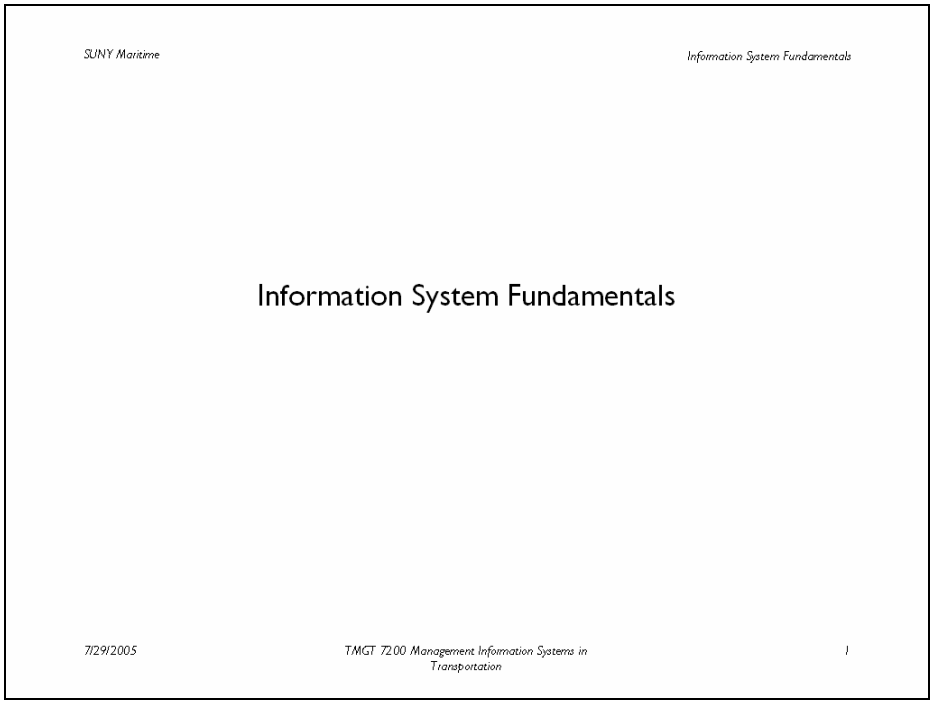
Maritime College
State University of New York

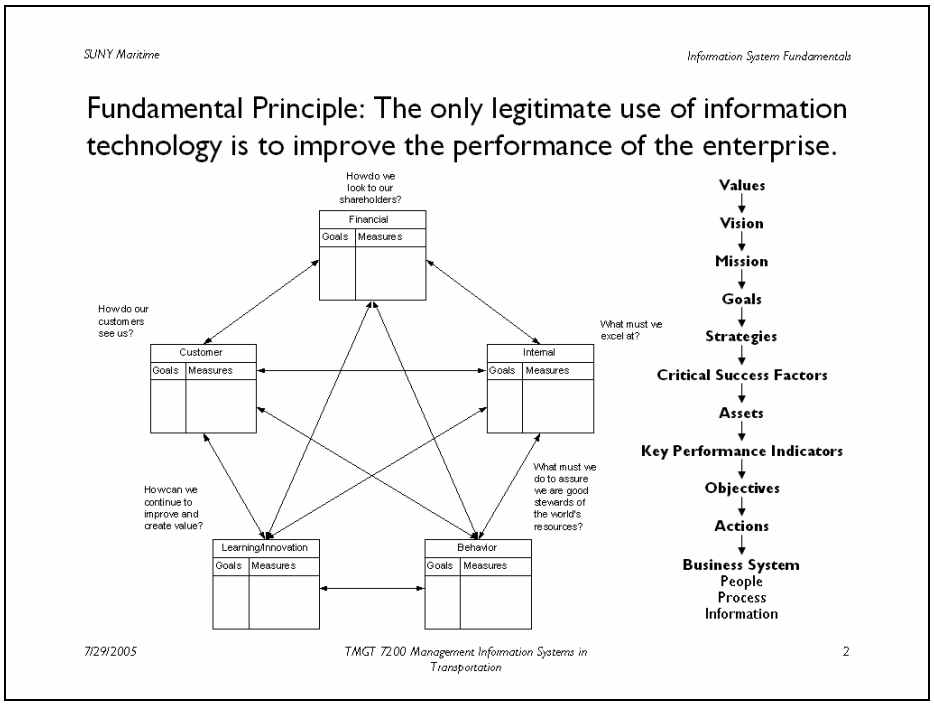
Department of Global Business and Transportation

Information System Fundamentals



This note takes up the issue of describing the fundamentals of an information system. In this context we mean a technology-enabled information system. That is, such things as computers and communications networks are essential elements of the information system.

We need, at the outset of this note, to review fundamental principles that shape information systems.



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

If the aim is to improve performance, then means of measuring performance needs to be put in place. The old business adage, "If you can't measure it you can't manage it." applies here.[1] In this case the means for measuring performance is an augmented balanced scorecard.[2] This is the pentagram shaped feature on the left of the picture above.

Performance improvement comes about because of change in the way a business works. That is, some component or element of the business configuration changes. This business configuration is represented by the vertical stack of words and phrases to the right of the above picture.[3]

One changes performance by changing the business configuration. The application of information technology has the potential for doing this.

If it is not clear how the investment in information technology may enable improved business performance, and if it is not clear how it will affect the business configuration, then, quite likely, the investment should not be made.

Information systems exist within enterprises. Enterprises exist within a business environment of sometimes astounding complexity, uncertainty, and speed of change.

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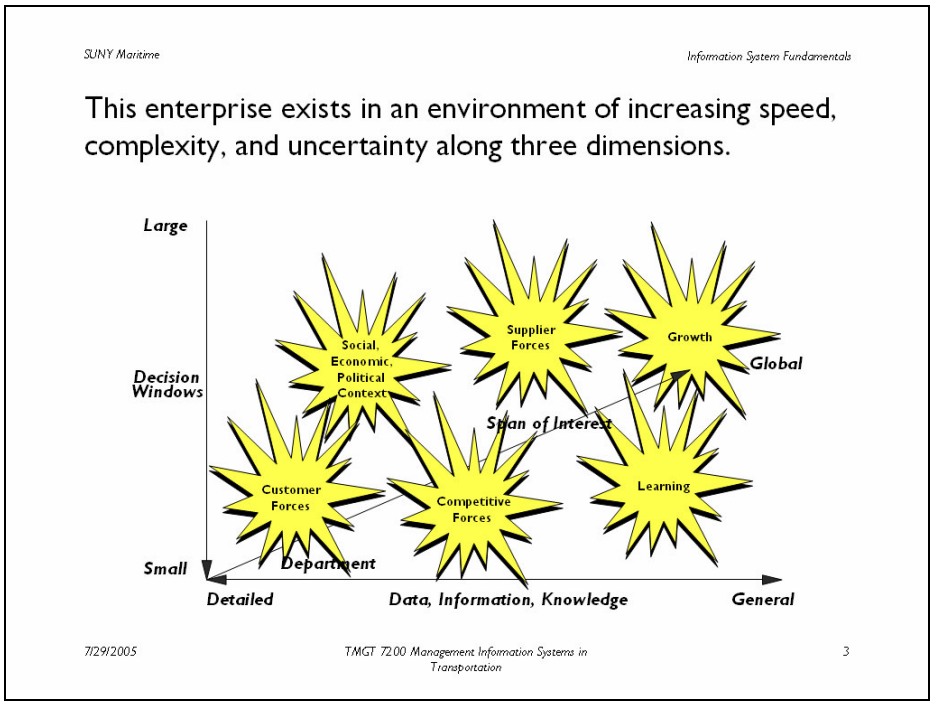
[1] There is a corollary to this. Just because one can measure something doesn't mean that one should. See J. Drogan, Note on Building a Management System, January 2005 for more on this.

[2] Adapted from Kaplan, R. S. and D. P. Norton (1992). "The Balanced Scorecard - Measures That Drive Performance." Harvard Business Review January-February 1992: 71-79.

[3] J. Drogan, Thinking About the Business Configuration, July 2005.



A three-dimensional space is represented in this diagram.

The x-axis represents the need for data, information, and knowledge across a spectrum from the detailed to the general.

The y-axis represents decision windows from small (i.e., a short time in which to make a decision) to large (i.e., a long time in which to make a decisions).

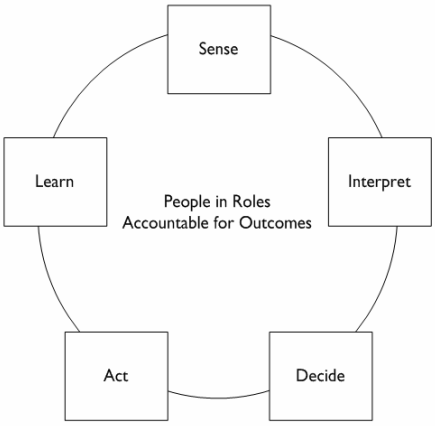
The z-axis represents the span of interest, from department to global, of the decision maker.

Changes, some unanticipated, in the fundamental business drivers[4] occur in this space. What this argues for is an information system that is robust (i.e., hard to damage) and adaptable.

If an enterprise continues to think what it has always thought, then it will get less and less of what it has always got. The enterprise must continue to adapt to the changing environment or it likely to land on the scrap heap. The information system must help this.

[4] J. Drogan, A Note on Business Drivers, Business Configuration, and Information Technology Strategy, July 2005

Speed, complexity, and uncertainty drive the need for an adaptive system.



Adapted from Haeckel, S. H. and Slywotzky, A. J. (1999) *Adaptive Enterprise: Creating and Leading Sense-And-Respond Organizations*, Harvard Business School Press.

Hence, a critical focus on the information system must be on how it helps enterprises improve their ability to sense, interpret, decide, act, and learn.

This leads us to state two important goals for the information system.

Within this environment, two important goals are emerging.

Everything important is always visible.

Everything to be managed is always reachable.

One might argue that these have been goals since the first business transaction that has been lost deep in history. That might be true, but these goals have never been more achievable. Always on and always connected is within reach.

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Everything important is always visible.

- Inventory
- Resources
- Commitments
- Customers
- Collaborators
- Competitors
- Socio-Economic-Political Factors
- Laws and Regulations
- Culture
- Weather

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Here is an example of some of things that are important and ought to be visible. Importance is decided on the basis of the decisions critical to the enterprise.[5]

Here is an example of the other goal.

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Everything to be managed is always reachable.

- Inventory
- Resources
- Commitments
- Customers
- Collaborators

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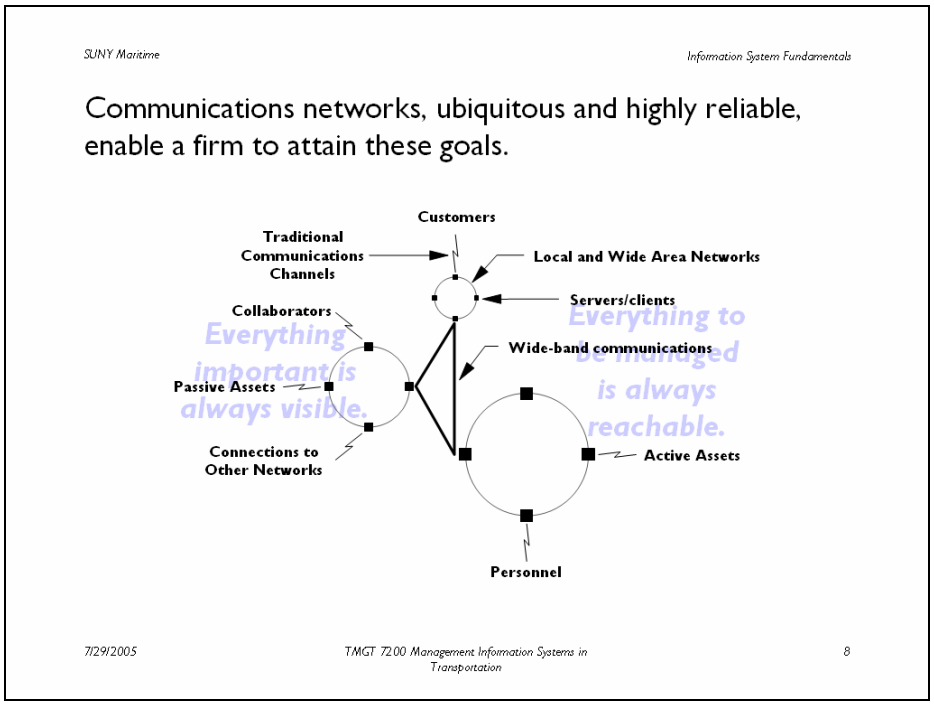
Communications networks are critical to the achievement of these goals.

[5] See J. Drogan, Note on Building a Management System, January 2005 p 3 for some idea on how to think this through.



Consider my laptop.

1. There is an infrared connection between my laptop (an IBM R30) and my personal digital assistant (a Palm Tungsten E).
2. There is a wireless connection between my laptop and my home network, the network at Maritime, the network at the Westport library.
3. There is an Ethernet connection between my laptop and the Maritime communications network.
4. I personally connect with my laptop through the keyboard, screen, and built in stereo audio system.

All these connections are nodes (the small back square in the above picture) in a global, interconnected communication system.[6]

We're well-served to reiterate the point about the "everythings."

[6] See How to Use Computers and the Internet in Transactions at http://jmsdrgn.squarespace.com/storage/How%20to%20Use%20Computers%20and%20the%20Internet%20in%20Daily%20Transactions.pdf for a discussion of how I use all this connectivity.

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Everything to be managed is always visible.

Everything to be managed is always reachable.

The "everythings" are the assets critical to success

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Manage what's critical.

There are three additional principles for the application of information technology.

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This brings us to three additional principles for the use of information technology.

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

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These are nearly as critical as the first principle, but we will not discuss these any further in this note.[7]

I introduced the notion of nodes above. A few more words regarding these nodes are in order.

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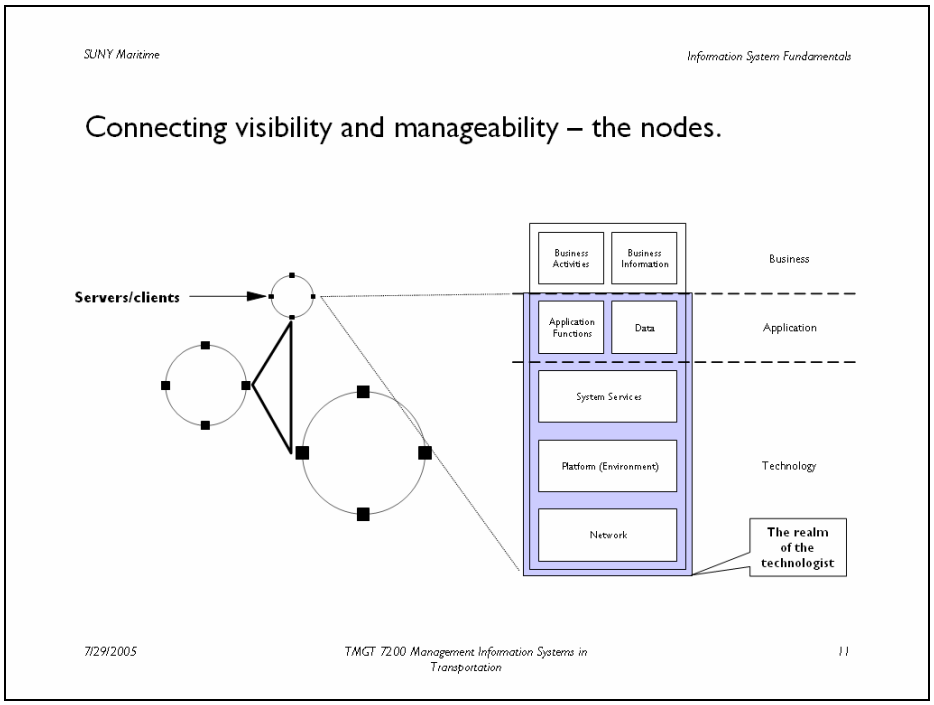
[7] See J. Drogan, Principles for Applying Information Technology, July 2005 for further discussion.



What's in or at the nodes?

There are two views of this.

1. The business activity taking place at the node.
2. The technology at the node.

In the picture above the business activity is represented by the boxes labeled Business Activities and Business Information.

The Business Activities and Business Information that are enabled by technology represented by the boxes Application Functions and Data, respectively.

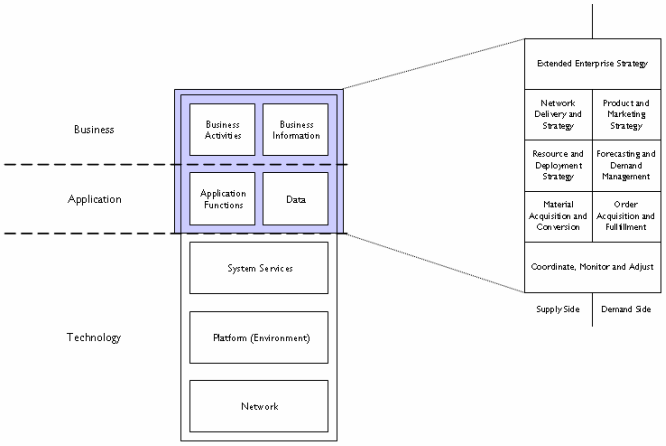
The Application Functions and Data are supported by the technology, represented here by the boxes labeled System Services, Platform (Environment), and Network.

There are, then, three layers at the node – Business, Applications, and Technology.

It is the Application layer that enables the Technology layer to support the Business layer.

There are two principal parties interested in the node, the Technologist and the Businessman. Shown above is the realm of the Technologist. By realm we mean area of interest and influence.

The businessman's view of and responsibility at the nodes.

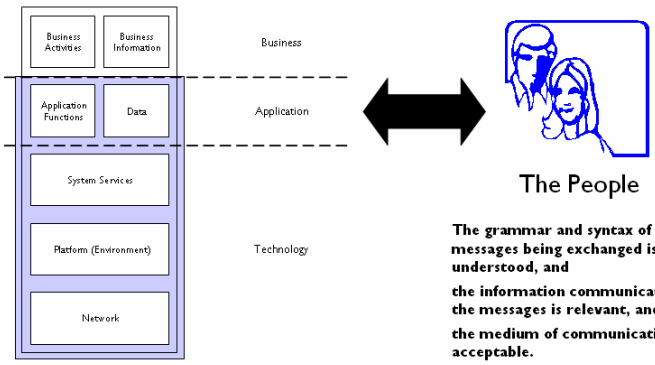


In this picture we show the realm of the Businessman. The right side of the picture is an example of the business processes that might be taking place at the node and supported by technology.

It is clear that an overlap in areas of influence and interest exists between the Technologist and the Businessman. We'll come back to this in a moment.

First, we take a brief look at the most important component of the system.

The most important part of the system.



The grammar and syntax of the messages being exchanged is easily understood, and

the information communicated in the messages is relevant, and

the medium of communication is acceptable.

The people dealing directly with information system have, over time, acquired the label of users. We would do well to make note of the following maxim.

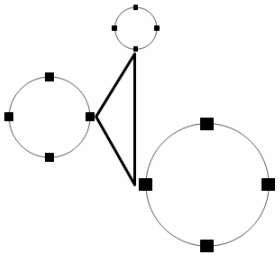
Systems aligned with human motivational factors will sometimes work. Systems opposing such vectors will work poorly or not at all.

John Gall, author of *Systemantics: How Systems Work and Especially How They Fail* (Fontana, 1979) as noted in *Railroad Business Information and Control Systems* (January 1980).

This suggests that determining what technology will be applied and how is not the responsibility of just the Technologist and the Businessman. The User has a critical role to play.

A final word about nodes.

More about the nodes.

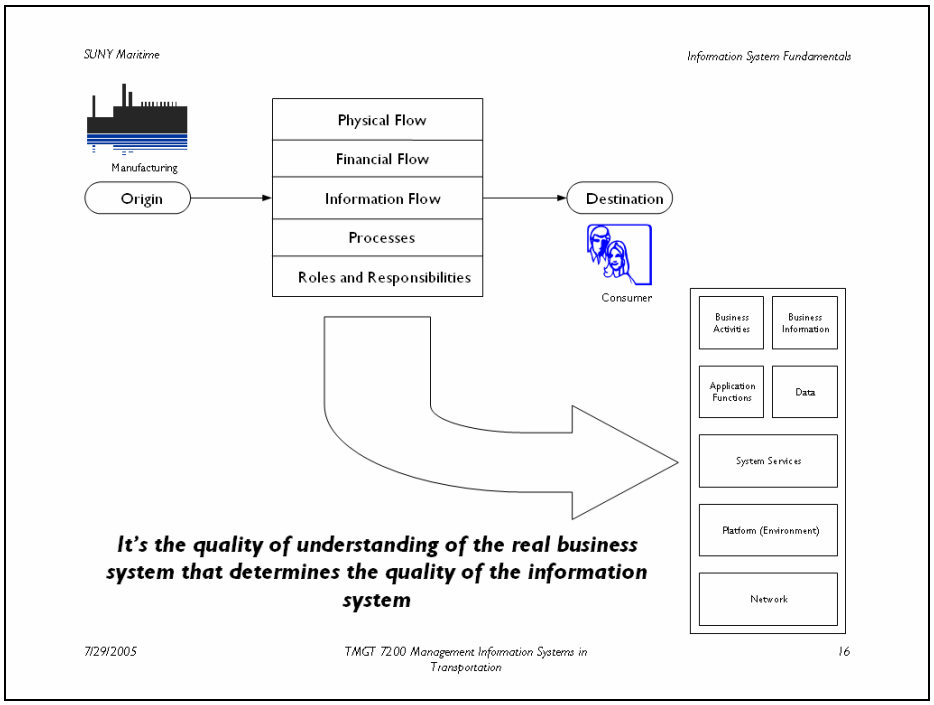


Examples of Nodes

- Computers from handhelds to supercomputers
- Handheld devices such as cell phones, blackberries
- Sensors such as weigh-in-motion scales, temperature and pressure sensors
- Tags such as RFID and UPC.
- Other networks
- Storage networks such as the Internet
- People

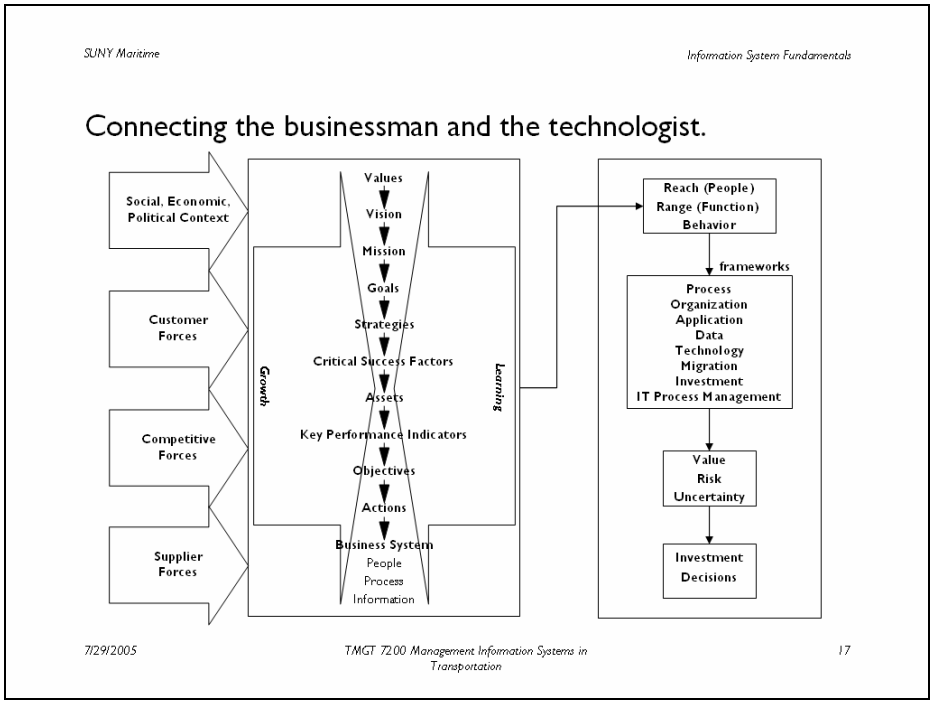
We have previously that the nodes represent connection to the "everythings." Shown above are some examples of nodes. They can be simple (a UPC code) and complex (supercomputers) and anywhere in between.

It is impossible to overstress the importance of the first principle.



There needs to be a mechanism to manage the overlapping areas on interest and influence that the Technologist and Businessman have.

A way to do that is to have a process for connecting the Business Drivers to Investment Decisions.

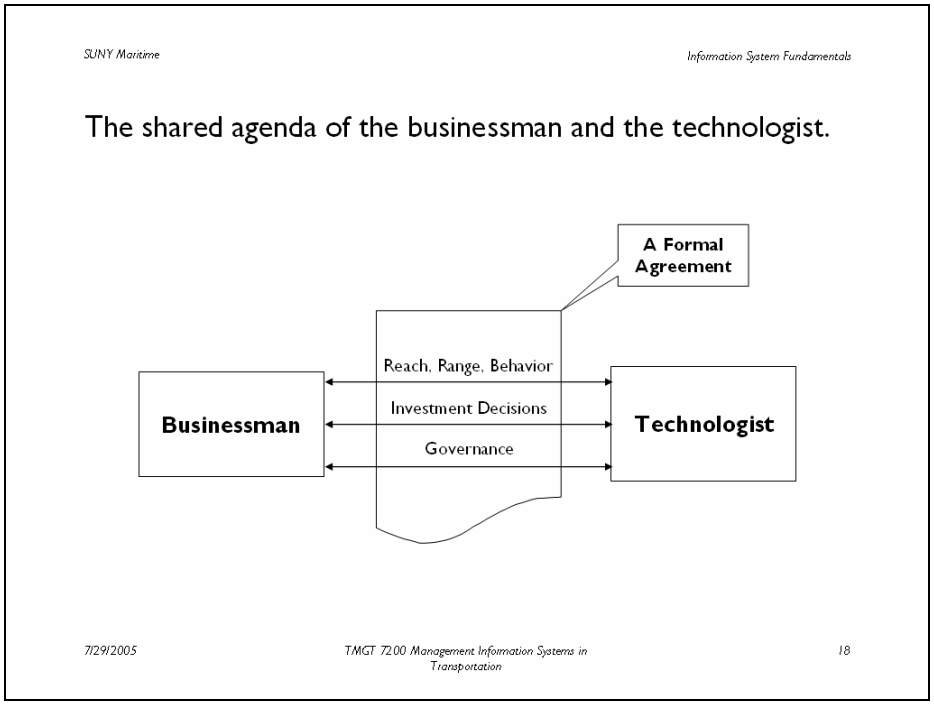


Such a process is represented in this picture.[8]

[8] See J. Drogan, A Note on Business Drivers, Business Configuration, and Information Technology Strategy, July 2005 for additional discussion of this diagram.

The connection between the Technologist and Businessman is represented by the Reach, Range, and Behavior shown to the upper right in the above picture.

Some means also needs to be put in place to agree to and manage Reach, Range, and Behavior.

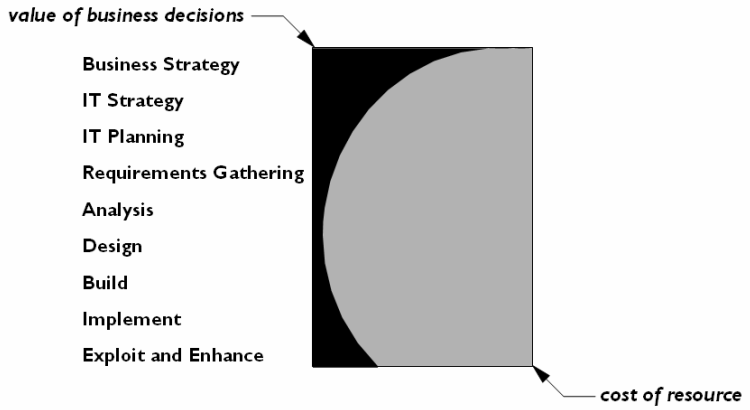


This is normally done through some sort of a formal agreement, often called a services agreement. This agreement specifies;

1. The Reach, Range, and Behavior of the information system.
2. The manner in which decisions regarding investing in the information system will be made.
3. The approach to jointly managing (governance in the above picture) the agreement.

It is important to note, and I suppose it obvious, that all of what being discussed here takes time – the systems life cycle. The importance and influence of Technologist and Businessman changes over the systems life cycle.

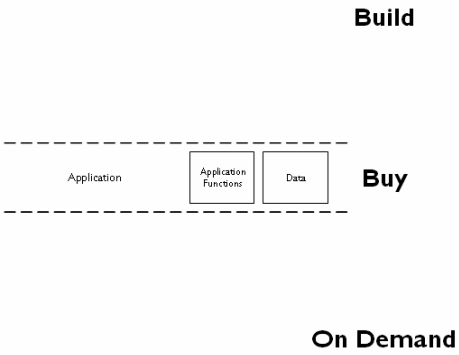
The businessman's leverage during the system life cycle.



If we subscribe to the First Principle then we need to give first consideration to the value of business decisions (e.g., investment in technology). The Businessman's leverage during this systems life cycle is greatest at the beginning and end. This is shown by the black are in the above picture. On the other hand, the cost of resource, mainly people, when implementing an information system is greatest in the middle of the cycle. These costs are represented by the gray in the above picture.

Since the time of greatest cost corresponds with the time of least business value one is tempted to consider how these costs may be managed,

Application functions and data (i.e., capability)



To what extent does the capability provide me with a competitive advantage?

Who can provide me with the required capability?

What capabilities must I own? Control?

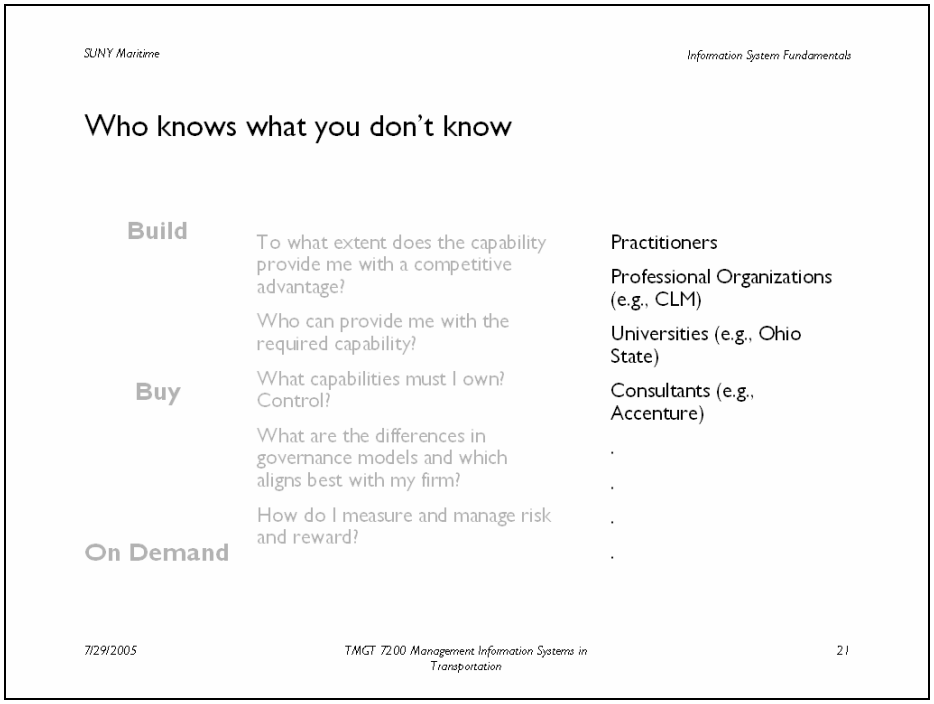
What are the differences in governance models and which aligns best with my firm?

How do I measure and manage risk and reward?

That is, should we build, buy, or rent (shown here as On Demand, a term coined by IBM) the information systems capability we need?

The questions noted in the picture are important considerations when making this decision.

Information systems is a fast-changing field that is both large and complex. It's virtually impossible for a single enterprise to know all that is of potential value.



It's important therefore to know what you know, know what you don't know, and know who knows what you don't know. Listed to the right on this picture is an example of some parties that could be important in helping an enterprise achieve its information system goals.

This note closes with advice that connects back to the Fourth Principle.

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

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

This note strives to identify some of the forces that need to be balanced and advocates ways to identify and manage the required balance.

Sometimes the best decision is to not employ technology.

James Drogan
July 29, 2005