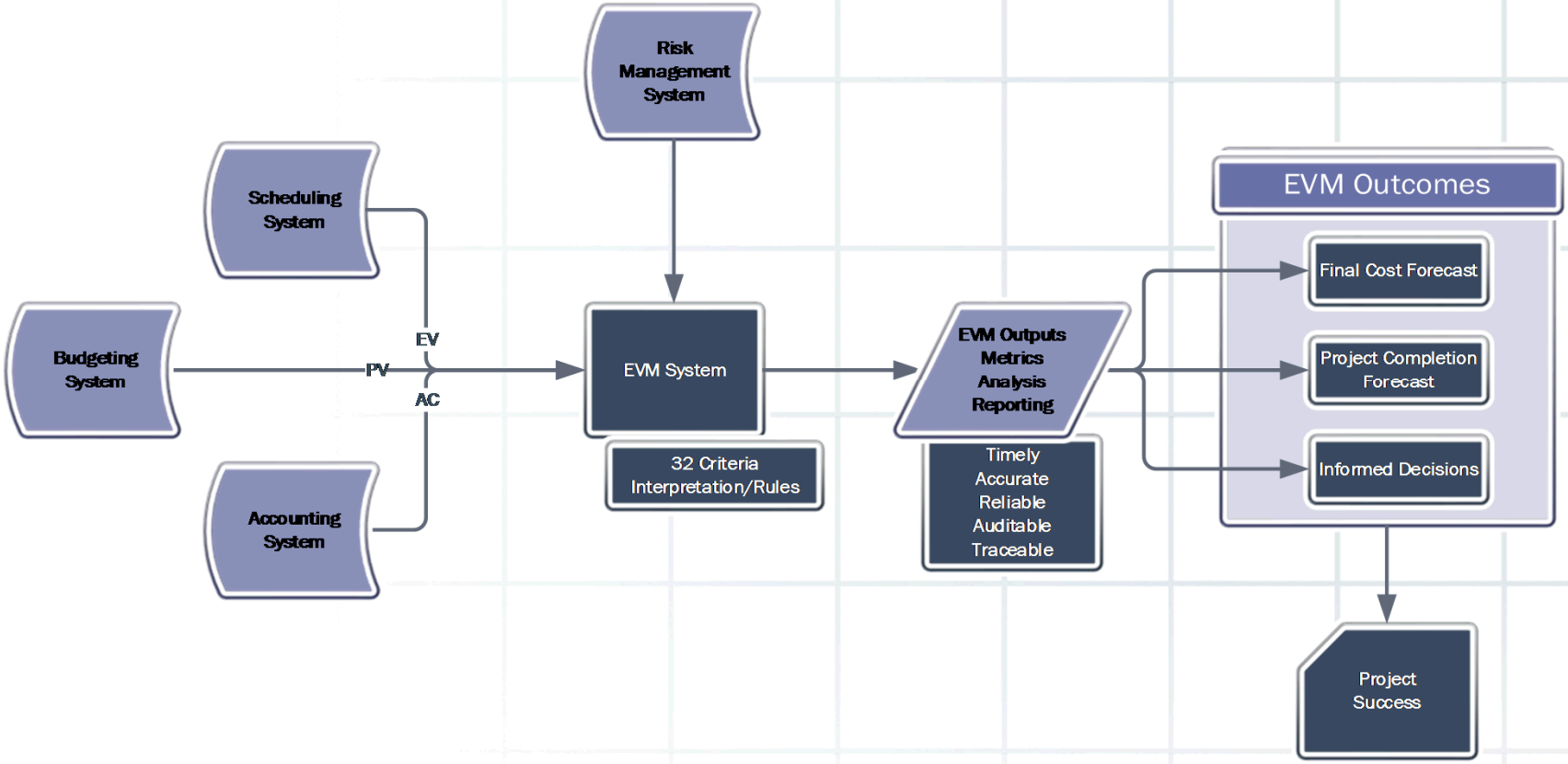
Tailoring Management Standards

Array projects must have the flexibility to develop their own standards for managing large, complex projects. (Shenhar & Dvir, 2007)

“None of the world's project management methodologies were designed to be dropped lock, stock, and barrel into organization without first tailoring them to the organization's needs and then separately, to the project’s specific needs.” (Avery, 2015)

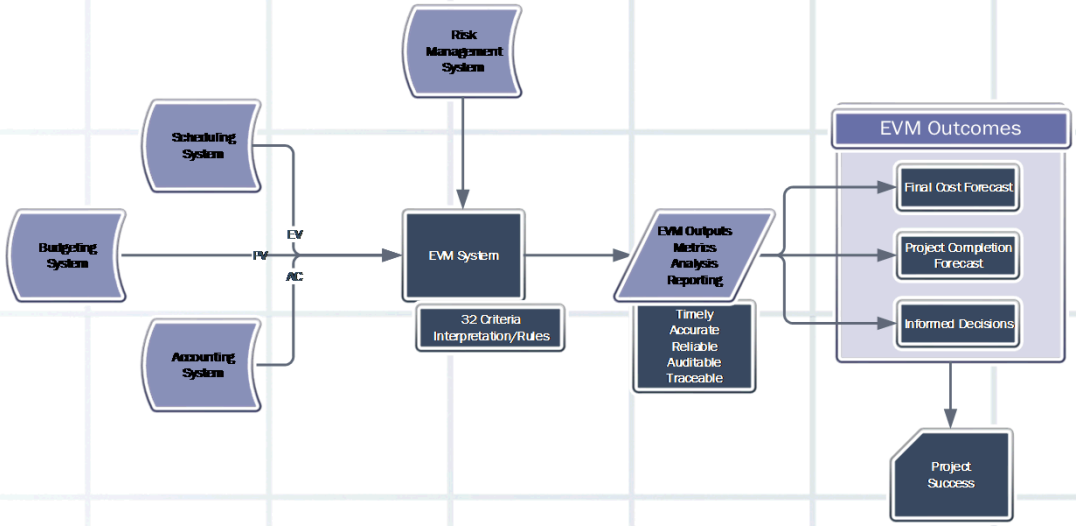
Avery, G. (2016). *Project management, denial, and the death zone. Plantation, FL: J. Ross.*

EVM System – Notional Model



How could we apply the model?

- Test hypotheses related to:
  - Specific criteria and their relationship to expected outcomes
  - The interrelationship of specific rules and expected outcomes
  - What elements may be tailored without negatively influencing expected outcomes
  - Explore effects of tailoring in specific environments
    - Project type
    - Project complexity



ORGANIZATIONAL RESEARCH

Organizational Research

- Management Control
- Scheduling
- Decision Making
- EVMS Implementation

Management Control Theory

- Organizational level
- Research started in 1960's
- Objective: Goal congruence
- Applications
  - Balanced scorecard
  - Key performance indicators (KPIs)

Management Control Theory

- Accounting basis
- Consists of
  - Goals and objectives
  - Feedback mechanisms
- Typically tied to fiscal periods

Levers of Control

- Four levers of control
  - Diagnostic Control Systems
  - Beliefs Systems
  - Boundary Systems
  - Interactive Control Systems

Simons, R. (1995, 2005). *Control in an age of empowerment*. Boston, MA: Harvard Business Press.

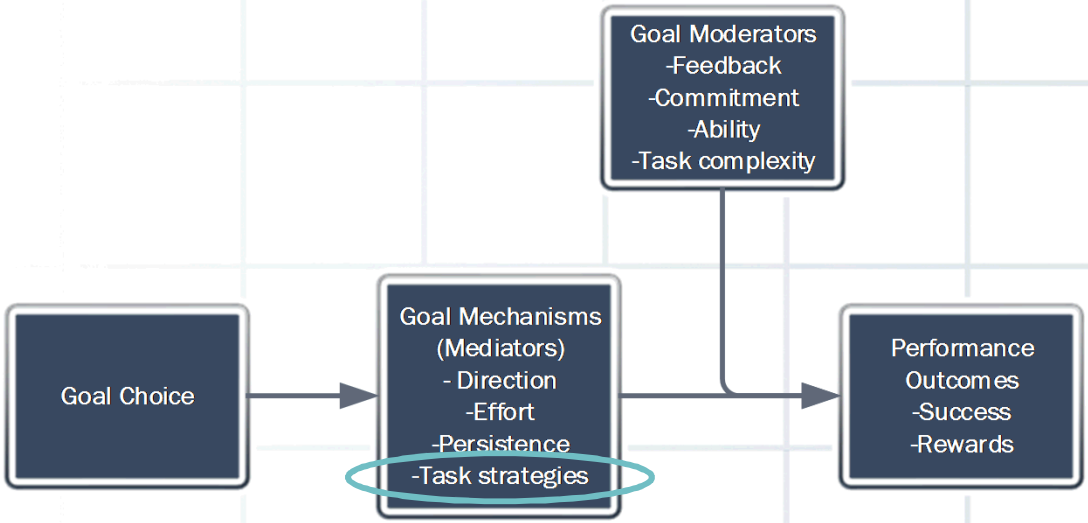
Relationship to Projects

- A project represents a temporary organization with a larger organization
- Organizational level control mechanisms may influence project level control mechanisms

Research and Scheduling

- Goal Setting Theory
- Transactive memory system (TMS)
- Cognitive Artifacts
- Planning
- Changes

Goal Setting Theory



Adapted from: Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance. Englewood Cliffs, NJ: Prentice-Hall.*

Transactive Memory Systems (TMS) Theory

- We use other people as memory storage
- Three dimensions:
  - Specialization
  - Credibility
  - **Coordination – enabled by effective strategies**

Cognitive Artifacts

- Schedules may be classified as cognitive artifacts
- Cognitive artifacts support coordination of distributed knowledge
  - Research indicates that once you “formalize” working schedules for other purposes, such as management visibility, they loose some of their effectiveness as working tools and users begin building “informal” schedules outside the formal process

Nemeth, C. (2003). How cognitive artifacts support distributed cognition in acute care. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 47(3), 381-385.*

Projects as Mental Prisons

- Critical theorists

Projects as “set of disciplinary practices that control and monitor individuals for the sake of organisational efficiency and effectiveness.” (p.111)

- Disciplining space
- Disciplining the mind
- **Disciplining time – schedule**

- Projects more controlling than Taylorism

Lundgren, M., & Packendorff, J. (2006). Projects and prisons. In G. Burrell, M. Marchington & P. Thompson (Eds.), *Making projects critical* (pp. 111-131). New York, NY: Palgrave.

Decision Making

- Team decisions may not be data driven
  - Groupthink
  - Normalization of deviance
  - Hidden profiles

EVMS Implementation

- Not invented here (NIH)
- Agency Theory
- Power
- Trust

Questions???