

When Technology Fails

Introduction

Technology – the gadgets, the Internet, the applications – is becoming an increasingly important in our lives and in the running of business. Our expectations of this technology – always on, always connected, always transmitting, instant response, access to anything at anytime from anywhere – are fundamentally changing our behavior.

"We know that technology changes our lives -- but could it be changing our selves as well?"¹

This change is marked by events such as:

I. BlackBerry outage exposes RIM's 'soft underbelly'

"A massive BlackBerry outage Tuesday and Wednesday revealed a huge drawback in the popular mobile e-mail system's design.

Many BlackBerry users, mainly in North America, stopped receiving e-mail Tuesday night. The company that makes the device, Canada's Research In Motion, didn't say how many of its 8 million subscribers were affected.

The problem was largely fixed by Wednesday morning."²

2. "I missed the bus because I went back to my apartment to get my cellphone."³
3. "When finally launched in 1990, scientists found that the main mirror had been ground incorrectly, severely compromising the telescope's capabilities."⁴
4. "In fact, most Wall Street computer models radically underestimated the risk of the complex mortgage securities, they said. That is partly because the level of financial distress is 'the equivalent of the 100-year flood,' in the words of Leslie Rahl, the president of Capital Market Risk Advisors, a consulting firm.

But she and others say there is more to it: The people who ran the financial firms chose to program their risk-management systems with overly optimistic assumptions and to feed them oversimplified data. This kept them from sounding the alarm early enough.

Top bankers couldn't simply ignore the computer models, because after the last round of big financial losses, regulators now require them to monitor their risk positions. Indeed, if the models say a firm's risk has increased, the firm must either reduce its bets or set aside more capital as a cushion in case things go wrong."⁵

¹ Sherry Turkle, Diane L. Coutu. "Technology and Human Vulnerability," Harvard Business Review September 2003 (2003). R0309B.

² Michelle Kessler, "BlackBerry outage exposes RIM's 'soft underbelly'," USA Today, April 17, 2007, http://www.usatoday.com/tech/news/2007-04-18-blackberry-outage-snarls-system_N.htm [October 9, 2008]

³ Student, "Executives on Campus Freshman Seminar for Learning Communities," Baruch College, October 2006

⁴ Wikipedia, "Hubble Space Telescope," http://en.wikipedia.org/wiki/Hubble_Space_Telescope [October 9, 2008]

⁵ Saul Hansel, "How Wall Street Lied to Its Computers," The New York Times, September 18, 2008, <http://bits.blogs.nytimes.com/2008/09/18/how-wall-streets-quants-lied-to-their-computers/?em> [October 9, 2008]

Technology is not, however, immune to disruptions of all sorts. Our lives are impacted by these disruptions since we have, for all intents and purposes, formed an almost inseparable relationship with technology.

This note is an examination of the failure of technology. It is not a “how-to” paper in the sense of making recommendations for the mitigation of the issue. Rather it is “what” paper in the sense of describing the issue.

The Fallback-Recovery Cycle

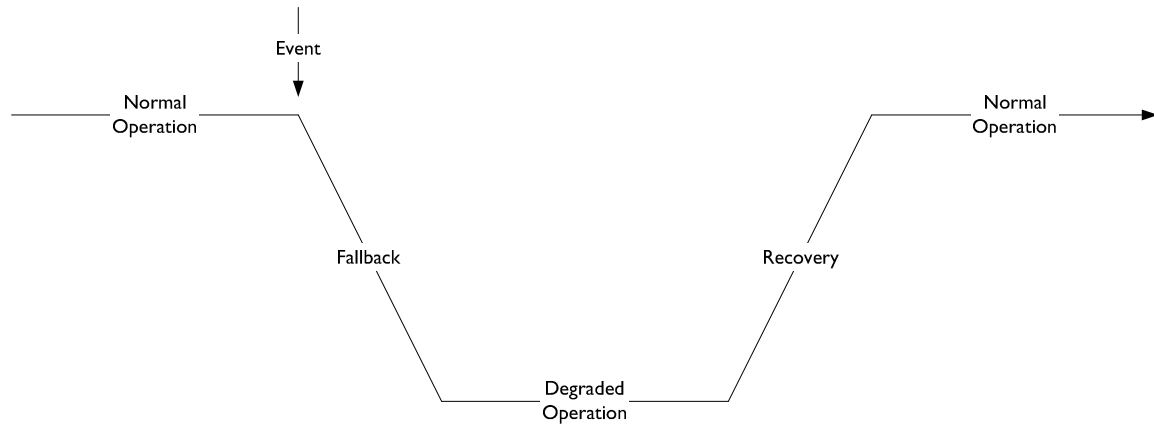


Figure 1 The Fallback-Recovery Cycle

Figure 1 represents a somewhat abstract view of the cycle initiated by the failure of technology.

Normal operation is, of course, the availability of function that we have come to expect. For example, when we open our cellphone we expect to see an indication of connectivity (see the illustration⁶ to the left). In fact, our expectations are so strong, that in all likelihood we do not check the connectivity unless we are unable to make a call.⁷



The inability to make a call is the event that alerts us that

technology has failed.

Our fallback procedure is to wander around, more-or-less aimlessly, searching for “the spot” where connectivity, even limited, will be restored.

If the connectivity is limited we operate in a degraded mode.

Subsequently, we often find ourselves, through recovery, in a spot where normal operation resumes.

Those who find ourselves inseparable from our cellphone may go through this cycle several times per day, thinking nothing of it.

So, we do already know a lot about the fallback-recovery cycle.

We think little of an experience of this nature since it generally has little impact on us.

However, when such a technology failure is more significant, as in the Blackberry outage mentioned in the Introduction, or even more significant, the communications failure during 911,⁸ then the cycle has a longer period and a more significant impact. These are the failures of technology which should concern us.

⁶ http://images.pcworld.com/reviews/graphics/113757-2202p138_3B.jpg [November 8, 2008]

⁷ “Can you hear me now?” is often an indication of poor connectivity.

⁸ Google “failure of cell communications on 911” for more information.

Points of Failure

Dealing with the issue of the failure of technology rests in an understanding of the nature of the technology structure utilized by the organization. What are the components of this structure? How do they interrelate? What is the probability of failure of one or more components? What is the nature of the impact of this failure?

In “Information System Fundamentals”⁹ I make use of a number of figures that are representative of the technology structure.

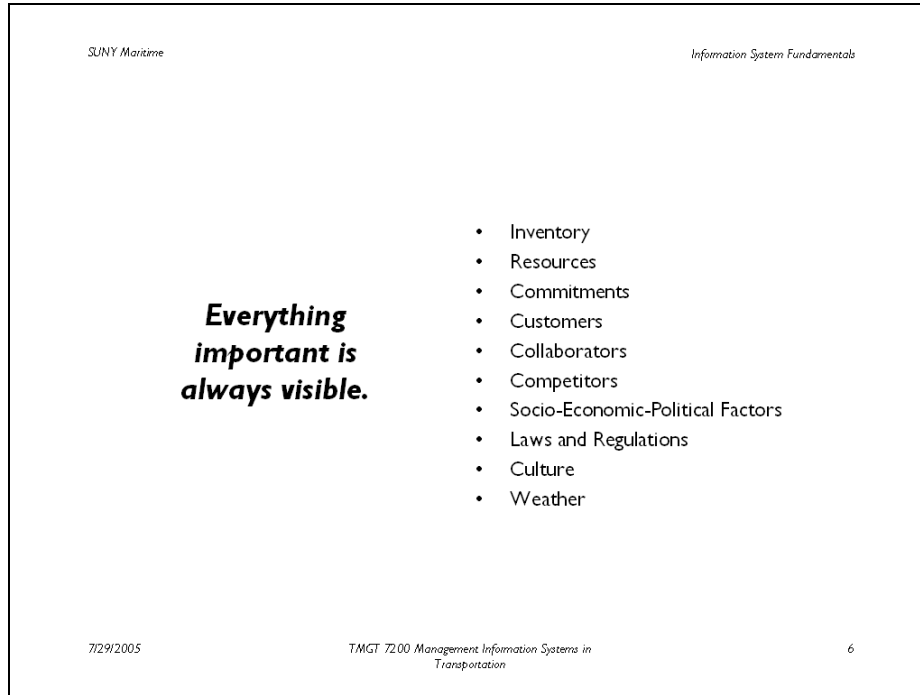


Figure 2 Everything Important is Always Visible

⁹ James Drogan, *Information System Fundamentals*, 2005, <http://jmsdrgn.squarespace.com/storage/Information%20System%20Fundamentals.pdf>, [January 28, 2007]

SUNY Maritime Information System Fundamentals

**Everything to
be managed
is always
reachable.**

- Inventory
- Resources
- Commitments
- Customers
- Collaborators

7/29/2005 TMGT 72.00 Management Information Systems in
Transportation 7

Figure 3 Everything to be Managed is Always Reachable

Technology, when properly designed, built, implemented, and managed ought to see and control that which we must know about and manage in order to be successful. Key to these is a way to sense the status of the items represented in Figure 2 and Figure 3. The associated sensors range from the person¹⁰ to an imbedded electronic sensor.¹¹

¹⁰ One of the most prominent examples of this is the “See Something Say Something” program of the Metropolitan Transportation Authority of the State of New York, <http://www.mta.info/mta/security/index.html> [November 27, 2008]

¹¹ E-ZPass, <http://www.ezpass.com/> [November 27, 2008]

Communications networks, ubiquitous and highly reliable, enable a firm to attain these goals.

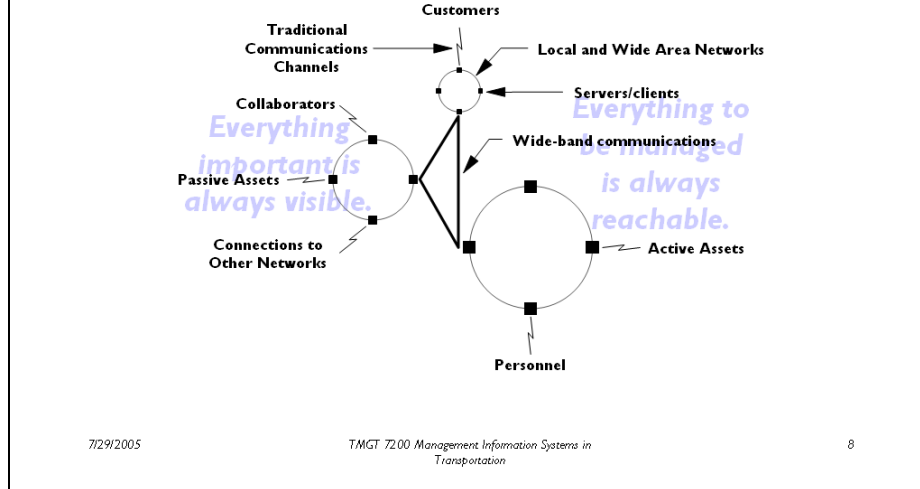


Figure 4 Communications Networks

These sensors become part of the technology structure by connecting through a communications network. The person may connect through a cellphone; the sensor may connect through a GPS circuit.



The following figure, from “The Future,”¹² is indicative of this connection (see the **Interface** towards the bottom of the figure).

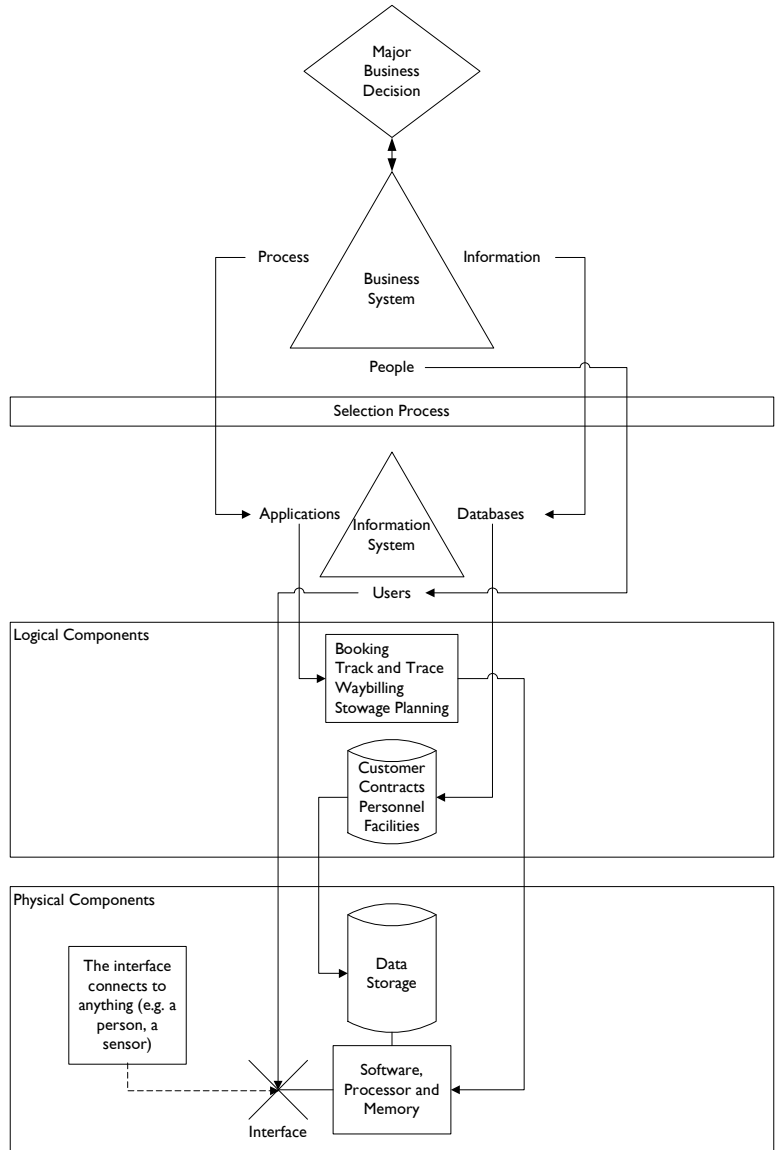


Figure 5 Technology Components and Relationships

Associated with the interface are other components. In this case there is data storage, software, a processor and associated memory. In the case of a cellphone, data storage is equivalent to the SIM card; the cellphone itself contains the equivalent of software, a processor and associated memory.

At times the physical components are collectively called a node (the small black squares in Figure 4 Communications Networks on page 5).

¹² James Drogan, *The Future*, 2007, <http://jmsdrgn.squarespace.com/storage/14.%20The%20Future.pdf>, [October 13, 2007]

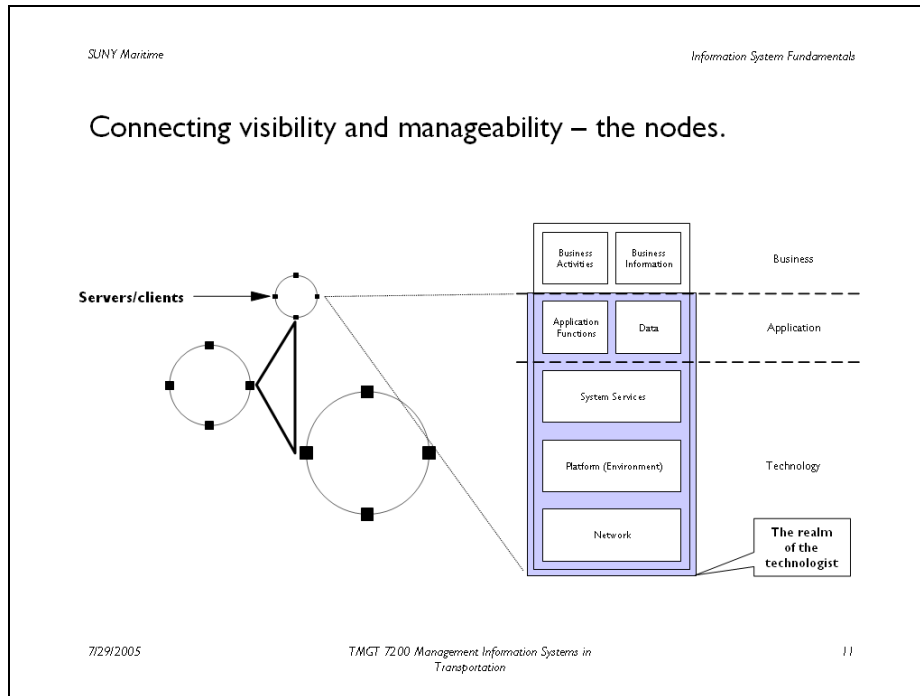


Figure 6 The Nodes

The nodes are usually further disaggregated in a manner more or less similar to that shown immediately above.

The summation of all this is that there can be a significant number of components in an information system interconnected via significant number of communications links.

For example, UPS "...is providing the lightweight and long-lasting devices to more than 11,600 UPS and Lynx drivers throughout the UK and Europe and a further 30,000 globally."¹³

Some reasonable assumptions regarding the number of additional components required to support the total of 41,600 devices leads one to the conclusion that the technology infrastructure can be very large and very complex.

I had once heard (sorry I can't remember the source) that the more complex the system the less we know about it. I'm of the opinion that the more complex the system, the greater likelihood of failure of a component or components and the less likely it is that we can understand the associated risk and impact of these failures.¹⁴

We need, then, to focus on a number of issues in dealing with the failure of technology:

1. What does the technology structure look like?
2. What is the likelihood of failure of a component or groups of components? What is the nature of the impact?
3. What is our process for managing fallback, degraded operations, and recovery?

¹³ Dave Friedlos, "UPS delivers handheld devices to staff," [computing.co.uk](http://www.computing.co.uk/computing/news/2160581/ups-delivers-hand-held-devices), <http://www.computing.co.uk/computing/news/2160581/ups-delivers-hand-held-devices> [November 27, 2008]

¹⁴ There is an entire field of study called Complex Systems Theory. See http://en.wikipedia.org/wiki/Complex_system for additional information.

4. How do we design resistance and resiliency into the system in order to minimize the probability of failure and impact?¹⁵

The failure of technology can lead to disruption of the business. However, we should not be satisfied with resolving only the technology issue.

Business Continuity

Technology is but a portion of the business system of an organization.¹⁶

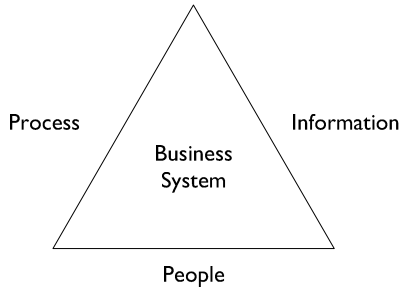


Figure 7 The Business System

What portion is not clear. I suspect that it varies by function and planning and control level.

Examples of broad categories of functions include:

Accounting and Finance
Administration
Executive
Intermodal
Maintenance and Engineering
Marketing
Sales
Transportation

Table 1 Categories of Functions

¹⁵ See Yossi Sheffi, The Resilient Enterprise : Overcoming Vulnerability for Competitive Advantage (The MIT Press, 2005) 0-262-19537-2 and Karl E. Weick and Kathleen M. Sutcliffe, Managing the Unexpected: Assuring High Performance in an Age of Complexity (San Francisco: John Wiley & Sons, 2001) 0-7879-5627-9 for further examination of the notion of resiliency.

¹⁶ Refer back to Figure 5 Technology Components and Relationships on page 6

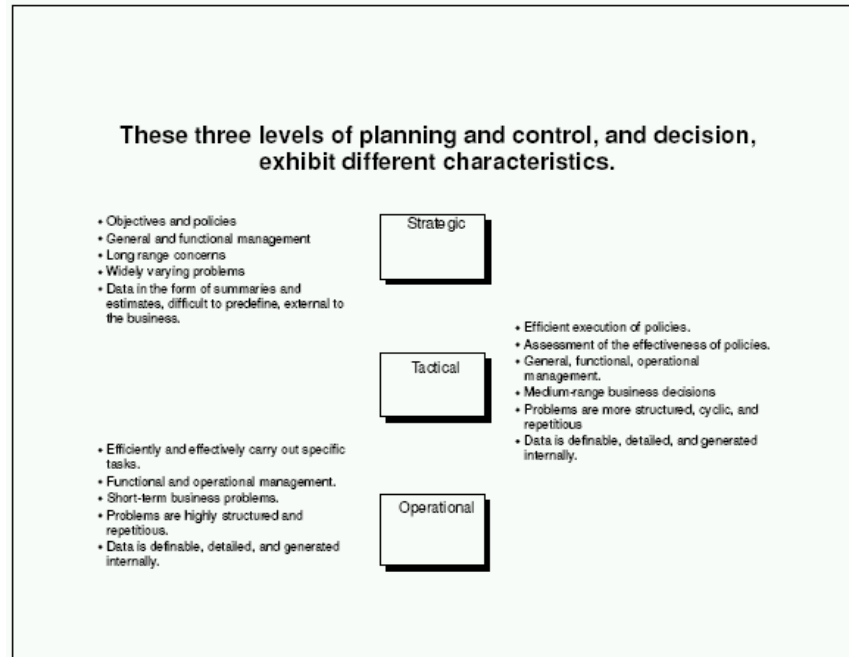


Figure 8 Three Levels of Planning and Control

A little bit of thought about roles, responsibilities, and business decisions that take place within the intersection of processes, and planning and control levels would lead us to the conclusion that some of the roles, responsibilities, and business decisions are more amenable to the injection of technology than others.

For example, technology is most often viewed as a substitute for labor. Hence, those functions containing a significant labor component are the most likely candidates for an injection of technology. This technology is most often applied at the operational planning and control level.

However, it's not the intersection of the functions, and planning and control level implied in the above paragraph that represent the most critical aspects of an organization.

Consider the following:¹⁷

Bruno's Inc., 1991. A corporate jet taking executives on a 1991 Christmas good-will tour of Bruno's Inc, a grocery store chain from Rome, Georgia, crashed into Lavendar Mountain, killing the seven passengers and two crew members on board. Killed were Bruno's chairman, the vice chairman, and three company vice presidents. Bruno's Inc., which operates more than 240 stores in Alabama, Georgia, Florida, Tennessee, Mississippi, and South Carolina. (**Author Note:** Hearsay: When I was giving this case example during my presentation at an MIS Symposium in November 1998, an attendee told the class that Bruno's went out of business within two years of the crash.)

Figure 9 Bruno's

The failure of technology is not the only thing that brings an organization to its knees nor may it be the most important thing.

¹⁷ Devlin, Edward S. Crisis Management Planning and Execution. CRC Press, 2006.

This raises the larger issue of business continuity; those things a company does to assure its continued operation in the face of disturbances. These things are inclusive of dealing with the failure of technology.

The connection between business continuity and technology is in understanding how technology can facilitate the implementation of a business continuity strategy. For example, implementing a decision support mechanism to assure that no more than a certain number of key executives are booked onto the same flight.

This, of course, adds to the complexity of the technology structure, further complicating the matter of dealing with its failure.

There is a rich information set on the subject of business continuity that merits further examination.¹⁸

The Human Component

In “Managing the Business”¹⁹ I contended that:

“Perhaps the largest difference in the emergent business systems will be in the people. The advances in technology have tended to move the line demarking that portion of the business system that is performed by technology (e.g., an ATM) from the left to the right in the following figure. Labor has been displaced by technology.

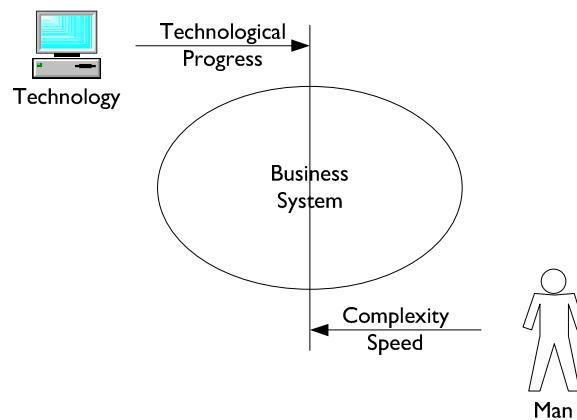


Figure 10 Symbiotic Systems

Technology works best when the rules are known and they can be codified (i.e., made into a program). I've been arguing, however, that increasing speed and complexity is making it increasingly difficult to know the rules, on the one hand, and codify them, on the other. That is to say, because of the changing nature of the future issues to be resolved, the line marking the division between man and machine in symbiotic systems²⁰ may be pushed to the left.

¹⁸ Your attention is called to the following books I consider highly relevant to this subject. Ray Kurzweil, [The Age of Spiritual Machines: When Computers Exceed Human Intelligence](#) (Penguin Books, 2000) 0-140-28202-5 and James Martin, [The Meaning of the 21st Century: A Vital Blueprint for Ensuring Our Future](#) (Riverhead Books, 2006) 1-57322-323-9.

¹⁹ James Drogan, [Managing the Business](#), 2007, Paper, SUNY Maritime College, <http://jmsdrngn.squarespace.com/storage/Managing%20the%20Business.pdf>, [February 19, 2008]

²⁰ Symbiotic systems are those that are architected in such a way that maximum advantage is made of the strengths of technology and the strengths of the person. These are represented most prolifically by the phrase “symbiotic decision support systems,” a subject first introduced to me years ago by the late Marvin Manheim (http://en.wikipedia.org/wiki/Marvin_Manheim) of MIT, then Northwestern.

The implication here is that technology can take you only so far.²¹ To get beyond the management frontier requires symbiotic systems of a different composition.”

The human component is the critical component in the business.

“**Living National Treasure** (人間国宝, *Ningen Kokuhō*) is a title awarded in [Japan](#) to certain masters of crafts such as [woodblock printing](#) ([ukiyo-e](#)), [papermaking](#), swordsmithing and [pottery](#), and to masters of performance traditions such as [bunraku](#), [kabuki](#), and various [matsuri](#) (festival) performance traditions, with the aim of preserving skills and techniques in danger of being lost.”²²

I contend that organizations have the equivalent of Japanese Living National Treasures; people whose knowledge, skills, and experiences, if lost, would constitute a danger to the organization. People play a critical role in technology and the broader business in which technology exists. As such, then, they merit important consideration in this discussion.

Conclusion

I have argued that there is a growing, virtually inseparable relationship, between technology and the human and, by extension, between technology and the organization.

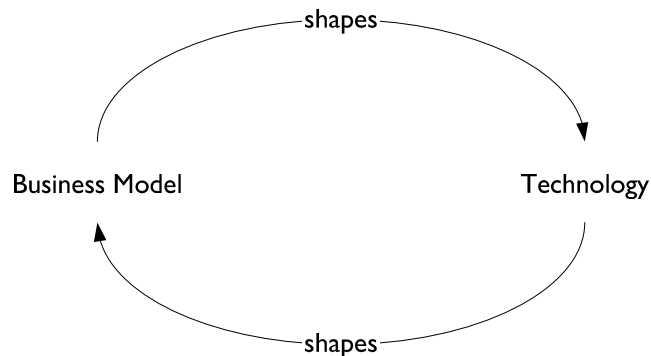


Figure 11 Business Model and Technology

There was a time when I thought the business model shaped technology. In large measure, chiefly because of the difficulty of adapting technology to the business, the expense (financial and time), and limited availability of the necessary skills, this was largely true. That is, I did not believe the phrase “technology-driven business.”

I no longer believe that to be true. Today, technology increasingly shapes the business model in the sense that it provides an opportunity to develop business configurations²³ that would otherwise be impractical. Arguably, as a result, businesses have become increasingly complex, pervasive, and critical. It then follows that the risks and impacts of failure of key components of the business have also risen.

This then puts a premium on understanding what one needs to do to provide business continuity.

James Drogan
December 4, 2008

²¹ See Drogan, [Managing the Business](#)]

²² Wikipedia, “Living National Treasures,” [http://en.wikipedia.org/wiki/Living_National_Treasure_\(Japan\)](http://en.wikipedia.org/wiki/Living_National_Treasure_(Japan)) [November 28, 2008]

²³ See Drogan, James. “A Note on Business Drivers, Business Configuration, and Information Technology Strategy”. 2005 and Drogan, James. “Thinking About the Business Configuration”. 2007 for more on the business configuration.

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