

WHEN ENTERPRISE = SYSTEM

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Abstract

Many business enterprises are a complex collage as are many public sector enterprises. But a successful, sustainable enterprise is an efficient, agile system. It consists of components and interrelationships, exhibits valuable stimulus:response characteristics and has dynamic range limits for stability and integrity. A business, being a "peopled" system, presents special challenges to those who would operate and evolve it. These challenges can be met only by leaders who are adept at the right kind of systems engineering. A systems view of a business gives the leader a competitive edge over those who see a business as a functional organization or a set of processes.

Foundational Notions

A system is a set of objects together with the relations between the objects and between their attributes (1). There can be a variety of types of entities and a variety of relationship types. Some of the relationships are tangible while other relationships are intangible or even subconscious.

When a system is presented with a stimulus it produces a response. The Stimulus:Response (S:R) characteristic is called the system's behavior. An simple stimulus may trigger a complex response that plays out over time. Similarly, a complex stimulus that extends over time may result in a single, simple response. The S:R behavior of a system is influenced by the nature of the relationships more than by the capabilities of the components.

Table 1 shows the basic Context and Content of a business enterprise as a system. A Business facilitates commerce between its Marketplace and Suppliers (2). A business can be viewed as a set of **Components** which interact to accomplish **Activities** which produce **Results**. Activities include taking input from suppliers, adding value, and providing output to the marketplace. Results include the value added by these activities, the rewards garnered from the marketplace and the rewards provided to the Suppliers. The competitive market establishes an actual street price which reveals the real value added by the business. The street price, in turn, determines the reward garnered by the business.

Table 1: Business Context and Content

Marketplace				
<i>Relationships</i>				
<i>Activities</i>	<i>Management MOE's</i>	<i>Business Components</i>	<i>External MOE's</i>	<i>Results</i>
<i>Relationships</i>				
Suppliers				

The nature of the *Relationships* along the Supplier - Business - Marketplace chain strongly influences the actual value perceived by the customers, thus the real value added by the business.

Business performance can be evaluated with a set of Measures of Effectiveness, MOE's, External MOE's are lagging indicators and Management MOE's can be leading indicators unless too much latency exists in management practices.

Table 2: The Whole, Self-sustaining Enterprise

Non-Prospects Information Providers (Private) Key Influencers (Public) Their Customers, Their Other Suppliers + Current Accounts, Prospects
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- Data Collection
- Awareness, Appreciation, Preference
- Selling and Account Management
- Distributing
- Installing
- Activating
- Supporting Operations
- Confirming Benefits

<ul style="list-style-type: none"> • Understand Context - Analyze Data - Evaluate Status • Lead Action - Plan - Goal - AssignResources • Improve Business - Model Business - Learn & Change 	<ul style="list-style-type: none"> • Cost of Quality • Model Fidelity • ChangeProficiency • Climate Surveys • Conflicting Goals • Benchmarks 	Products Services People Culture Information Systems Processes Policies Resources Vision Mission	<ul style="list-style-type: none"> • MarketStanding • Innovation • Productivity • Liquidity • Image 	<ul style="list-style-type: none"> • Grow Satisfaction • Add Value - Information - Services - Products • Grow Profit
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- Ease of Learning, Use, Integration
- JIT, Zero Defects
- Purchasing
- Awareness, Appreciation, Preference
- Data Collection

Parts and Subassemblies Internal Systems and Equipment Information, Foresight, People, Capital + Their Suppliers - Their Other Customers (Private) Key Influencers (Public) Information Providers

Table 2 shows the 63 "projects" that a business must do everyday. Each should have a project manager, project plan, project team, milestones, deliverables and celebrations. Some projects may take only a few minutes per day but all must be done.

Measures of Effectiveness

Peter Drucker says that the basic external measures of enterprise health are Market Standing, Innovation, Productivity and Liquidity. Others highlight and add Image even though it is part of Market Standing in Drucker's formulation,

Note that all these are *post-facto* measures whereas anticipatory measures are needed as well. That is why we have Management MOE's. The most informative measures of management are Cost of Quality (especially the Price of Non-Conformance™), Business Model Fidelity, Change Proficiency, Climate Surveys and incidence of Conflicting Goals. Special attention should be given to Conflicting Goals because they are clear signals that the strategy is not working or that communication is inadequate or distorted. Benchmarks are a slower and more expensive way to measure management effectiveness and are *post-facto* measures, anyway. Best Practices (c.f. CMM's and EIA 731) are popular effectiveness references but are *post-facto*, as well, and not only less informative but also potentially misleading.

Obviously Table 2 represents only a static view of the business. More important is the dynamic, behavioral view. Significant and even mind numbing complexity is added to the picture by the time-based flows of materiel, information and decision during the formulation of the thousands of responses each day.

Because the context of the business changes in a series of stochastic shocks, good systems produce the right Responses to Stimuli, better systems improve themselves as Stimulus:Response pairs and the resulting rewards are experienced and the best system adapts itself, "firstest with the leastest" to new stimuli. Accordingly, the life expectancy of a business depends not only on current performance but also on its agility -- the ability to thrive in an environment of unpredictable change.

Dynamic Stability

In any system there is a tension between stability and maneuverability. A paperweight is highly stable but not very maneuverable. Likewise Brownian Motion is highly stable because even if the particles are in random motion the random motion persists over time (even though the particles have moved to new locations). A mode of control that seeks stability is homeostasis, the normal human's ability to maintain an internal body temperature of 98.6 F regardless of external temperature.

Many would agree that Teenagers exhibit a low level of stability and a low level of maneuverability (doing what they are told, the first time). In contrast, a motorcycle is highly maneuverable but not very stable, particularly at rest.

Some systems exhibit high levels of stability and maneuverability simultaneously. A helicopter is much more maneuverable than an airplane but is stable, at least as long as all of its internal control systems are working. Also, contrary to engineering predictions, the hummingbird exhibits this property. Likewise, a rules-driven organization is more stable and more maneuverable than an enterprise where everyone does what they please but is not as stable nor maneuverable an agile organization.

The secret of helicopters, hummingbirds and agile, learning organizations is clear. This is called dynamic stability. Dynamic stability is achieved by the inclusion of a process control system in the basic system. As control becomes more effective the enterprise can achieve higher levels of stability and maneuverability simultaneously.

A process control system contains a model of the system to be controlled -- a model of the business -- and the accuracy of control is limited by the fidelity of this model to the real world. That is why Model Fidelity is a measure of management effectiveness. The attributes of a process control system are Acuity, Latency and Accuracy. Acuity means that the control system can sense or know about all the pertinent events and conditions throughout the enterprise. Latency means the delay between the time an event happens in the real world and the time that the control system deals with the

event. Accuracy means how closely the control system can adjust the actual conditions to the desired conditions.

In addition to model fidelity limitations the mode of control limits Acuity, Latency and Accuracy. As the mode of control progresses from Oversight (as in congressional oversight or periodic assessments of capability) to Embedded (as in peer design reviews or on-chip, non-functional tests) to systemic (as in a quality ethic) one achieves what Peter Senge (3) called “control without controlling.” With systemic control embedded in each business component whole new kinds of business enterprises can be envisioned. Stability vs. Maneuverability no longer needs to be a tradeoff. Businesses can enjoy dynamic stability just as do hummingbirds and helicopters.

From Components to a System of Systems

A business can be viewed as a policy and process system, a people system, an information and decision system and a materiel handling system. Unfortunately, such systems cannot be bought. Only the components can be bought. Then the “system” must be evolved, in situ.

The components that comprise a business are (4):

- **Mission** -- The statement of enterprise purpose. Explains the role the enterprise will play relative to its context. Justifies the existence of the enterprise. One instance is preferred.
- **Vision** -- Describes the enterprise meaning. A single, clear expression of what the effort is all about. A vision statement often uses metaphor to communicate meaning. One instance is preferred.
- **Resources** -- Cash and other real assets including real estate, inventory (properly discounted), knowledge (models) and relationships. The category, resources, does not include People. People are the reason for the enterprise, not the resources. Human Resources is a notion best forgotten and replaced with responsible managers. Multiple instances are common.
- **Policies** -- the rules by which the enterprise allocates resources, conforms to norms and standards and attempts to control its politics. Used to bound the permissible forms of processes and cultural behavior. Multiple instances are common but the fewer the better.
- **Processes** -- the set and sequence of activities by which the enterprise applies information, time and resources to honor all inputs, add value, and generate all outputs. Not all activities will add value directly but all valid ones will trace to a value-adding activity. Others represent unnecessary activities -- waste. Multiple instances are common but the fewer the better.
- **Information** -- the usable part of the enterprise's knowledge base. Also includes the technology (know how) base. Leverages the data stored in the people, information system, library and other places. Multiple instances are common and the more the better.
- **Systems** -- the mechanisms that store, process, and move both materials and information throughout an organization. Multiple instances are common but the fewer the better.
- **Culture** -- "how things are done around here." The beliefs and values, the rituals, the symbols, the recognition's and rewards. Includes the political power patterns and dances. Multiple instances are common but the fewer the better.
- **People** -- the total roster of the business including the Board of Directors and any other group whose decisions directly influence enterprise achievement. People are not "resources." Rather, people are the "operators" of the business. People are the sole

producers and utilizers of knowledge and other forms of innovation. They are the sources of collaboration and the sole sources of fears of inadequacy and impending irrelevancy. Multiple instances are common but the fewer the better.

- **Products** -- one vehicle for transmitting added value to customers. Includes hardware products, software products and information products. Multiple instances are common but the fewer the better.
- **Services** -- the other vehicle for transmitting added value to customers. Multiple instances are common but the fewer the better.

Business Size, Complexity and Confusion

As a business grows, the number of projects, people and locations increase and a pattern of confusion and inefficiency sets in. Part of this is due to the $R = N(N-1)/2$ equation which says the number of relationships, R, grows faster than the number of components, N, and another part is due to management competency or lack thereof.

Typically, growth adds echelons in an organization chart. The more layers the more complexity and the more misinformation gets passed. This manifests as Uncertainty in the Board Room and as increasing Apathy down the echelons. Little wonder why organizations get in trouble if they do not shift their mode of operation at staff sizes of 15, 65, 250, and so forth.

Viewing a business as a system reveals the folly of the long standing management dilemma of organizing by function or by project or by the "least worst" alternative -- matrix management. The ten Principles of Agile System Design (<http://www.parshift.com>) indicate that a business should be highly modular and have a web topology, all within a common framework that is consistent with the nature of the stimuli placed by the context to which the business intends to respond. Top Down has no meaning because no one can tell which facet of the system is the top.

In peopled systems the interpersonal and learning styles of the individuals involved must be taken into account, managed and often times mitigated (5). Interrelationships are extremely important. This is demonstrated when a synergistic team of lesser capable people outperforms a group of non-cooperating experts.

Critical Success Factors

To ensure that the MOE's will be met all business plans and decisions should pursue the triple maximum of Quality, (Cycle Time)⁻¹ and Return on Resources.

Return on Resources is measured in two dimensions. One concerns the financial capital invested and is measured by the amount of real value added and the time rate of adding value (in the numerator) and the amount of resources required and the time rate of capital (in the denominator). A second, more future oriented, dimension of Return on Resources concerns the people capital invested and is measured by the magnitude and rate of learning that the people achieve (in the numerator) and the amount of time and effort they invested (in the denominator).

The Nine Collaboration Projects

A common framework for the agile enterprise is the set of nine Collaboration Projects. This framework integrates all activities and ensures pursuit of the triple maximum. Each Project is instantiated as a goal-seeking system in its own right so that each provides the standardizations needed to facilitate the triple maximum across the components while simultaneously collaboratively adapting to the stochastic shocks of inevitable change. Note the purposeful absence of terminology such as Marketing, Sales, Engineering, Manufacturing, etc.

- Business Co-Evolution Project

- Business Development Project
- Sales and Account Management Project
- Customer Services Project
- Product Development and Introduction Project
- Production and Distribution Project
- Infrastructure Development Project
- Competency Development Project
- Status and Gaps Reporting Project

Reflection

It is worth noting that any systems engineering activity is a business. Accordingly, the views of a business presented herein give strong clues to the requisite content of a given SE activity. Good SE produces the right Responses to Stimuli. Better SE improves itself as it experiences Stimulus:Response pairs. And the best SE adapts itself, “firstest with the leastest,” to the evolving problem space it encounters.

References

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