

3. Complexity

There are two sections that follow.

The first deals with systemics. We find the idea of systemics useful to understanding the world. The way that individuals see the world, or part of the world, is not identical. Some are more comfortable with “small” systems that seem manageable. Others see a “bigger picture”.

The second section deals with the type of systems that we see. We have grand categorizations of “simple”, “complicated” and “complex”.

Sidebar: Content from the BPM discussion database

- 2004 Fioretti Visser, Cognitive Interpretation of Org Complexity {Gary Metcalf}

<< Idea 3.1: We find that framing businesses in systemic terms provides a vocabulary for discussion, as well as insight into helpful similarities and distinctions >>

« DI: Do we want to use the phrase “systemics” instead of “systems”? »

The word “system” is a natural part of the business vocabulary, but for researchers in the systems sciences, it brings deeper meanings. These deeper meanings can add to our understanding in business.

Systems theory should not be seen as a “silver bullet”, able to slay the beast of business understanding. It is a body of work that provides a vocabulary and concepts, so that a group of intelligence business professionals can gain additional understanding about a situation or circumstance.

Systems discussions tend to not retreat into disciplinary warrens. A challenge is not necessarily seen as a “marketing problem”, nor a “finance problem”, nor an “organizational problem”. It may be all of those, or none of those. In fact, systems thinking often seeks to gain insight into the business world by looking into other worlds. A business organization may be seen as similar or dissimilar to a machine, or to a biological entity, or to an ecology. Concepts from these other fields may or may not be applicable as models or metaphors. The appropriateness of these metaphors is rich fodder for discussion.

3.11: We each play a part in the design of our business systems

In business, we make decisions and choices that influence the design of the business. In some systems, our contributions to the design are rather complete, and we have the ability to plan every detail. In other systems, we can only influence small portions of the design, and either coordinate with others with influence over other small portions, or we set a trajectory and hope that everything will fall into place.

« DI: DLH has mentioned that Ackoff got an epiphany from reading an entry in an encyclopedia, that had to deal with teleology and free will. I have a hardcopy of those pages, somewhere »

The most basics concepts are parts, wholes and boundaries

« Parts and wholes, as old as the Greeks »

Sidebar 3.11a: In design, three helpful concepts in systems are function, structure and process.

-begin Sidebar 3.11a -

« Stronger definitions are needed, but here's a start »

In business, we bring parts together to form a whole. Systems theory provides us with a vocabulary to describe the relations between one part and another, and between part(s) and the whole.

Function is the contribution of the part to the whole. This requires recognition that a system is always contained within a larger system. Thus the sales department provides a function of selling, to a business enterprise.

Structure is an arrangement of parts in space. This is most obvious in physical arrangements. In organizational structure, a manufacturing operation may report to a country manager, who is in a structure of international business.

Process is an arrangement of parts in time. In serving a customer, it often makes a difference whether a customer makes a payment in advance of seeing the contracted result, or instead if the result must be produced before the payment.

-end Sidebar 3.11a -

3.12 Business systems are social systems in which we can choose our purposes

A business can have many functions, such as serving specified customers, adding value onto invested capital and/or employing skilled people. From these many functions, it is common to choose one or a few as the primary purpose(s) for our business. This enables our collective efforts to be channeled into a productive direction, with some efficiency in the use of resources.

Sidebar 3.12a: We each play a part in the design of our business systems.

- begin Sidebar 3.12a -

« DI: A better introduction needs to be written for this. To be complete, we would need to unpack the differentiation between purposive (as goal-seeking) versus purposeful (as ideal-seeking). Here's the original citation. »

Reference: Russell L. Ackoff and Jamshid Gharajedaghi, "Reflections on Systems and their Models", *Systems Research*, Vol. 13, No. 1, 1996, pp. 13-23.

There are three basic types of systems and models of them, and a meta-system; one that contains all three types as parts of it (see Table 1).

Table 1: Types of systems and models

Systems and models	Parts	Whole
Deterministic	Not purposeful	Not purposeful
Animated	Not purposeful	Purposeful
Social	Purposeful	Purposeful
Ecological	Purposeful	Not purposeful

These three types of system form a hierarchy in the following sense:

animated systems have deterministic systems as their parts. In addition, some of them can create and use deterministic systems, but not vice versa.

Social systems have animated systems as their parts.

All three types of system are contained in *ecological systems*, some of whose parts are purposeful but not the whole. For example, Earth is an ecological system that has no purpose of its own, but contains social and animate systems that do, and deterministic systems that don't. [p. 14, editorial paragraphing added]

- end Sidebar 3.12a -

3.13 Synergy should be view in frames that are expansive and reductive

Systems can be viewed both from expansive (i.e. system in the world or environment) or reductive (i.e. take the thing apart) perspectives. Both are valid. In business, it seems that it's often easier to focus on being reductive, because these are things that we can control. In typical business, we feel that we can control our employees (who are inside our defined system), but we can't control our customers (who are outside our defined systems). Thus, we may often fall into a trap of "talking to ourselves", when resolutions may be better found in "talking with our customers".

Expansiveness as the bigger picture.

Reductionism as narrowness.

Systemic is both expansive and reductive, yet science often forgets the expansive

3.2 Three orientations to business parallel three system concepts

The orientation that individuals have towards collective action - both from an external perspective (outside of the business enterprise) and an internal perspective (working within the business) can be viewed in three major categories.

Business orientation	System conception
Best	Simple
Both	Complicated
More	Complex

3.21 A "best" orientation is effective when the conception of the business is as a simple system

"Best" means straightforward strategies, where it's possible to optimize in a single direction. "Lowest prices, always" is clear. "Ultimate luxury" is clear. "The finest that money can buy" is clear.

If the business is defined as a providing a single product or service, and is relatively independent of suppliers and business partners, the clarity and simplicity of a unified direction presents a "strategy" that may be hard to beat.

3.22 A "both" orientation works in a business conceived as a complicated system

"Both" is a refinement of the "best" orientation. "Best" can mean different things to different

customers or constituents. If it's possible to cleanly separate or segment interests into various groups, then it may be possible to give each group what they consider "best". Branding is often an example of how this is done, e.g. Chevrolet vs. Cadillac from General Motors, or the Toyota brand as compared to Lexus.

From a systems perspective, customers or constituents may be served by distinct organizational units. The overall enterprise can be seen as a container of systems, where each business unit operates semi-autonomously. Each business unit has its distinct focus and expertise, but all tend to draw on some shared common services.

3.23 A "more" orientation takes advantage of a business conceived as a complex system

"More" is the approach for the messiness of a complex system. There may be something more that can't be achieved by a straightforward "best" or "both" orientation. There may be some intangible that is unique to the business (e.g. the creative genius of a Steve Jobs or Richard Branson), or some historical anomaly (e.g. the dual nationality of Royal Dutch/Shell) that would be wiped away by simplifying the business.

In our modern world, complexity is sometimes seen as a bad thing. It means that at least a large proportion of the people are unable to unravel the business, and understand how it works. For people who have never worked in a large corporation, IBM is often a complex mystery. Multinational, multi-product divisions serving a wide variety of clients don't work in straightforward ways. Any description of how the business operates (e.g. products / geography / industry) is only an abstraction, with chunks and bumps resulting in irregular organizational shapes. As an example, IBM Canada does not have the critical mass to staff every cell of the product-geography-industry cube, whereas IBM U.S. requires that granularity to make work manageable.

People who have worked in one complex business do get some appreciation of how others work. IBM, GE, General Motors, Dupont ... are all complex businesses. Chinese tangs and Japanese keiretsu are complex businesses. Successful people in these businesses are sometimes portrayed as corporate jungle fighters. They may appreciate the "wisdom of teams". People that don't appreciate these complexities find the businesses bureaucratic and non-sensical. Complex businesses may have come to that state by choice or by incremental evolution. They can be regarded as systems of systems. Optimizing one of the subsystems always has repercussions elsewhere, so new directions can be difficult.

<< Idea 3.3: We propose three grand categories of business systems >>

We propose three grand categories of business systems:

1. simple systems; « actually I would prefer to not use the word "simple", but it's the simplest that I can think of! »
2. complicated systems; and
3. complex systems.

These categories represent somewhat false, but useful distinction. A business systems is conceptual, and thus it depends on how each individual thinks about it

3.31 In a simple business system, function seems relatively clear, and structures and processes follow

« The following two paragraphs were originally in Chapter 1, but mentions of simple were cut out there. These may or may not belong here »

In businesses designed as simple systems, focus is important. In the growth phase of the business, resources may be limited, and the choice of promising directions is as important as the exclusion of distractions. In the most entrepreneurial businesses, this focus may mean that alternative opportunities may be spun off as separate businesses, so as to remain unconstrained by the legacy organization.

In designing a business as a system, although organizational leaders may sometimes feel “boxed in” but constraints – from customers, suppliers or bankers – they should realize that they always have a choice. Some options and alternatives may be less viable than others, but there always is choice. The end result may not be that which is most preferred, but choice is nonetheless a feature of business in a free enterprise society.

« End two inserted paragraphs »

Most business people find the idea of a marketplace relatively simple. The function of a marketplace is to facilitate the buying and selling of goods. The structure has roles for buyers and sellers. The process allows either the buyer or seller to suggest a price for some good, which the other party may reject or counteroffer, until an agreement is struck. In this example, the primary function is clear. A marketplace may also provide the function of a social meeting place, but if buying and selling of goods ends, it is inaccurate to continue calling it a marketplace. The structure supports an individual playing the role of either a buyer or a seller, although this role may change over time. The process may vary slightly by either the buyer first approaching a seller, or a seller first approaching a buyer, is also relatively straightforward.

A simple system, in addition to the advantage of understandability, often has the feature of robustness. The idea of a marketplace appears in almost every human culture. It operates in times of peace, and in times of war. It happens on small scales, such as local farmers' markets, or on international scales, as in the trade of diamonds. It can be placed in face-to-face conditions, or through electronic media. A simple system in business, may, however, not preclude some players from entering, or may have some other undesirable social side effects.

« DI: a drawing of a system may be appropriate here. A circle with dotted boundary, labeled “system” inside, and “environment” outside »

In a simple system, a business person should find defining a boundary around the business entity relatively straightforward. Getting agreement about what is “inside” the systems, and that which is “outside” the system is not considered to be a great challenge.

Sidebar 3.31a: Simple systems, complicated systems and complex systems

– begin Sidebar 3.31a –

« need to do a summarization, but here's some sources that helped me »

– begin excerpt from SB Research database (on a DI commentary), 11/17/1998 –

Complicatedness means that, on an evolutionary continuum, you can trace backwards in time (e.g. man going back to the apes), but going forwards is an interesting problem. Genetic variations result in “dead ends”, i.e. species that don't exist anymore, and you may or may not be able to explain why the species died out. Work this out is complicated, but, in effect is problem-solving: work on it long enough, and you'll figure it out.

Complexity, on the other hand, is related to systems theory, particularly in terms of emergence.

There's nothing in hydrogen or oxygen that will help you understand the behavior of water.

- begin excerpt from SB Research database, 11/17/1998 -

- begin excerpt from SB Research database 12/15/2001 -

In a new vocabulary, we now identify structural elaboration as an increase in *complicatedness*, and distinguish it from elaboration of organization identified as an increase in *complexity*. We call the elaboration of organization a process of *complexification*, which leads to a *complex* system. The elaboration of structure we call a process of *complication* and it leads to a *complicated* system. The respective action verbs are to *complexify* and to *complicate*. Thus complexity is used hereafter in this paper to refer only to elaborate organization, except when we refer explicitly to usage in traditional or conventional terminology. By separating complicatedness from complexity, we are able to cast the modern human condition in terms of ancient and modern sociopolitical systems. [p. 407]

T. F. H. Allen, Joseph A. Tainter and T. W. Hoekstra, "Supply-Side Sustainability", *Systems Research and Behavioral Science*, Volume 16, Number 5, September - October 1999, pp. 403-427.

- begin excerpt from SB Research database, 12/15/2001 - - end Sidebar 3.31a -

3.32 In a complicated business system, multiple directions or constituents may be satisfied through recognizing clear distinctions or rules

In business, the approach of "divide-and-conquer" commonly takes place. Responding to different customer segments in different ways recognizes diversity in the richness of programs or services, as well as varying levels of profitability. Handling clients, business partners or suppliers by geographic proximity or access to local resources is a common way of doing international business. Operating multiple manufacturing facilities may allow favored status with local governments, as well as some resilience from redundancy, if disaster should strike at any one location.

In a complicated system, each business unit may subtly vary its function, structure and/or process. In function, one brewery in Canada often bottles multiple recipes and brands to satisfy local tastes, as compared to an American brewery that produces only one product for an entire region, or a European brewery that bottles for export to other countries. The structure of work can vary according to local customs (e.g. holidays), work rules (e.g. union agreements) or expertise (e.g. technical skills). Processes may vary according to the availability of resources, or just the "natural way" of doing things in the local environment.

A complicated system allows a business to have greater breadth. Instead of producing the Model T Ford, and declaring that "Any customer can have a car painted any color that he wants so long as it is black", variations allow a business to respond to the desires of multiple sets of customers while maintaining a high level of control. ¹⁾ In fact, if processes can be stabilized so that a dynamic range of products can be produced, a model of "mass customization" may be sustainable. ²⁾ Maintaining coherency, as the business system gets pulled in multiple directions, however, does present a challenge. Business units that are loosely coupled always seem to need corraling to prevent drifts away from common interests, while business units that are tightly coupled often chafe as they vie for autonomy.

« DI: A draw of a complicated system may be appropriate here. An rectangle with dotted boundary as the "complicated system", containing circles with dotted boundaries labeled "system" »

A business person describing a complicated business may say that it is a container of systems. Each business unit has a distinct identity, and can operate semi-autonomously from other business units.

At the same time, however, there are interactions between these semi-autonomous business units in which each has some stake and authority.

3.33 In a complex business system, working out one knotty issue often leads to additional entanglements

The world economy can be described as a complex system. The U.S. Federal Reserve influences monetary policy not just in the United State, but throughout the world. A multinational corporation, such as IBM, is also a complex system. It not only produces multiple product and services, some of which become internal competitors to each other, but it also involves customers and employees around the globe. The path from a basic product idea to a final market offering is murky, and possibly untraceable. Even if all of the inputs into such a complex system were listed, and the outputs measured, the mapping from inputs to outputs would be unclear.

The lack of understanding of what happens in a complex business is not to say that things don't happen logically. In fact, for those involved in influencing decisions within the system, the chains of events and turns can be quite logical. To observers outside of the system – and even probably those inside the business not immersed in the minutiae driving the final result – processes and structures are likely to remain a mystery. In addition, when the processes and structures are not understandable, the observers are likely to question to functions and/or purposes within the business enterprise.

« DI: A diagram of a complex system would be good here. It may take some time to figure out the right representation. To make it simple, a single oval with a dotted boundary might contain multiple circles of varying sizes and dotted boundaries, overlapping »

In addition, the approach of “divide and conquer” doesn't seem to apply to complex businesses. Working to improve the performance one business unit interconnected with other business units is problematic. An improvement in one aspect can ripple through into negative consequences in another aspect, with a potential overall effect of zero or negative results. Such a situation is often described as a mess. Trying to clear up a mess in one corner of the business may only make the mess worse in another part of the system. This may be akin to working on tangle of ribbons, and discovering while untying knots that it includes many Moebius strips. It may be possible to unknot the ribbons, but removing the Moebius topology not only changes structure and process, but possibly the function or purpose in the whole.

A business may be designed as complex for various reasons. In its evolution, some peculiarities may have had rational origins. Wine distributors that had privileges prior to government regulation of alcohol may still retain grandfathered rights. Technical specifications, such as railroad track widths, video refresh rates and audio sampling frequencies, may have developed from a trajectory of situational experiences, rather than a standards-forming committee. The beliefs of the original leaders of the business, such as Mormon or Jewish founders, may have institutionalized certain practices into an organization's culture. Business units included or excluded for reasons of antitrust sometimes place arm's-length relationships in the strangest contexts. As much as some of these quirks may seem like obstacles to making businesses more efficient, they may also be seen as features that make the enterprises unique by reinforcing an identity.

A complex system may be described as a system of systems. At the micro level, each subsystem may have an identity, but that identity may be mixed in with other business units. At a macro level, removing a part from the whole may seem heretical, if not destructive to the function of the whole. If the business is a viable complex system, attempting to convert it into a simpler or merely complicated form may cause it to lose its essential character.

<< Idea 3.4: These views of a business present a challenge when we try to change it >>

The description of a business as a system, no matter which type, is an abstraction. When the business is operating normally, a depiction as simple, complicated or complex does not make a difference. When it does make a difference, however, is when we want to change something.

Changing something in a business results in individuals having to take positions. Those driving for change see the world in some way differently than those who resist change. As a portrayal of these types of situations, consider the cases depicted into the following table.

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<table class="inline"> <tbody align="left"> <tr> <th rowspan="2"
colspan="2"></th> <th colspan="3">My approach to the business system</th>
</tr> <tr> <th>I want business to be simple</th> <th>I want business to be
complicated</th> <th>I want business to be complex</th> </tr> <tr> <th
rowspan="3">Your approach to the business system</th> <th>You want business
to be simple</th> <td>We're aligned</td> <td>I believe I can take advantage
of clear distinctions (e.g. customer segments) when you would prefer a
universal action</td> <td>I believe that I can take advantage of situations
that others could not replicate, when you would prefer a universal
action</td> </tr> <tr> <th>You want business to be complicated</th> <td>You
believe that you can take advantage of some distinctions, whereas I believe
they don't make a significant difference</td> <td>We're aligned</td> <td>You
believe that simple rules will be sufficient, whereas I think situational
understanding of side effects and consequences will be required</td> </tr>
<tr> <th>You want business to be complex</th> <td>You believe that side
effects and consequences will require a situational understanding, whereas I
believe straightforward action is sufficient</td> <td>You believe that there
are hidden meanings and side effects, whereas I believe that easy
categorizations and visible distinctions will suffice</td> <td>We're
aligned</td> </tr> </tbody> </table>
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« DI: If you like the above table, it will take a few paragraphs to unpack its content, here »

When all parties agree on the definition of a system, making changes will be easier. Agreement means some common definition on boundaries (i.e. what is included in the change and what is excluded), as well as a common understanding of functions, structures and processes – often at multiple levels.

« DI: A smooth transition to the next section needs to be written »

1)
See http://www.wordiq.com/definition/Ford_Model-T, although there's some doubt cast at <http://www.hfmvgv.org/exhibits/showroom/1908/model.t.html> that Henry Ford ever uttered these words.

2)
The original book on this idea was B. Joseph Pine II, *Mass Customization: The New Frontier in Business Competition*, Harvard Business School Press, 1992.

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