



# The Future of Industrial Engineering

*Shop Floors to Factories to Supply Chains to Enterprises*

*William B. Rouse*

# Overview

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- Evolution of Industrial Engineering
- Enterprises
  - Definitions
  - Examples
  - Solutions
  - Challenges
  - Transformation
- The Future of Industrial Engineering

# Evolution of IE

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- Shop Floors
- Manufacturing Processes
- Manufacturing Systems
- Logistics
- Supply Chain Management
- Enterprises

# Enterprise Definitions

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- Enterprise: A goal-directed organization of resources -- human, information, financial, and physical – and activities, usually of significant operational scope, complication, risk, and duration
- Other definitions:
  - A venture, particularly one of some scope, complication, and risk
  - A purposeful or industrious undertaking, especially one that requires effort or boldness
  - Industrious, systematic activity, especially when directed toward profit

# Statutory Definition

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“Enterprise” means the related activities performed (either through unified operation or common control) by any person or persons for a common business purpose, and includes all such activities whether performed in one or more establishments or by one or more corporate or other organizational units including departments of an establishment operated through leasing arrangements, but shall not include the related activities performed for such enterprise by an independent contractor: Provided, That within the meaning of this subsection, a retail or service establishment which is under independent ownership shall not be deemed to be so operated or controlled as to be other than a separate and distinct enterprise by reason of any arrangement, which includes, but is not necessarily limited to, an agreement (1) that it will sell, or sell only, certain goods specified by a particular manufacturer, distributor, or advertiser, or (2) that it will join with other such establishments in the same industry for the purpose of collective purchasing, or (3) that it will have the exclusive right to sell the goods or use the brand name of a manufacturer, distributor, or advertiser within a specified area, or by reason of the fact that it occupies premises leased to it by a person who also leases premises to other retail or service establishments.

# Enterprise Examples

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- Proprietorship – Single Owner, Location
- Company – Single Business Unit
- Corporation – Multiple Business Units
- Supply Chain – Supply, Mfg, Distribution
- Market – Competing Supply Chains
- Government – Laws, Taxation, Services
- Economy -- Markets & Governments

# Enterprise “Solutions”

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- ERP: Enterprise Resource Planning
- MRP: Materials Resource Planning
- CRM: Customer Relationship Mgt.
- SCM: Supply Chain Management
- SFA: Sales Force Automation

# Enterprise Challenges

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- Underlying Phenomena
- Strategic Management
- Nature of Challenges
- Relationships Among Challenges

# Underlying Phenomena

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- Most enterprises face similar challenges, although relative importance varies
- Success of enterprises, and their leaders, strongly affected by these challenges
- Multiple useful ways to address strategic challenges successfully
- True nature of strategic challenges not determined by tools chosen to address them

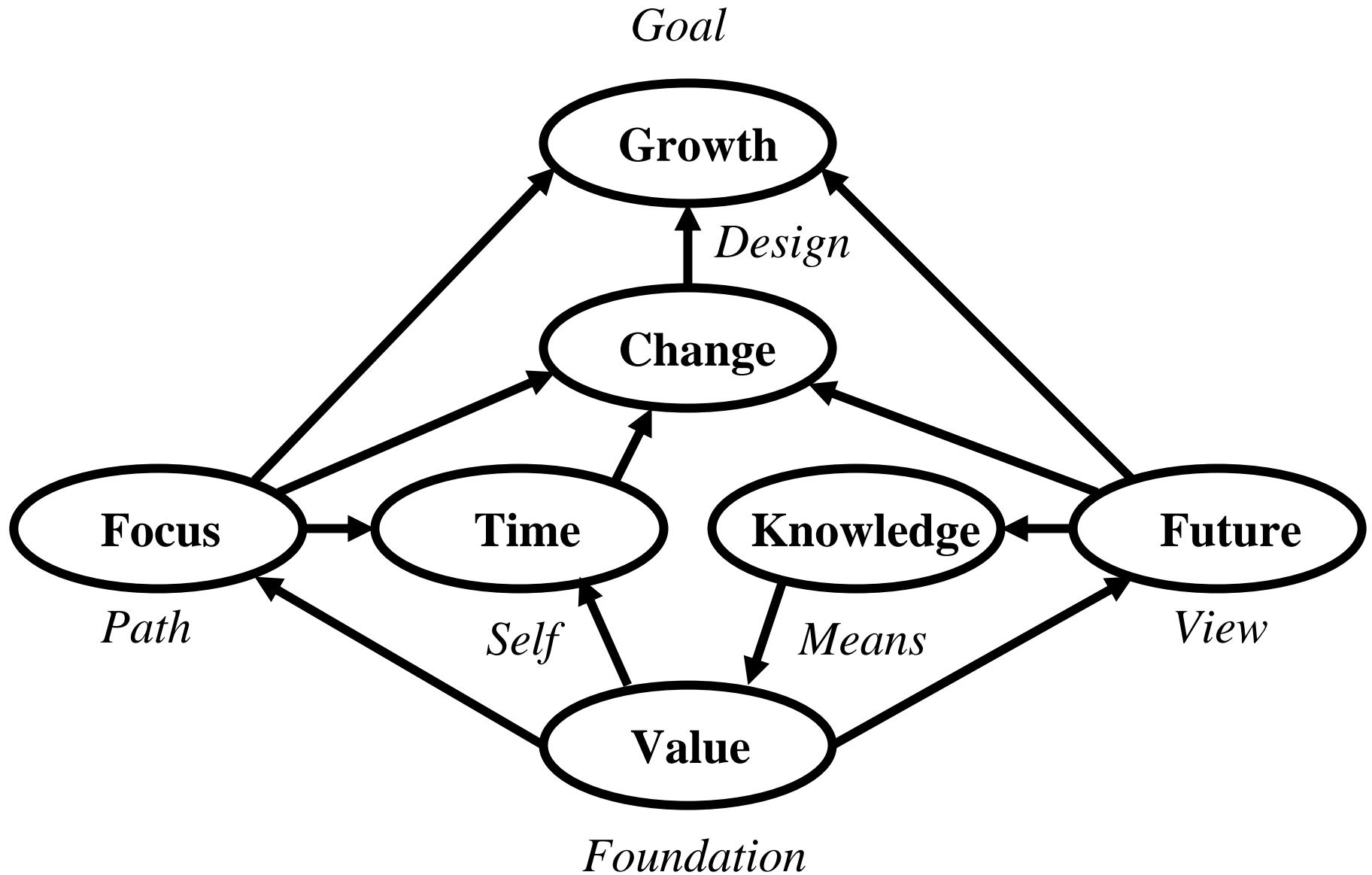
# Strategic Management



# Nature of Challenges

Challenge	Nature
Growth	Increasing Impact, Perhaps in Saturated/Declining Markets
Value	Enhancing Relationships of Processes to Benefits & Costs
Focus	Pursuing Opportunities & Avoiding Diversions
Change	Competing Creatively While Maintaining Continuity
Future	Investing in Inherently Unpredictable Outcomes
Knowledge	Transforming Information to Insights to Programs
Time	Carefully Allocating the Organization's Scarcest Resource

# Relationships Among Challenges

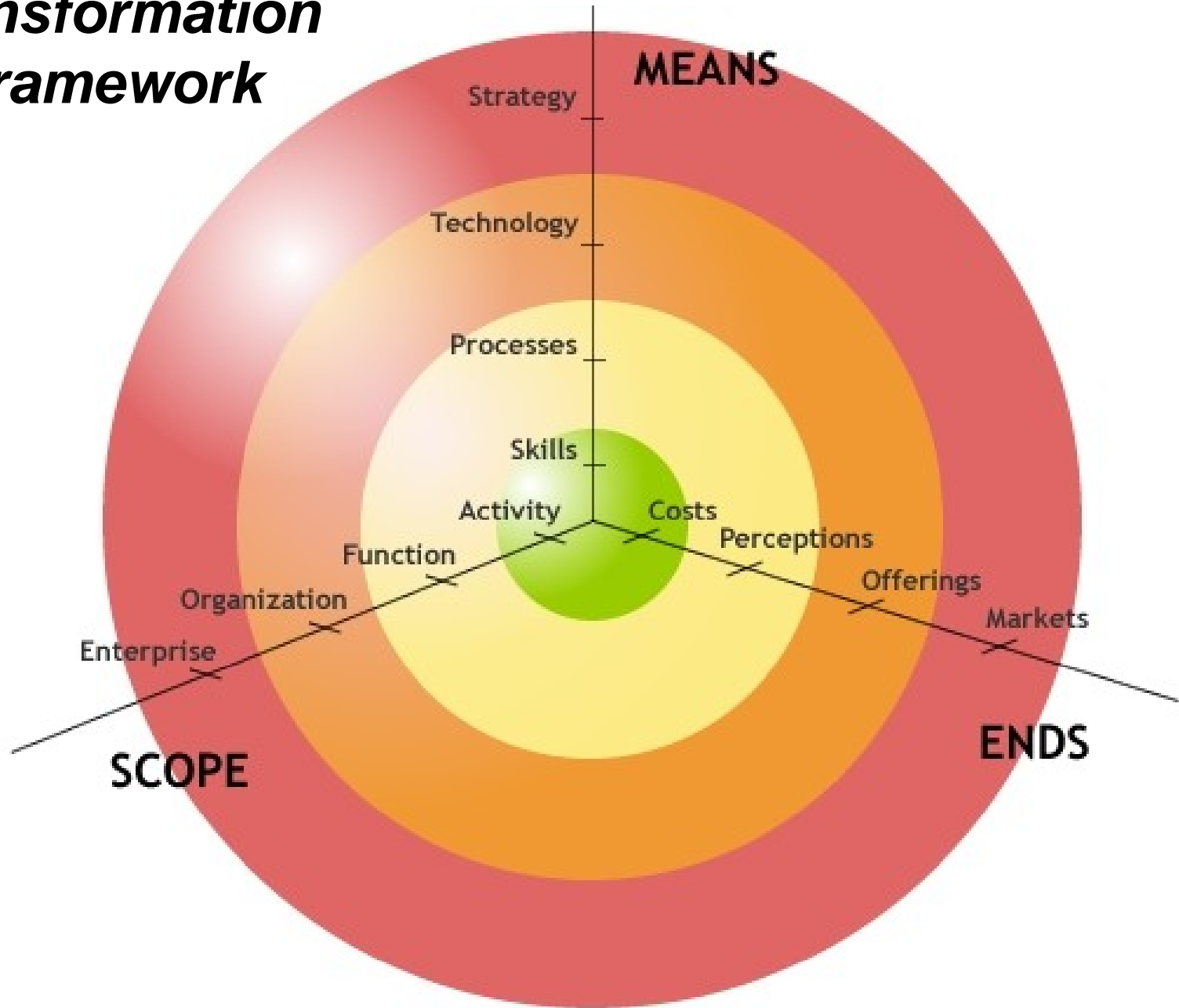


# Enterprise Transformation

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- Framework
- Examples
- Perspectives
- Approaches
- Theory

# ***Transformation Framework***



# Examples

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- Changing Markets
- Changing Offerings
- Changing Perceptions
- Changing Operations

# Changing Markets

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- Amazon leveraging IT to redefine book buying
- DoD adopting effects-based planning & acquisition
- e-Bay leveraging IT to redefine the resale market
- FedEx defining the overnight mail market
- NCR leveraging IT to redefine banking (via ATMs)
- Wal-Mart leveraging IT to redefine the retail industry

# Changing Offerings

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- CNN redefining news offerings
- GE moving from products to financing
- Home Depot redefining hardware store offerings
- HP attempting to redefine offerings in the printer market
- IBM defining the business PC market (via outsourcing)
- Motorola moving from radios to cell phones
- Schwab redefining how people buy securities

# Changing Perceptions

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- Dell repositioning computer buying (via build to order)
- Interface adopting green practices to reposition carpet buying
- Southwest repositioning discount air travel
- Starbucks repositioning coffee buying
- Victoria's Secret repositioning lingerie buying

# Changing Operations

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- American Cancer Society consolidating & integrating operations
- Lockheed Martin merging three aircraft companies
- Newell Rubbermaid resuscitating home products companies
- Nucor decreasing the cost of steel making (via mini-mills)
- Tennenco resuscitating Anacomp, Party City and Pemco

# Theory of Transformation

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- Definition
- Elements of Theory
  - Value Deficiencies
  - Work Processes
  - Decision Making
  - Social Networks
- Summary

# Definition

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Enterprise transformation is driven by experienced and/or anticipated **value deficiencies** that result in significantly redesigned and/or new **work processes** as determined by management's **decision making** abilities, limitations, and inclinations, all in the context of the **social networks** of management in particular, and the enterprise in general.

# Elements of Theory

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- Value Deficiencies Drive Transformation
- Work Processes Enable Transformation
- Allocation of Attention & Resources
- Management Decision Making
- Social Networks

# Value Deficiencies Drive Transformation

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- Value Opportunities: The lure of greater success via market and/or technology opportunities prompts transformation initiatives
- Value Threats: The danger of anticipated failure due to market and/or technology threats prompts transformation initiatives
- Value Competition: Other players' transformation initiatives prompt recognition that transformation is necessary to continued success
- Value Crises: Steadily declining market performance, cash flow problems, etc. prompt recognition that transformation is necessary to survive

# Work Processes Enable Transformation

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- Markets Targeted, e.g., pursuing global markets such as emerging markets, or pursuing vertical markets such as aerospace and defense
- Market Channels Employed, e.g., adding web-based sales of products and services such as automobiles, consumer electronics, and computers
- Value Proposition, e.g., moving from selling unbundled products and services to providing integrated solutions for information technology management
- Offerings Provided, e.g., changing the products and services provided, perhaps by private labeling of outsourced products and focusing on support services

# Work Processes Enable Transformation

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- Supply Chain Restructuring, e.g., simplifying supply chains, negotiating just-in-time relationships, developing collaborative information systems
- Outsourcing & Offshoring, e.g., contracting out manufacturing, information technology support; employing low-wage, high-skill labor from other countries
- Process Standardization, e.g., enterprise-wide standardization of processes for product and process development, R&D, finance, personnel, etc.
- Process Reengineering, e.g., identification, design, and deployment of value-driven processes; identification and elimination of non-value creating activities
- Web-Enabled Processes, e.g., online, self-support systems for customer relationship management, inventory management, etc.

# Allocation of Attention & Resources

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- Anticipate and adapt to changes of external variables, i.e., control the enterprise relative to the “road ahead” rather than the road behind
- Cultivate and allocate resources so as to yield future enterprise states with high projected value with acceptable uncertainties and risks

# Management Decision Making

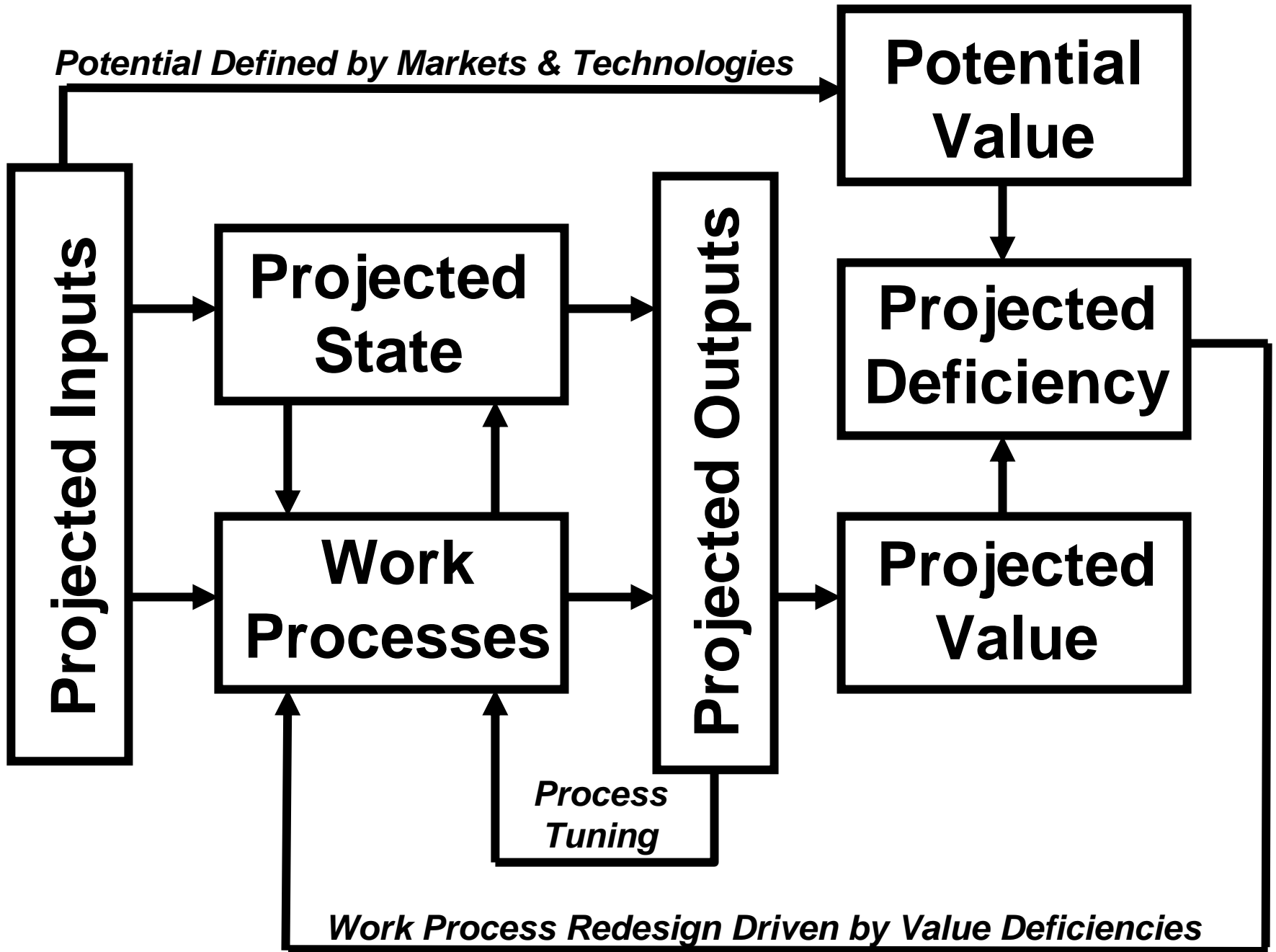
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- Phenomena
  - Folklore and fact of managers' jobs (Mintzberg)
  - Optimizing vs. Satisficing (Simon)
  - Organizational Delusions (Rouse)
  - Role of Intuition (Klein)
- Frameworks
  - How managers address change, ranging from tuning, to adaptation, to reorientation, to re-creation (Nadler & Tushman)
  - Managers' modes of control, ranging from scrambled, to opportunistic, to tactical, to strategic (Hollnagel)

# Social Networks

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- Strong vs. Weak Networks (Burt, Granovetter)
  - Strongly connected networks result in rapid and efficient information and knowledge sharing among members
  - Weakly connected networks have “holes,” in many cases between strongly connected subnetworks
- Implications for Transformation
  - Weakly connected networks are better sources of new information and novel ideas
  - Strongly connected networks are better at implementing change once sense has been made of them



# The Future of IE


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- Concepts, principles, methods & tools
- That address complexity
  - Large in scale
  - Laced with uncertainty
  - Dynamic in function & form
  - Driven by real-time information
- And integrate across disciplines
- To create value-centered enterprises

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