9. Information Technology

Introduction

The business management system (covered in 8. Management System) determines the deployment of information technology.

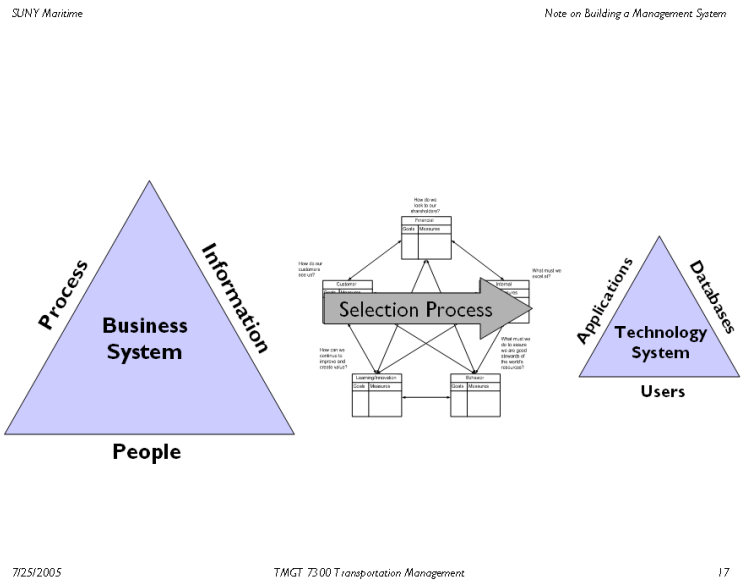

Figure 1 Automation Selection Process[1]

Figure 1 depicts, in a very general way, the process that selects portions of the business system to be enabled by technology. TMGT 7200 MIS in Transportation takes up the issues of technology in considerably more detail.

This note discusses the issues associated with management information systems and technology.[2]

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[1] James Drogan, "8. Management System," 2007.

[2] This note calls heavily on James Drogan, "11. Information Management and Technology," 2006.

The Changing Environment

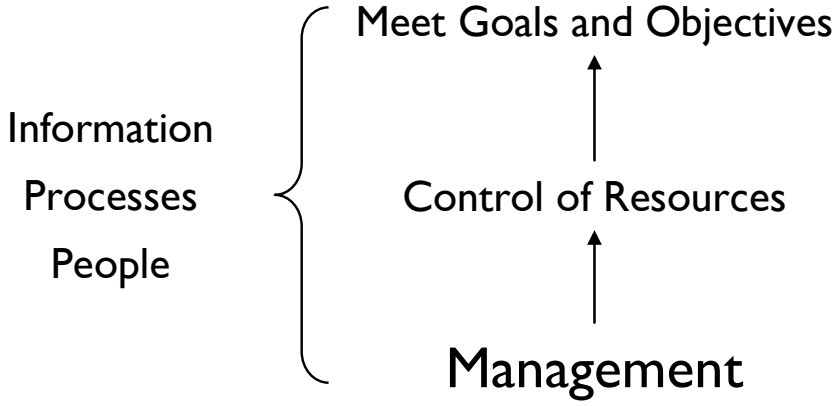

Figure 2 The Purpose of Management[3]

Tasks assigned by management are carried out by people, processes, and information. These are the manifestation of all the components of a business. That is, the values, vision, etc. of the business configuration are made real by the business system.[4] The implication here is that a business system that is fundamentally poor is likely not to be much improved by the introduction of technology.

Deployment of technology rests on four fundamental principles.

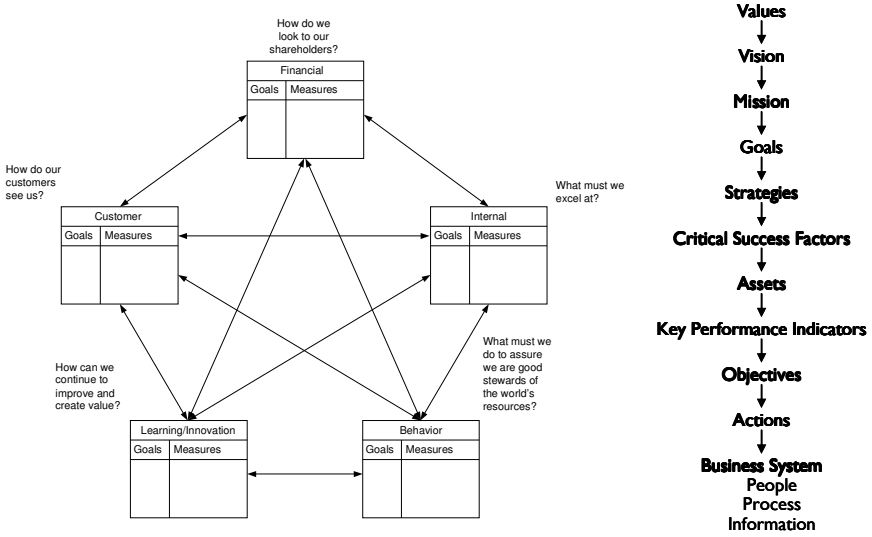

Figure 3 First Principle

First, the only legitimate use of information technology is to improve the performance of the enterprise.

This suggests the existence of:

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[3] James Drogan, "1. Introduction to the Course and to Transportation Management," 2007.

[4] James Drogan, A Note on Business Drivers, Business Configuration, and Information Technology Strategy, July 19, 2005 2005, SUNY Maritime, http://jmsdrgn.squarespace.com/storage/A%20Note%20on%20Business%20Drivers%20Business%20Configuration%20and%20Information%20Technology%20Strategy.pdf].

1. An agreed way to measure the performance of the enterprise. This is represented on the left side of Figure 3 by the Augmented Balanced Scorecard.[5]
2. An understanding of how the business works and why it works that way. This is represented on the right side of Figure 3 by the Business Configuration.

The world is complex and rapidly changing, "permanent whitewater" if you will.

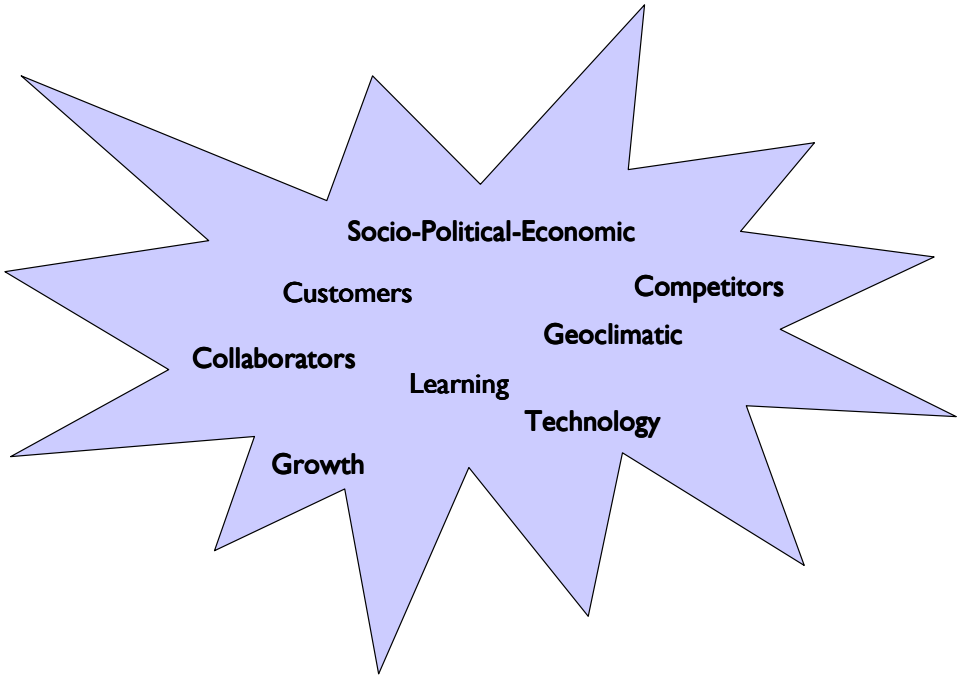

Figure 4 Speed, Complexity, and Uncertainty of Change

The lecture note "1. Introduction to the Course and to Transportation Management" brought into play the notion of business drivers.[6] Changes in these drivers, sometimes very significant and sometimes unexpected, are occur within a three dimensional space.

[5] The Augmented Balanced Scorecard is adapted from Robert S. Kaplan and David P. Norton, "The Balanced Scorecard - Measures That Drive Performance," Harvard Business Review January-February 1992 (1992).

[6] For further detail on business drivers see Drogan, A Note on Business Drivers, Business Configuration, and Information Technology Strategy].

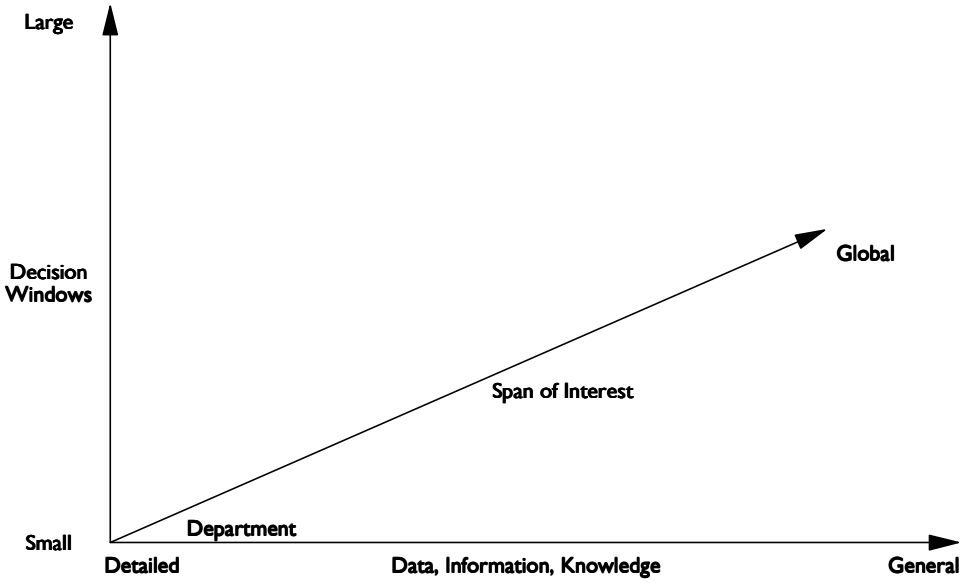

Figure 5 Context for Decisions

Data, Information, Knowledge: The advent of the internet and the growing sophistication of technology and the systems employing technology has led to dramatic growth in the available of information from the very detailed to the very general. The issue here is seizing on that data, information, and knowledge in order to make decisions before the decision window closes.

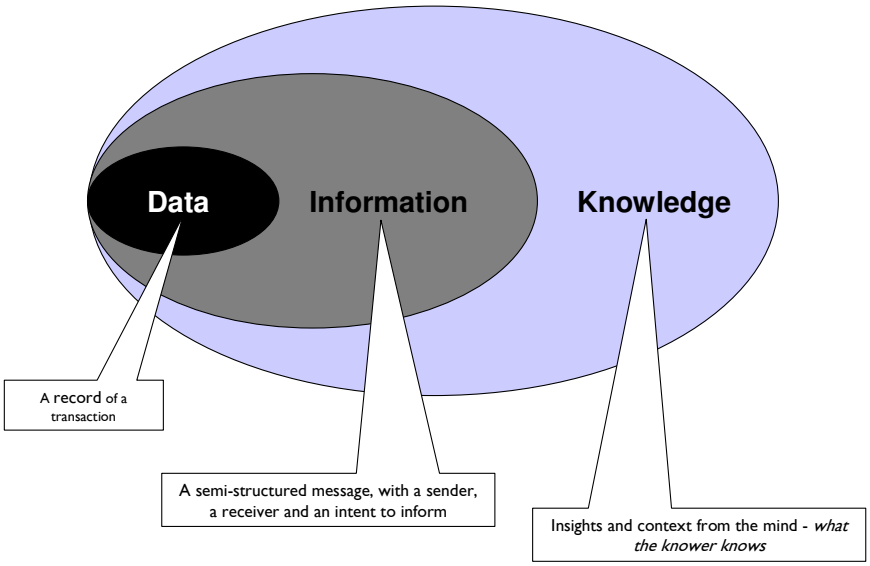

Figure 6 Data, Information, Knowledge

Decision Windows: The time available to make a decision continues to grow smaller.

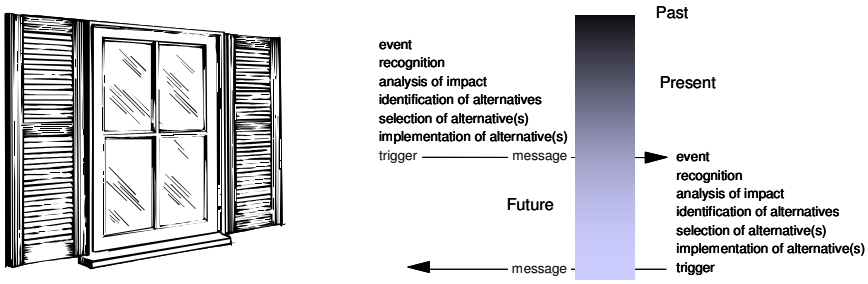

Figure 7 Decision Window

> 'Our mission is to use our knowledge of supply chain management and information technology to help companies achieve their business goals. In these past few months, we find that the definitions of short, medium and long term now mean something completely different:
>
> Short term used to mean within the next six months. It now means "next Monday."
>
> Medium term used to mean six months to a year. It now means "after next Monday."
>
> Long term used to mean two to five years out. It now means "over the next six months.'"[7]

Span of Interest: This span now reaches a global level. We can no longer be content with being interested in what is immediately in front of us.

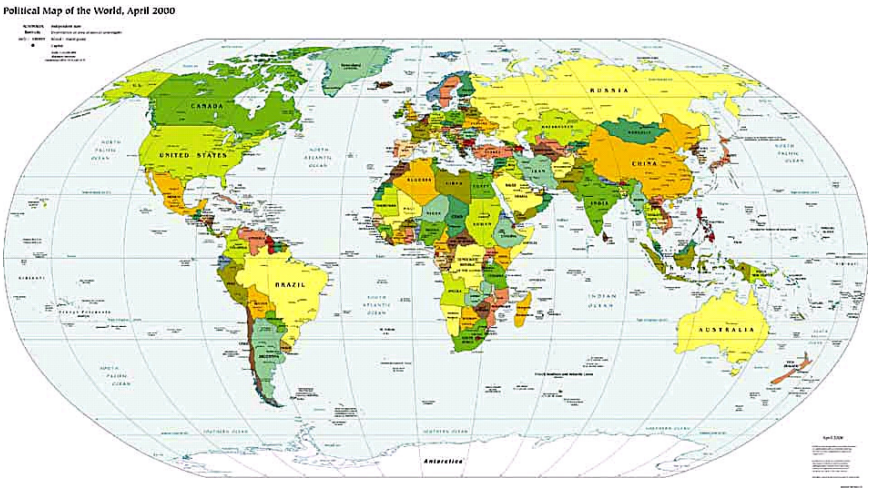

Figure 8 Span of Interest[8]

The space in which we need to be able to competently operate is much larger than it was before the advent of deregulation of transportation in the late 1970s and the coming of the internet in the mid 1990s.

> "Patrick gathered a small group of his Get Connected renegades, including Grossman, at his vacation house, set deep in the woods of western Pennsylvania, There they cobbled together a mock-up of an IBM home page. The next step was to get through to Gerstner's personal technology adviser, who agreed to make him available for a demo of the prospective IBM corporate Web site. When Gerstner saw the mock-up, his first question was, "Where's the buy button?" Gerstner wasn't a quick study-he was an instant study. But Grossman and Patrick knew

---

[7] Establish/Herbert W. Davis Company

[8] Source: http://www.hawaii.edu/powerkills/WF1.WORLD.JPG [March 2, 2007]

that an intrigued CEO wasn't enough. There were thousands of others who still needed to get the Internet religion."[9]

Gerstner was not the only key executive in the mid-1990s to sense the promise of the internet.

Speed, complexity, and uncertainty drive the need for the ability of the enterprise to adapt to change as a critical success factor.

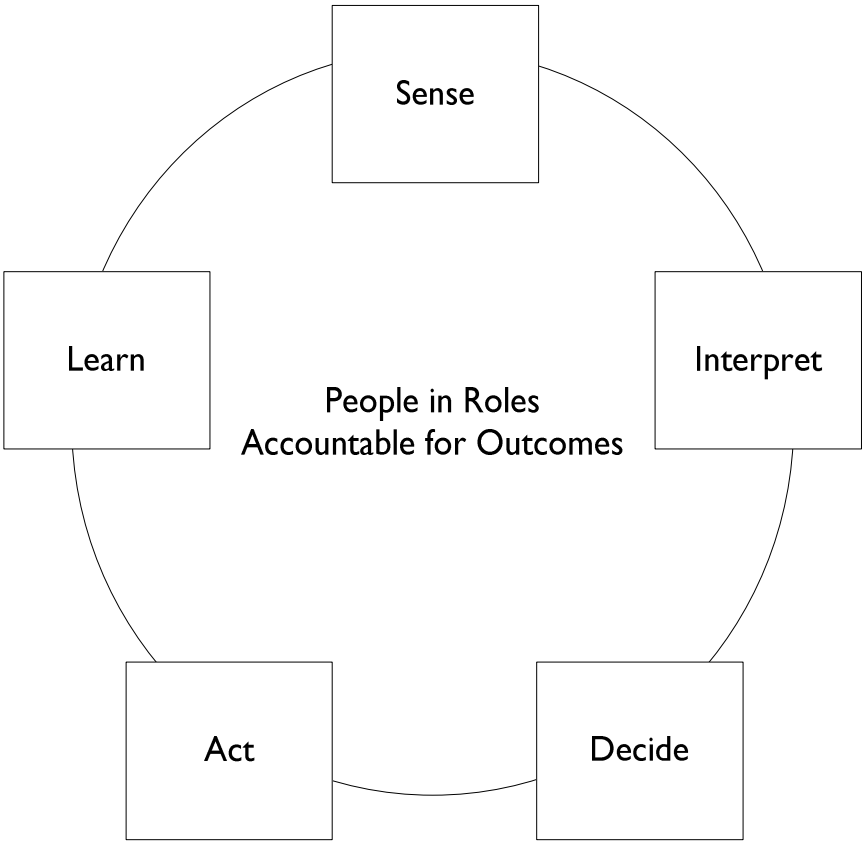

Figure 9 SIDAL Loop[10]

This suggests that the loops (e.g., Figure 9) will need to become smaller, more response, more comprehensive. Information technology will play a critical role in these hyper-efficient business loops.

I have so far been describing an environment that sets the requirements for information technology. Within this environment, two important goals are emerging.

1. Everything important is always visible. For example:
    a. Inventory
    b. Resources
    c. Commitments
    d. Customers
    e. Collaborators

---

[9] http://patrickweb.com/inthenews/stories/wakeup.html [March 2, 2007] This is based on Gary Hamel, "Waking up Ibm: How a Gang of Unlikely Rebels Transformed Big Blue," HBR On Point (2001).

[10] Adapted from Stephan H. Haeckel and Adrian J. Slywotzky, Adaptive Enterprise: Creating and Leading Sense-and-Respond Organizations (Harvard Business School Press, 1999).

f. Competitors

g. Socio-Economic-Political Factors

h. Laws and Regulations

i. Culture

j. Weather

2. Everything to be managed is always reachable. For example:

a. Inventory

b. Resources

c. Commitments

d. Customers

e. Collaborators

These lists are meant to only be representative.

This then brings me to the remaining three Principles:

2. Information systems are inextricably intertwined with the mission, objectives and structure of the enterprise.
3. Disciplined approaches to applying information systems are critical to success.
4. Information systems are technology plus process plus tools plus skills plus culture.

Now the First Principle says the only legitimate use of information technology is to improve the performance of the enterprise. Lambert, Lewis, and Stock determined that

> "The primary difference between world class organizations and those viewed as average is that world class firms allocate scarce resources to those things considered most important by their customers rather than dissipating resources on those things viewed by customers to be relatively unimportant."[11]

Hence, the final point I will make in this section is one of paying attention to the customer. Knowing the buying behavior of the customer (touched on in 2. Transportation Basics[12] and in 7. Logistics[13]) is critical to being a successful transportation provider.

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[11] Douglas M. Lambert, W. Christine Lewis, James R. Stock, "How Shippers Select and Evaluate General Commodities LTL Motor Carriers" (1991).

[12] James Drogan, "2. Transportation Basics," 2007.

[13] James Drogan, "7. Logistics," 2007.

Some Relevant Technologies

In this section I present and discuss some technologies relevant to transportation.

Global Positioning Systems

Precise positioning in the four dimensions.

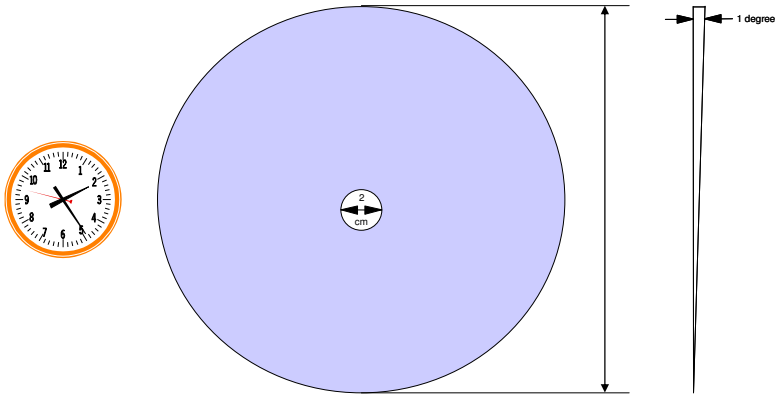
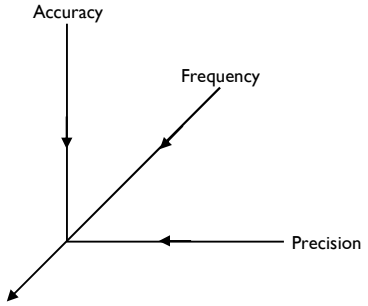


Figure 10 GPS Positioning

The precise positioning provided by GPS allows one to know the location of items that are important. By making multiple measurements, of course, one knows how these assets are moving through the transportation network.

So what?



Does the increasing "fineness" of measure lead to business decisions of value?
What sort of decision support systems are required?

Figure 11 Accuracy, Frequency, and Position

We need to be confident that the technology we select and the data it provides can deliver value to the organization. Simply because we can get more faster it doesn't necessarily follow that we can produce better decisions. I recall to your attention Figure 2 in 8. Management System and its accompanying narrative for caution on this matter.

Sophisticated, very responsive decision support systems are often required to extract value from data that is more precise, accurate and frequently collected. These may or not being within reach of the enterprise.

Vertical Integration of Systems

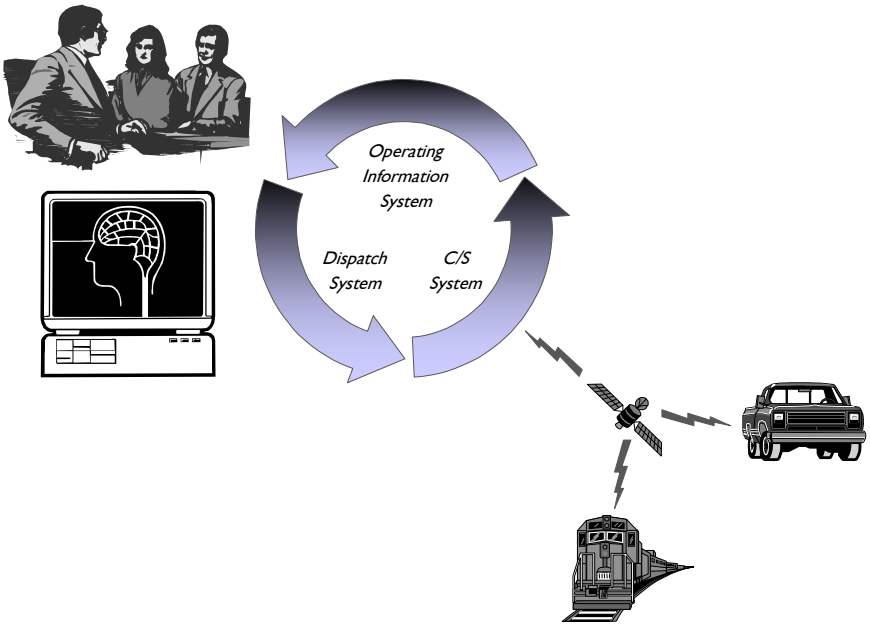


Figure 12 Vertical Integration of Railway Information Systems

Technology – here I mean hardware, software, standards, and technique – provides an opportunity to integrate systems, to provide smaller, more responsive, more comprehensive SIDAL loops (see Figure 9 SIDAL Loop on page 6) to better cope with the smaller decision windows.

In the railroad industry the communications and signal system interfaces with the track structure, the dispatch system manages the network and the equipment moving thereon, and the operating information system provides the tactical and operational planning and execution support. With vertical integration data and information are easily passed between these three systems.

This integration coupled with GPS allows for the railroad to achieve higher levels of customer service and greater utilization of its assets.

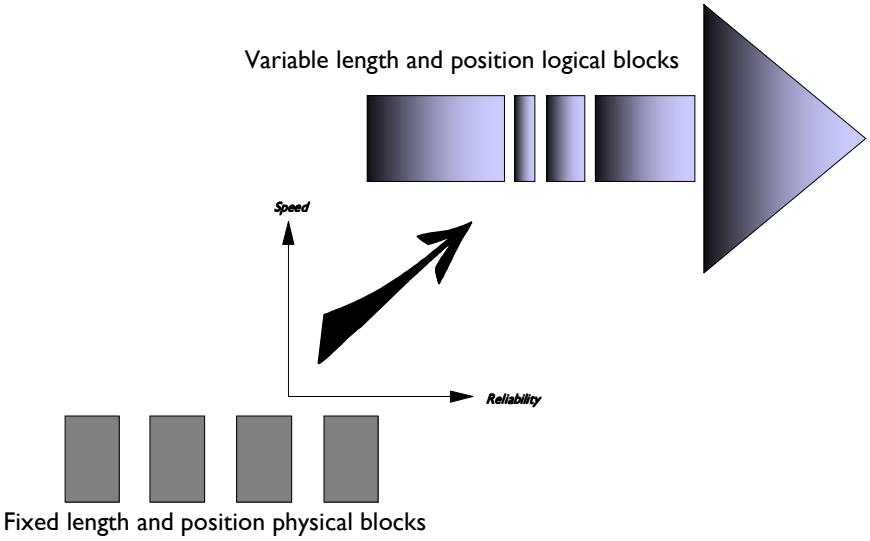


Figure 13 Changes in Railroad Blocking Strategy

So what?

"A one mile per hour increase in network velocity is valued at $105M annually."[14]

Technology deemed essential to meeting this objective includes:

- Technology at the wayside to provide geographic location, speed restrictions and grade changes.
- Wireless data communications, differential GPS, computers, displays in the locomotive.[15]

As you might expect, and as with almost any use of technology, there are associated issues:

- Definitions, rules, standards, interoperability, implementation
- On-board versus wayside track databases
- Decisions
- Business cases

Technologies like these are motivating a new look at railway operations that focuses on delivering on commitments to the customers.

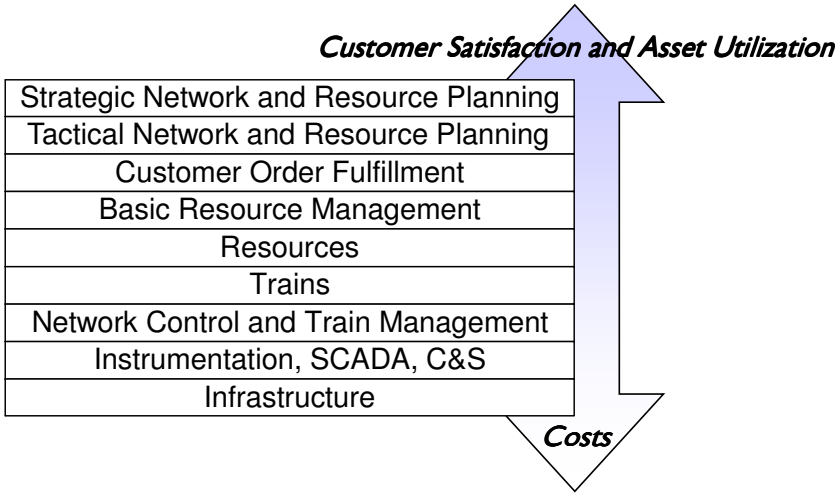


Figure 14 A Holistic View of Railway Operations[16]

Key to obtaining the potential value is a holistic view of how all the elements of the business fit together.

[14] Jeff Young, Union Pacific, April 30, 1997

[15] Progressive Railroading Magazine , "A Controlling Interest in Interoperability," April 1998

[16] SCADA; Supervisory Control and Data Acquisition. C&S; Communications and Signals.

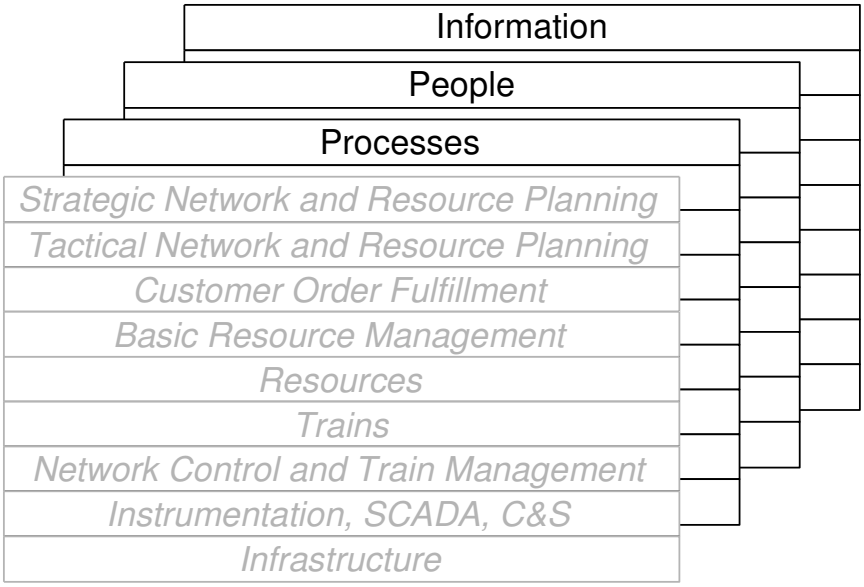


Figure 15 Adding to the Holistic View

In Figure 15 we include those key components of the management system.

Tagged, On, and Connected

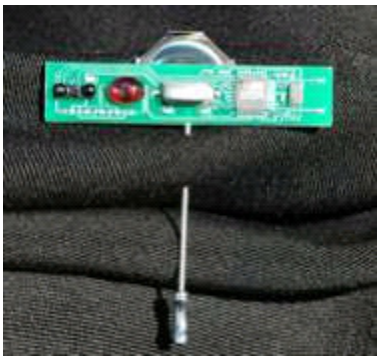


Figure 16 Infrared Stickpin

> 'One-thousand infrared-enabled stickpins were distributed to attendees. The pins "remembered" the unique identifier of every other pin that comes into range. When the wearer walked past a central display, his or her data was downloaded into a PC that generated a visualization of the entire network.'[17]

It's not so much that these stickpins are enabled by infrared. After all, it's a communications technology and there are other communications technologies. It's the intelligence associated with the stickpins that is intriguing. Suppose, for example, that all containers have a device like this and communicated with each other and a central point. Would that allow us to make decisions that would improve performance?

[17] BoingBoing 9/8/2004

Everything Important is Always Visible

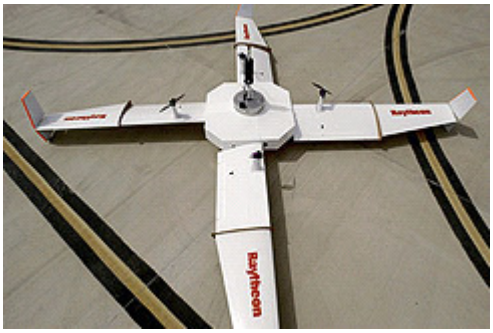


Figure 17 Whirl

> "Prototype of the 'Whirl,' an unmanned spy plane designed by Raytheon engineers to hover for days at high altitudes."[18]

When we earlier discussed the idea that everything important is always visible, the implication was it was visible electronically (e.g., a blip on a radar scope). The Whirl makes it possible to visually see what is going on below. Does this allow one to make better transportation decisions in the face, say, of metropolitan congestion?

[18] WSJ 9/8/2004

Manipulation of Reality

Figure 18 Rising Sun

The movie Rising Sun (1993) gave new meaning to the phrase "digitally remastered." Also see The Manchurian Candidate (2004) for another example of manipulation by means of technology. Technology is increasingly pervasive and manipulative (e.g., Photoshop). What are the steps required to protect ourselves and our businesses from this manipulation?

Autonomous Machines

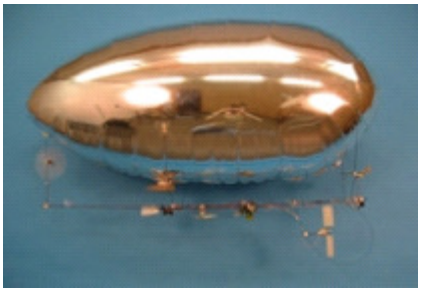


Figure 19 Autonomous Blimp

> 'A small robotic blimp floats gently through the Autonomous Systems Laboratory at the Swiss Federal Institute of Technology, wirelessly interacting with a desktop computer to literally evolve its own navigation software without human intervention. What the blimp sees via its onboard

sensors is Bluetoothed to the PC for processing. The artificially evolved "brains" are then transmitted back to the mylar blimp so it can intelligently fly through its environment, improving with each run....'[19]

The sorts of technology and technique that leads to the machine in Figure 19 could, perhaps, be used to improve the operations of equipment in a terminal.

Or, perhaps someday one will simply put an autonomous container into the global transportation system and it will find its own, most efficient way to the consignee.

Tags

Figure 20 E-Z Pass

E-Z Pass is perhaps the most well-known example of the use of Radio Frequency Identification (RFID) tags. RFID tags come in all sorts of shapes and sizes for all sorts of uses. Imagine if there was a standard that would apply to all containers, chassis, trucks, and trailers.

Figure 21 Honey Bee with Attached RFID

[19] BoingBoing 9/2/2004

If one can track a honey bee, is there anything that one can't track?

Perhaps Technology Isn't Enough

Some time ago I had published an article in Traffic World on a new business model for the railways.[20] While the article was but a page long (in the TW Commentary section, the last page of the magazine) it was based on a considerable amount of experience and thinking about what the railways should do.

The thesis was that technology was not enough, that the railways needed a new business model. This section calls heavily on the background material for that article.

The Future Business Model

The central thesis here is that the Future Business Model represents a clear understanding of what shapes the views of its constituencies and tunes innovations to evoke the desired response from these constituencies. There are a number of values and attendant implications underlying this thesis.

- The Future Business Model represents a clear understanding of what shapes the views of its constituencies; tunes the innovations to evoke the desired response.
- The customer linkage is enabled and streamlined through a One-Click Shipping concept.
  - This implies short process cycles esp. for the design and proposal of service offerings.
- Customer value is dominant in transportation planning and execution decisions.
  - Service management and operations management are linked through customer value.
- The customers and collaborative service providers are managed as a portfolio of value.
  - This implies a method of valuing customers and collaborators.
- Customer service matures into customer success.
  - The implies that the railway thinks in terms of how successful it has made its customers, not how successful it has been made by its customers.

Figure 22 Values and Implications

The Future Business Model comprises five fundamental business processes and relationships with two key external parties.[21]

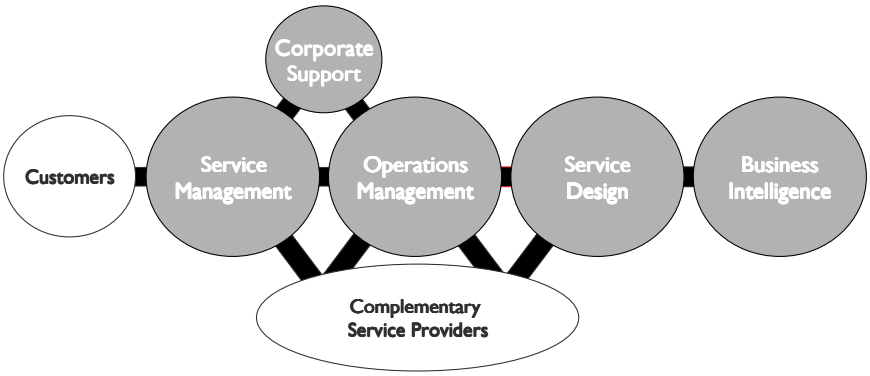


Figure 23 The Future Business Model

[20] James Drogan, "A New Business Model for Rail," Traffic World Magazine February 5, 2001.

[21] This structure emerged from an information technology and strategic planning engagement performed for an Australasian railway in 1998.

Overarching everything was the vision of being able to move at will in the marketplace.

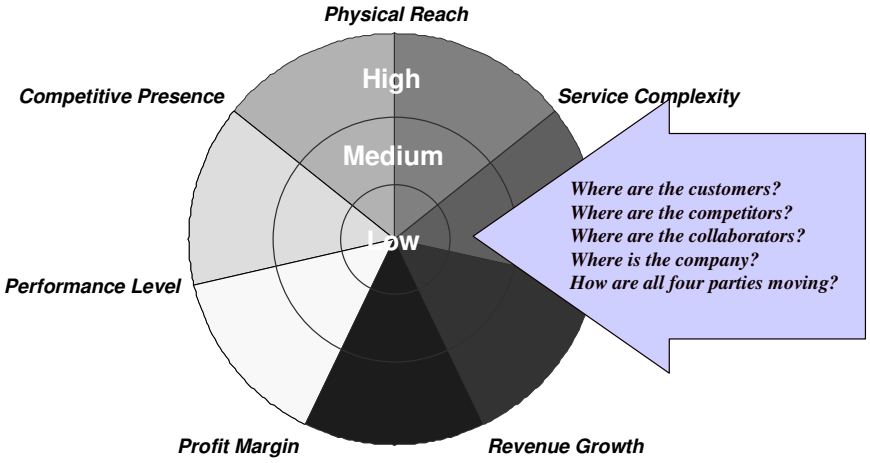
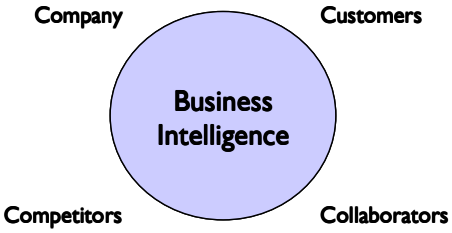


Figure 24 Vision

This mean that the market not only had to be definable, but that one needed to know the current position of the players in the marketplace, and have some notion as to how they might move.

This then led to the idea that moving at will is about knowing what you need to know when you need to know it in order to take a market position of maximum advantage. This suggested a more formal approach to gathering and analyzing business intelligence.



- Cost - price *(an internal focus)*
- Scope - offering
- Speed - ability to change *(an external focus)*

Figure 25 Business Intelligence

It was thought that the basis for competition should, over time, change from cost to scope to speed. By speed we don't mean the speed of the trains, but the speed with which the railway could adapt to new threats and opportunities.

Business intelligence was considered to be about a deeper understanding of value chains and the actions the railway might take to change the configuration of the value chain and the parties' participation therein.

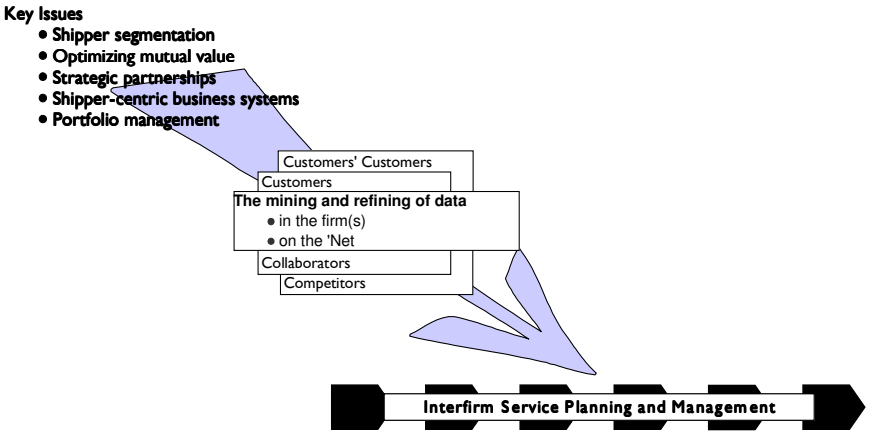
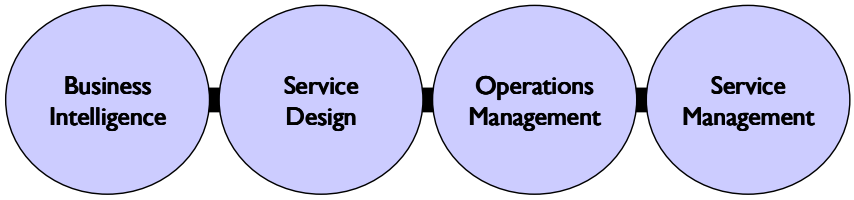


Figure 26 Changing the Value Chain

This, of course, implied knowledge as to how the parties affiliated with the railway did their business. What, for example, can the railway do to help its customer help, in turn, its customer? This was not, at the time, an accepted point of view in the railway industry.

It was recognized that business intelligence is of value when associated with complementary mechanisms that implement and measure change.



Competitive advantage comes from implementing management initiatives faster than the competition.

Figure 27 Mutual Dependencies

It was recognized that any investment in business intelligence was likely not to return, of its own account, any value. The output of business intelligence had to enable better service design which, in turn, needed to inform operations management and that would lead to better service management from the customer point of view. And reading right to left, there were also dependencies for what could be done in a particular area were only as good as the information being feed to that area.

In other words, there were no stand-alone operations; there were not multiple agendas.

This model envisioned that at the end of the interconnected business processes would be a mechanism that made it very easy, even delightful, to deal with the railway. Amazon showed the way here.

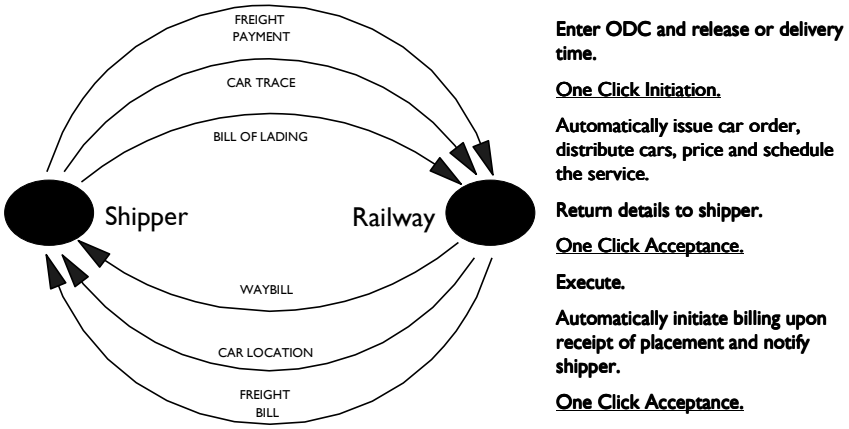


Figure 28 Railway One Click

The implications of the Future Business Model were significant.

Information technology needed to...

> provide easy access anywhere and anytime to people, processes, and information -- the promise is lower interaction costs and faster decisions
>
> > which meant
>
> that companies were opened to scrutiny in a new fashion -- access and speed rapidly reveal bottlenecks in organizations
>
> > which meant
>
> that organizations were tuning up, or more frequently transforming their existing business operations
>
> > which meant
>
> more speed
>
> > which meant
>
> implementation of management initiatives faster than the competition
>
> > which meant
>
> a less predictable future.

We concluded, therefore, that…

> existing forms of organizational structure, skills, processes (esp. such things as strategic planning and budget cycles), built on the premise of predictability could well prove a hindrance in the marketplace
>
> > which meant
>
> that an organization with the ability to sense key changes in the environment, and respond to these more quickly than the competition, may be in order;
>
> that information technology put a premium on establishing and managing relationships between organizations for mutual benefit; and
>
> that speed gives new meaning to switching costs.

Information technology, then, is least of all about technology and most of all about fundamental transformation in order to gain both speed and adaptability.

This transformation resonates through the whole of the organization.

The Future Business Model is enabled by an integration of capabilities that allows for economies of scale while providing for individual railway needs.

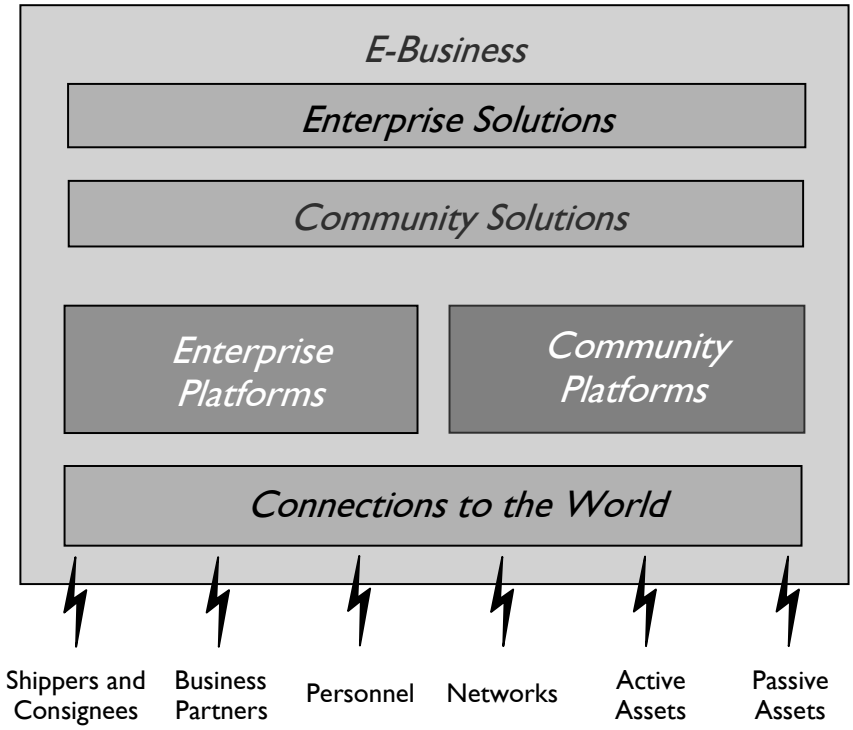


Figure 29 Solutions, Platforms, and Connections

The thinking here is that there are a number of functions common to businesses (e.g., payroll) that do not provide competitive advantage. These should be, therefore, community solutions running on community platforms to take advantage of economies of scale. Correspondingly, there were enterprise solutions that would run on enterprise platforms because the enterprise did not, for some reason such as competitive advantage, wish to share these solutions.

Fundamental to success will be a network allowing us to meet the two important goals mention on page 6.

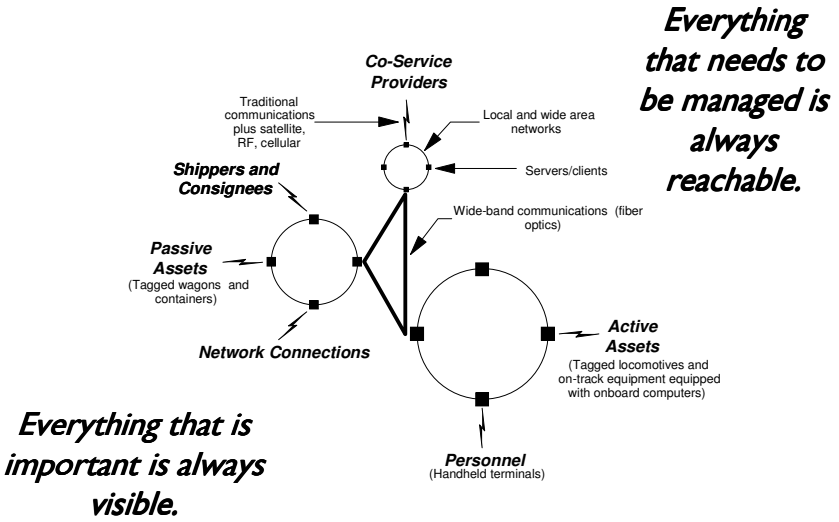


Figure 30 The Communications Network

Getting There

The Future Business Model is little more than an intellectual exercise unless it includes a plan for making the transformation.

Sketched out here is the associated plan for change.

Getting to where we wanted to go required establishing goals and executing strategies across three phases.

Goal	Strategies
Business and Technology establish a relationship of trust based upon common commitment, collaboration, and a sustained level of high performance. Together, Business and Technology pursue • Sustained performance at pre-merger levels. • Organizational stability.	Substantial, sustainable improvement in the price and performance of the infrastructure. Technology retains and reinvests the benefits. Governance that works - communication, collaboration, shared commitments to and management of initiatives. Development mechanism that provides for the rapid realization of management initiatives. Increase the amount of funding devoted to new product development.

Figure 31 Phase 1 – Renewal

Goal	Strategies
Discover and invent new ways for technology to deliver value to the business. Together, Business and Technology pursue • Significant and constant improvements in customer satisfaction. • Share of customer spending on transportation and logistics continually increases.	Continual increase in the amount of funding dedicated to new product development. Utilize cross-functional Business and Technology teams to discover, invent, realize, exploit, and enhance new products.

Figure 32 Phase 2 – Growth

Goal	Strategy
Define and implement a new business model for the corporation. Together, Business and Technology pursue becoming • First or second in share in markets the railway chooses to serve. • Distinguished from the competition by the superior quality of all elements of its service.	Establish a new business model team comprising the next generation of leadership.

Figure 33 Phase 3 – Leadership

We also reckoned that there were a number of goals that applied to all phases.

- Identify, and develop to a world-class level, those competencies that must be retained in order to assure competitive distinction.
- Outsource those competencies which, will required for operation, do not directly provide competitive distinction and which others can perform better.
- Establish a formal change management program across the organization.
- Establish the management of data/information/knowledge as a critical success factor for the corporation.
- Establish a culture where the dynamics of change are considered a competitive ally.
- Establish an adaptive enterprise to exploit the culture.

Summary

In the end,

> "Success takes a balance of forces, but technology is not always necessary and is almost never sufficient."[22]

As business men and women, we need to keep Scott-Morton's admonition in mind. However, we might tentatively advance the notion that in the almost seven years since Scott-Morton made his comment, the

[22] Michael Scott Morton, MIT, Inventing the Organization of the 21st Century Project, Co-Director, The MIT Report, December/January 2000, p. 5.

world has fundamentally changed. We might realistically question the middle part of his statement, but the beginning and end still stand as fundamental truths.

My personal view is that the most important thing to do is act. Speed trumps all!

Finally, let me add the following.

> "I believe that we're about to witness what may turn out to be the last competitive frontier business will see. It's going to be a war over the one priceless resource. Time. And when it comes, trust may turn out to be the best investment anyone's made."[23]

I don't think technology can engender the kind of trust Kelly is talking about. Trust is between individuals. Trust takes time. Time is the resource that is increasingly in short supply.

Remember the key questions.

James Drogan
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[23] Jim Kelly, CEO of UPS, Remarks to the Commonwealth Club of San Francisco & Oakland Chamber of Commerce, February 23, 2000.

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