Maritime College
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Note on Building a Management System

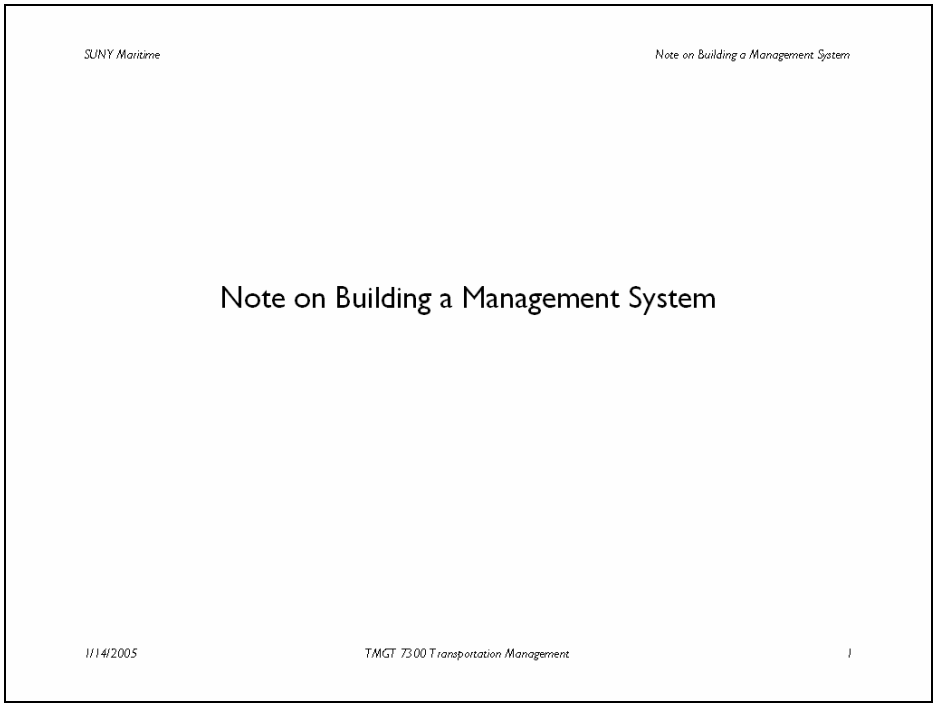

Figure 1 Note on Building a Management System

The subject of transportation management suggests an associated management system. This note discusses building such a system.

A management system is often further qualified. For example, the Union Pacific Railroad has a Transportation Management System. Customer relationship management systems are currently very much in vogue. This note is intended to be applicable to all these types of systems.

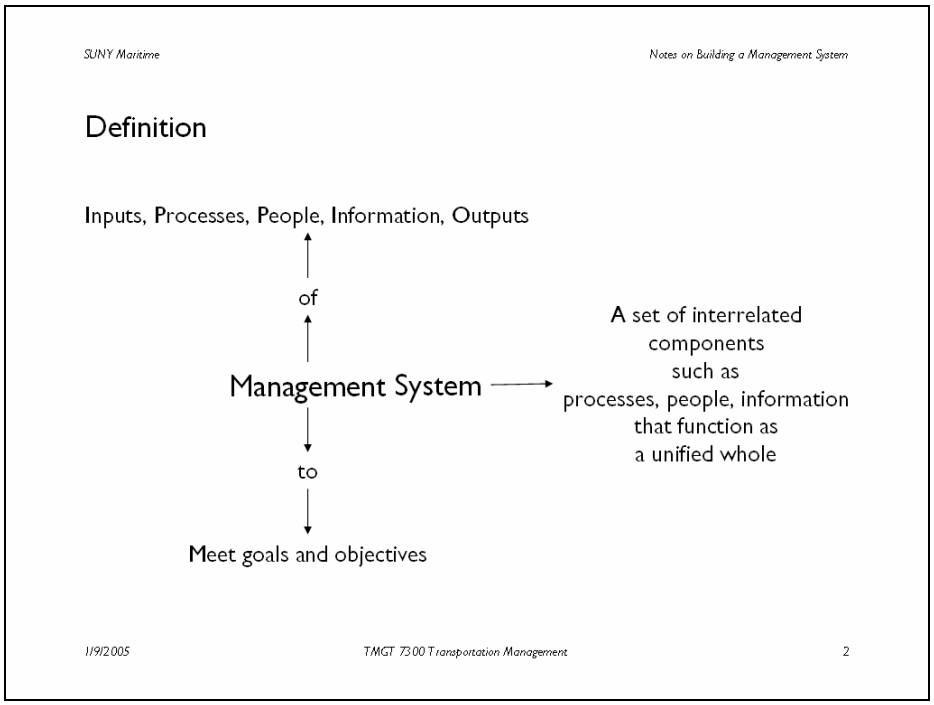

Figure 2 Parsing Management System

It's useful to start this note with a definition of management systems. It comes from parsing the words "management system."

The object of management is to meet the goals and objectives of the organization. Management achieves this by manipulating combinations of inputs, resources, processes, people, information, and outputs.

A system is an integration of various components into a unified whole. A stereo system is a good example of what I have in mind.

How should we go about building a management system?

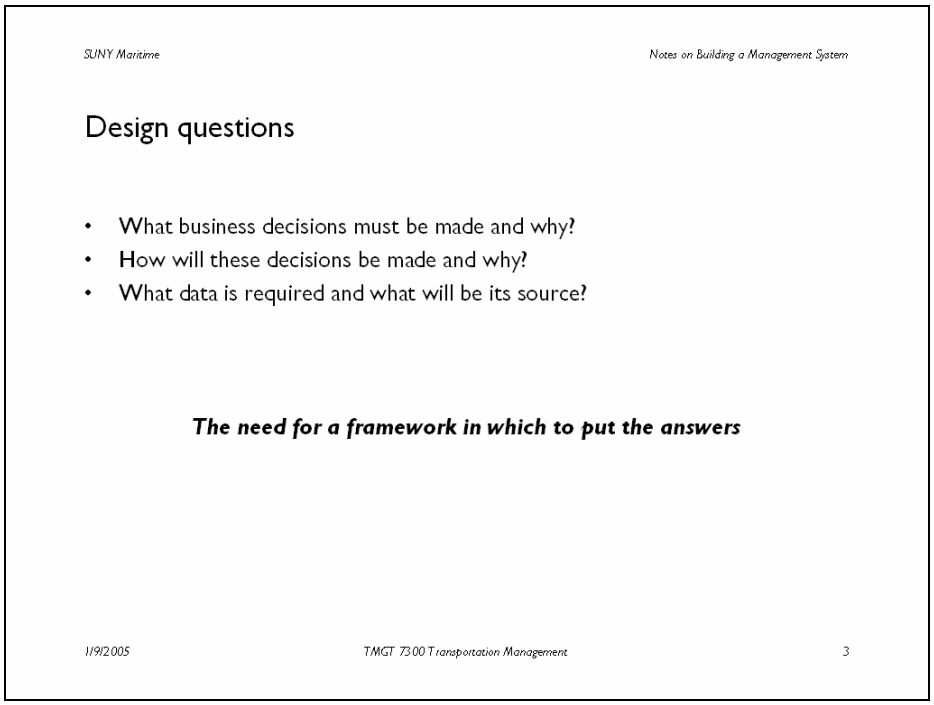

Figure 3 Design Questions

It starts with an understanding of a few basic questions.

1. What business decisions must be made and why? Here we are seeking to write declarative sentences that look something like "We need to make a decision about … because it will affect how we …" These need to be decisions of significance to the firm.
2. How will these decisions be made and why? By how I mean the general approach to making the decision. For example, a decision on which container to move next will be based upon a) the value of the goods to the shipper and 2) the value of the shipper to the organization. It's useful to also write declarative sentences to help answer these questions.
3. What data is required and what will be its source?

This initial step in building the desired management system can be done in a simple format. An example is:

I. Decision
   A. Method
      1. Data

At this stage of the building of the management system one might think in terms of 12 or so major decisions. Audit this description by working from the lowest level up to the top. That is:

1. How does the data support the method used to make the decisions?
2. How does the method used enable the decision to be made?
3. How does the decision relate to the critical success factors of the organization?

It then becomes useful to have a framework into which you can out the answers to your questions.

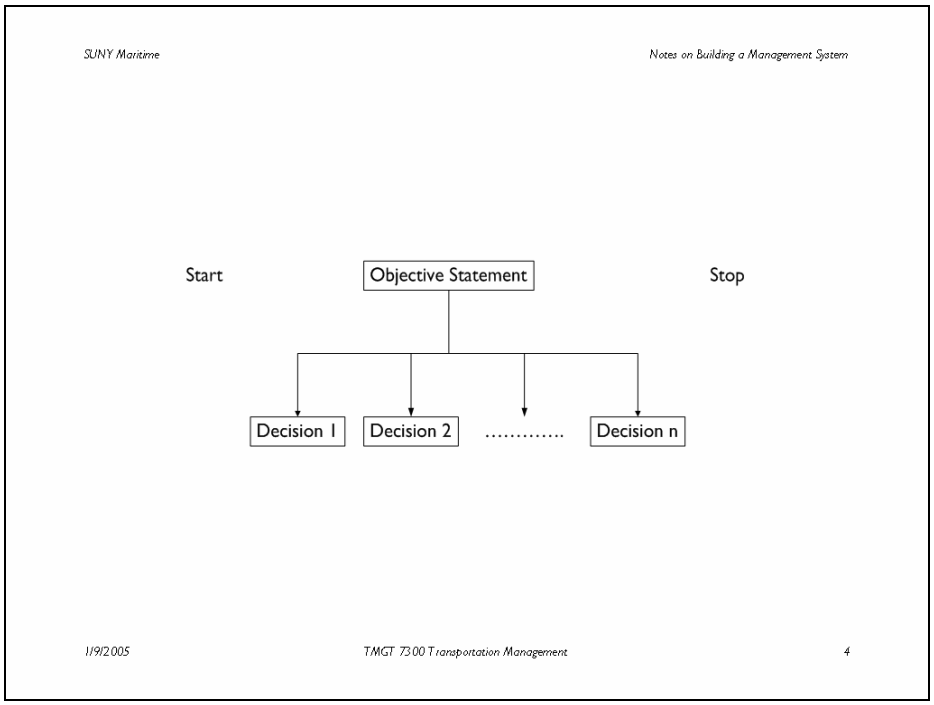

Figure 4 Objectives, Decisions, and Sequence

This framework encourages a graphical depiction in order to make the relationships between the various elements of the system clear.

The direct relationships between the decisions and the objective are shown in the case immediately above.

These decisions are laid out in a logical sequence according to the business cycle under consideration. Hence mention of "start" and "stop" in Figure 4 Objectives, Decisions, and Sequence.

Consider, as an example, the wagon (i.e., freight car) cycle[1] for a freight railroad.

[1] The Railway Value Chain (1998)

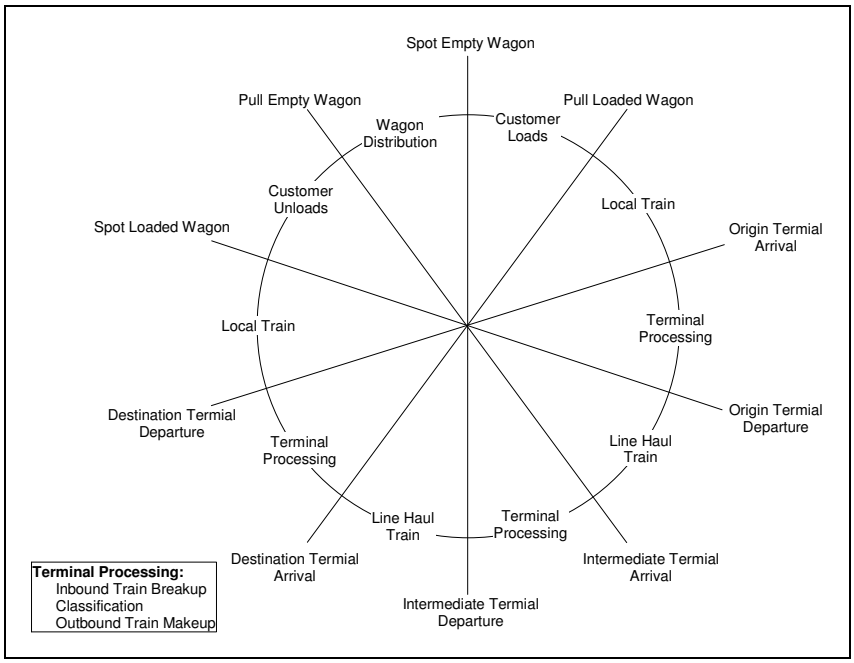

Figure 5 Wagon Cycle

The initial decision may be "Spot Empty Wagon" in the diagram and thus would occur to the left in the framework.[2] The final decision would then be "Pull Empty Wagon" and would go on the right of the framework. According to the scheme thus far described there would be eight intervening decisions.

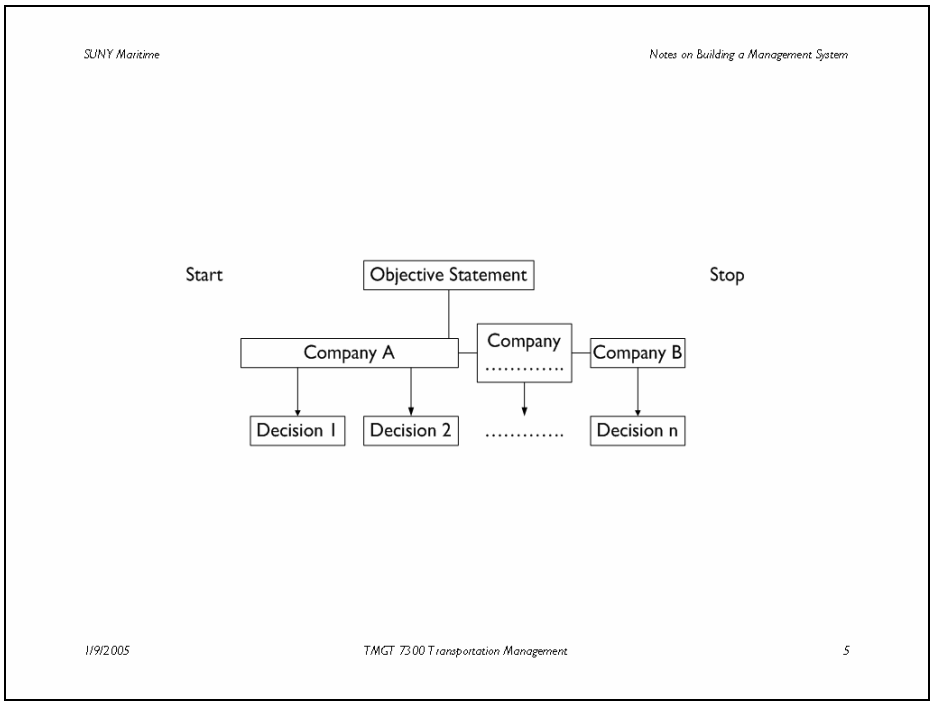

Figure 6 Objective, Decisions, Roles and Responsibilities

[2] Spot a wagon means to physically place the wagon at a location so the shipper may load.

Business systems comprise process, people, and information. This is a good time to begin to put the roles and responsibilities of people into the mix. I've done this in the framework by indicating which companies are responsible for various decisions. I have in mind in this example that multiple companies have roles and responsibilities in the management system. I could just as easily use divisions, departments, or, at the extreme, individuals. I will discuss roles and responsibilities later at a finer level of detail.

Decisions, of and by themselves, are a bit abstract to be useful beyond this point. Accordingly, I break these down into processes.

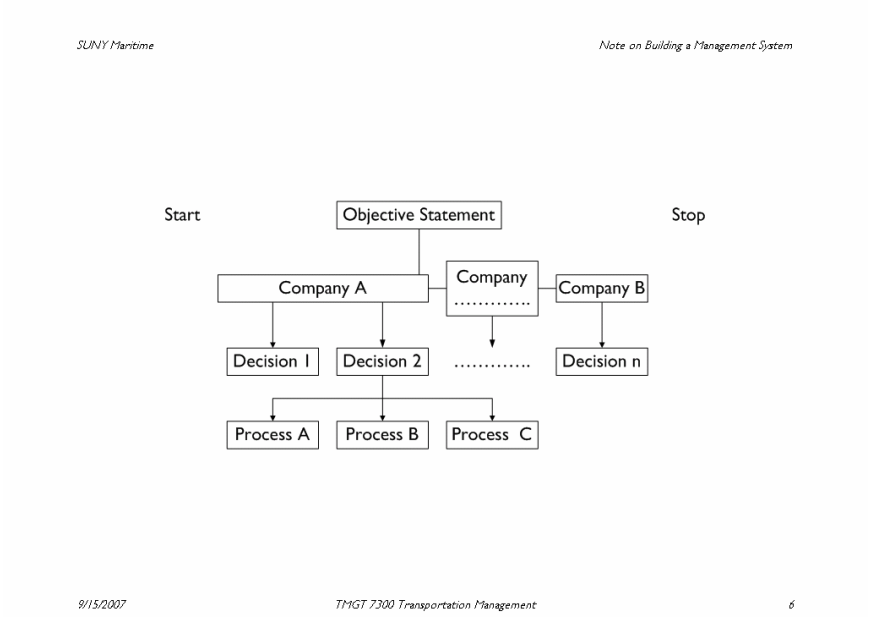

Figure 7 Decisions and Processes

In this example, Decision 2 comprises Process A, Process B, and Process C. Let's return to the decision to "Spot Empty Wagon." What might be the associated processes?

1. Receive and validate data from shipper regarding the type of wagon and its condition, the amount and kind of commodity to be shipped, and the requested spotting date.
2. Select a wagon from all available wagons that meets the requirements of the shippers request at lowest possible cost.
3. Issue a movement instruction that causes movement of the empty wagon from its current location to the shipper's requested location.
4. Advise the shipper of the action taken.

It's useful to be as concrete as possible as to the meaning of a process

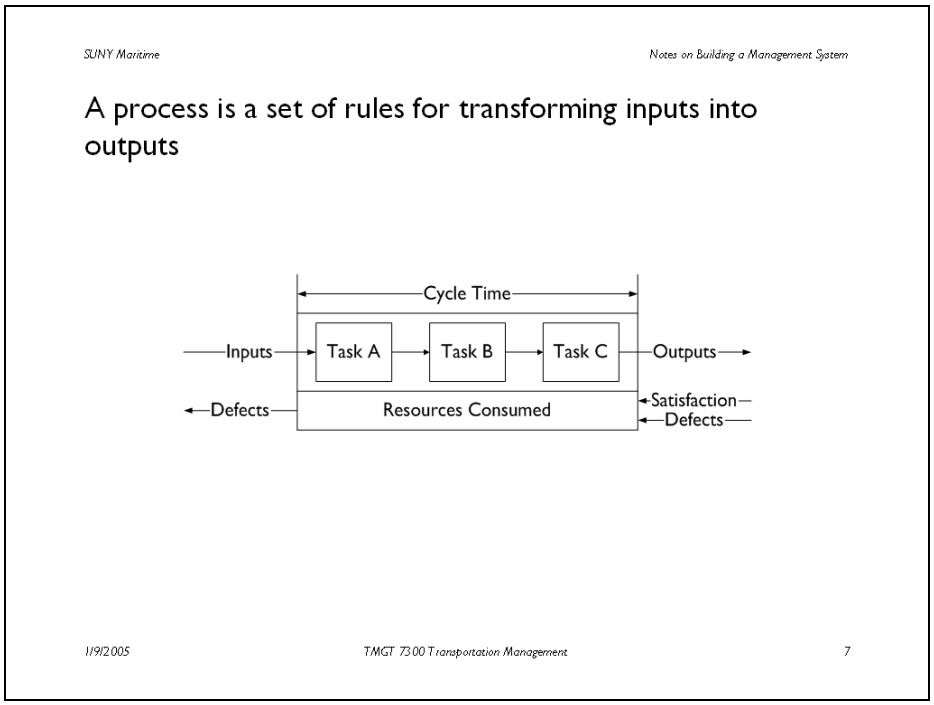

Figure 8 A Process and Its Metrics

A process is a set of rules for transforming inputs into outputs. For example, in the syllabi for courses I teach, I describe the process whereby I turn input – the student's performance during the course – into output – a final grade.

In the graphic above the process is delimited by the vertical lines of the larger rectangle and has associated with it a cycle time (the amount of time it takes to complete the process). For example, Xpress Lube has a process for quickly performing an oil change and lubrication for your automobile.

Figure 9 Xpress Lube

From the customer's point of view the cycle time for Xpress Lube starts when he or she drive up and ends when he or she drives away. The oil change and lubrication process consists of several tasks (e.g., gathering information about the car).

Cycle time, as you can see in Figure 8 A Process and Its Metrics on p 7, is but one of several metrics useful for describing the performance of the process.

How many processes should one strive to define? This is another way of deciding on the level of detail to which one needs to develop to understand how the business works. IBM defined a Shipping Information System for the liner industry in a 1987 that identified 30 different processes. IBM also defined a Railroad Information System that defined some 70 processes. These definitions were across all functional areas of the business (e.g., operations, marketing, engineering, etc.). The answer to the question is not prescribed by any rigid law and is clearly a function of the complexity of the business being studied.

The level one seeks is where there is a clear distinction between what processes do.

Examples of broad categories of processes include:

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

I had previously stated that business systems comprise process, people, and information. We dealt with the process above. Now it is time to consider people and information.

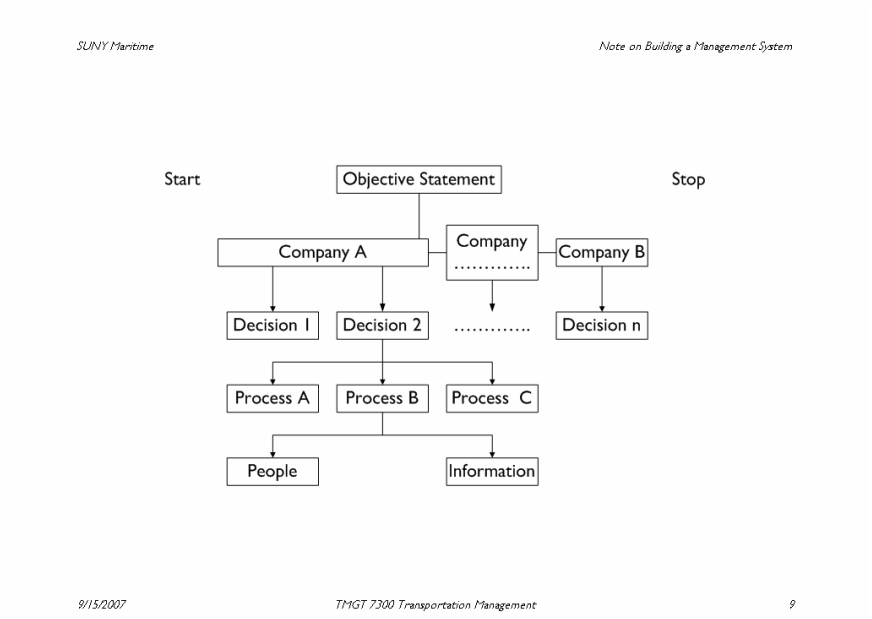

Figure 10 People and Information

Here we have related the people and the information to the process.

Our first inkling of the people involved came from the association of a company with a decision (see Figure 6 Objective, Decisions, Roles and Responsibilities on p 5). People represent the next level of detail within the company. I recognize that there is likely an intervening step here of defining the departments within the company responsible for the decision.

Identifying the required information is dependent upon knowing what the process does. For example, what information is required to produce a rate for a shipment?

Examples of broad categories of information are:

- Collaborators
- Commitments
- Competitors
- Culture

- Customers
- Inventory
- Laws and Regulations
- Resources
- Socio-Economic-Political Factors
- Weather

What we have been discovering to this point is a logical relationship between the components – people, processes, and information – of a business system. This analysis and these diagrams tell us what the business system is, but not how it works.

To do that we need different kinds of representations.

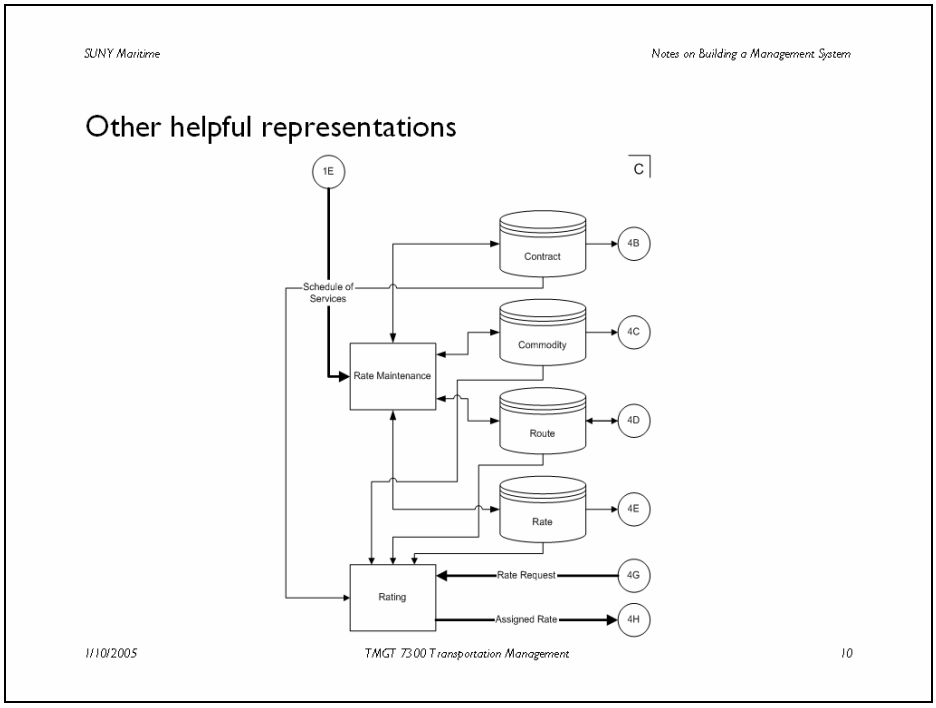

Figure 11 Processes, Information, and Flows

Here is portion of the Railroad Information System mentioned earlier. Processes are represented as rectangles (e.g., Rate Maintenance), and information as cylinders standing on end (e.g., Contract). In this diagram we have two processes and four sets of information.

In this representation, we can see that the Rate Maintenance process receives a message (the broad arrow labeled Schedule of Services) and uses this message to update each of the four sets of information. We know this happens because we have elsewhere defined what Rate Maintenance does.

The thin arrows indicate a connection between a process and a set of information.

This next example highlights how processes are connected via messages.

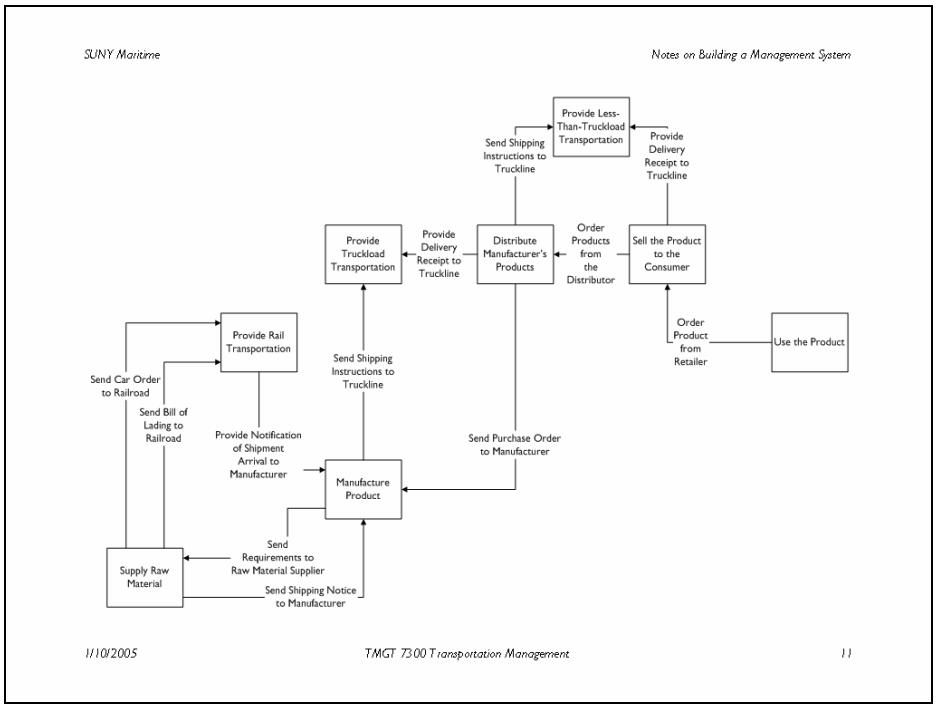

Figure 12 A Multi-Company Process and Message Flow

In this graphic are processes from consumers, less-than-truckload carriers, distributors, truckload carriers, manufacturers, railroads, and raw material suppliers.[3] One can see how work is performed by following the messages through the processes. For example, starting at Use the Product (Consumer) that generates a message Order Product from Retailer. This message is received by the Sell the Product to the Consumer (Retailer) process. This process then generates a message to the distributor of the product and so forth.

This diagram is useful for getting an overview of a multi-company operation, but would likely need to go to the next level to get at a level of detail, including information and people, that would be useful.

Here is another example of portraying the components of the business system.[4]

[3] Adapted from The Supply Chain Management Project: Process Framework (1995)

[4] 960102BLL Modified LOVM Model

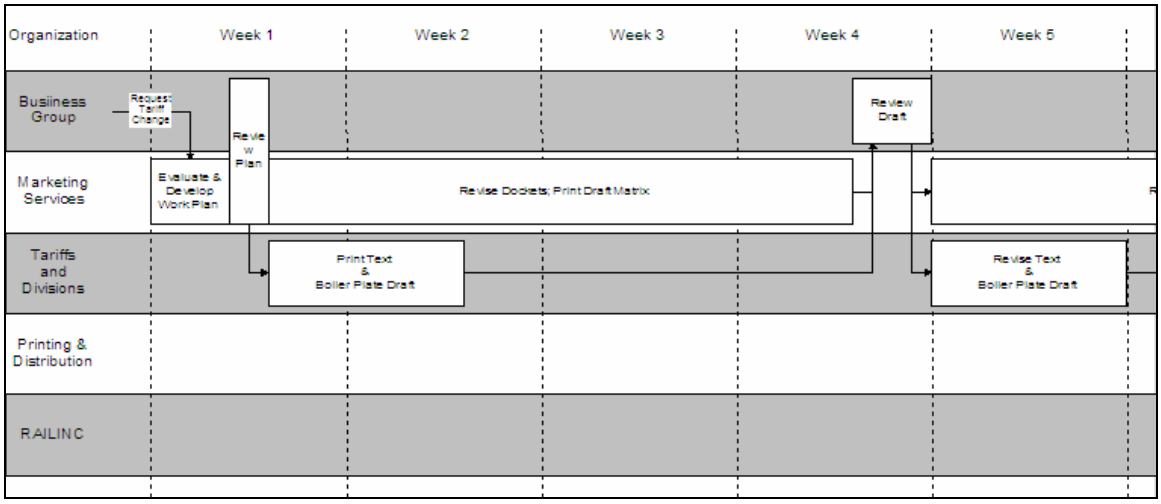

Figure 13 A Pretty Useful Description of a Management System

Business groups (e.g., Marketing Services) are arrayed down the left side and time is represented across the top. Processes are in the row representing the department accountable for their execution. The width of the process represents the process cycle time. The interconnecting lines represent the messages we have discussed before. From this we can see who is doing what when. Lengthy cycle times show clearly.

Collections of information can also be easily shown on this chart by putting them on a bottom row and connecting them to the processes in the manner shown earlier.

A chart such as this is a very powerful tool for conveying an understanding of how a business system works. Inspection of this chart be competent personnel can reveal opportunities for improvement in how the business works.

So, if we can do what I've described above, then we will have a good description of the business system for a firm.

I have said nothing to this point regarding the use of information technology (IT). What has been said above applies whether or not information technology is used.

However, we know it's virtually impossible to manage a modern business without information technology. It's time to discuss how we make decisions to apply information technology to the business system.

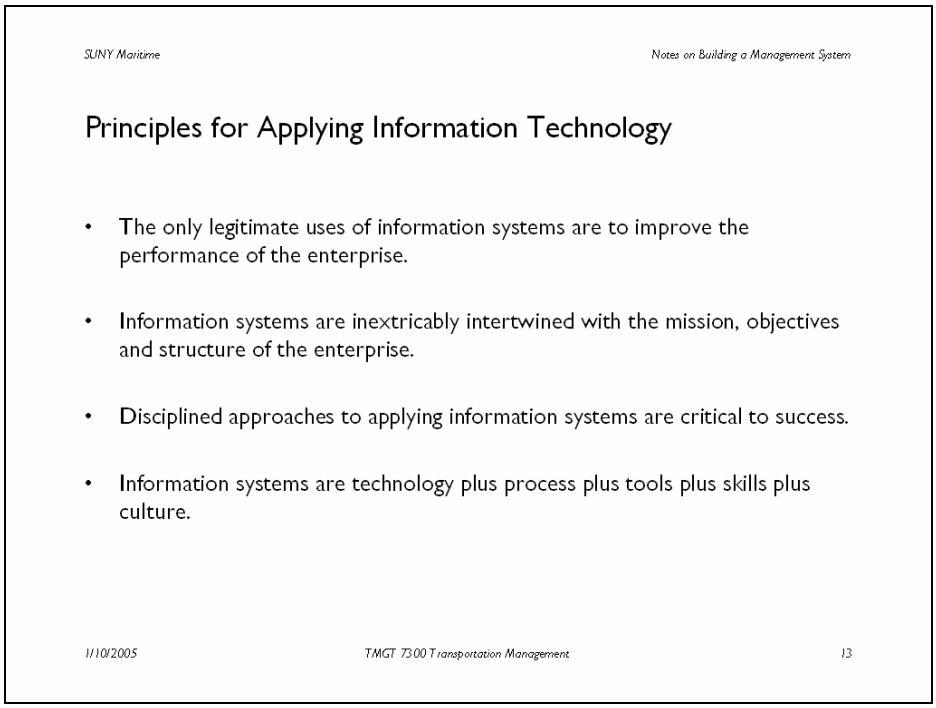

Figure 14 Information Technology Principles

The principles presented above have emerged from my experience of almost 40 years in the practical application of information technology to business. Appropriate return on the investment in information technology is usually gained when these principles are applied. Appropriate return is usually problematical if any of these principles are not applied.

The first of these principles rests upon mechanism for assessing performance of the firm. One might, for example, be adapted from the Balanced Scorecard.[5]

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

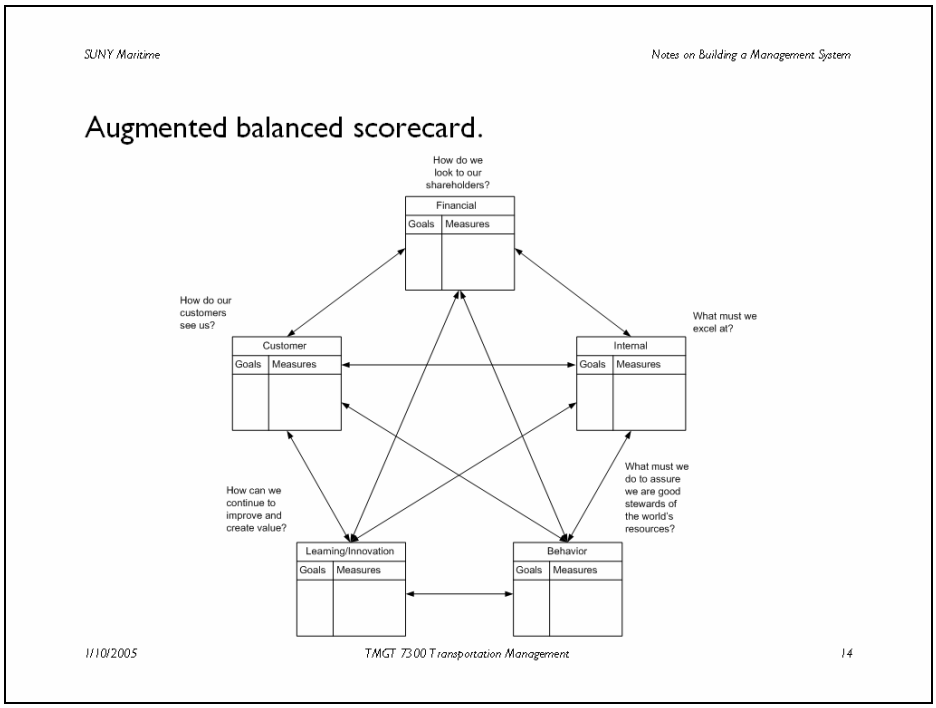

Figure 15 Augmented Balanced Scorecard

Suppose our firm has decided that these are the five major areas by which success will be measured, Any investment in information technology must, therefore, result in an overall improvement in the performance of the organization as measured by the criteria shown above. The implication is that before steps are made to deploy information technology the criteria for success and the method in which success will be measured need to be understood.

The second principle is the reason why I spent time in the beginning of this paper in discussing how a business system might be discovered, defined, and understood.

The third principle says that a systematic approach for the application of information technology needs to be brought to bear.

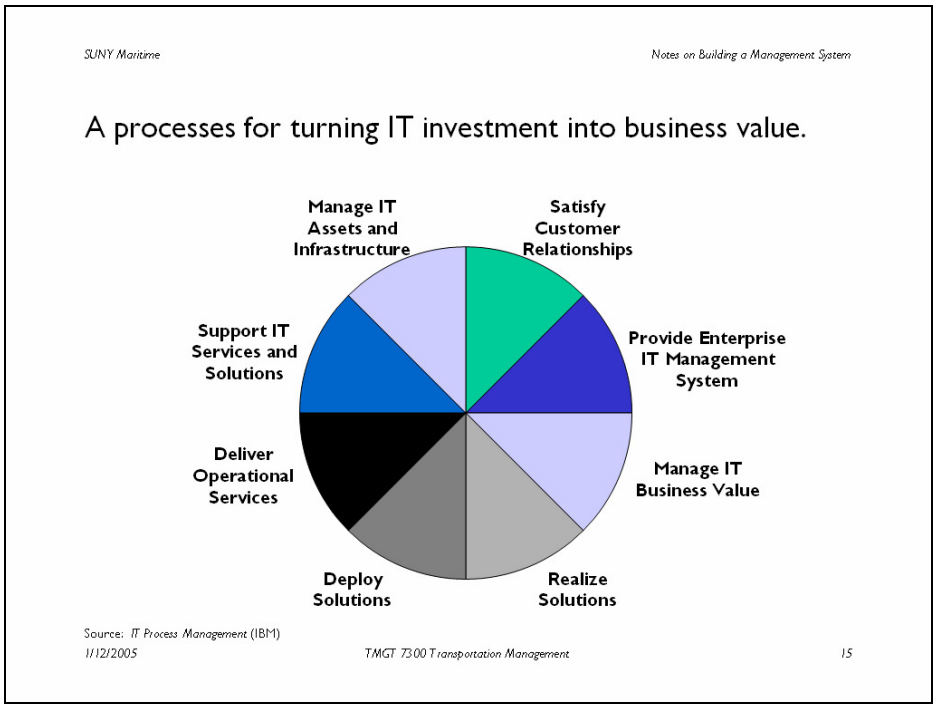

Figure 16 IT Process Management

Just as we need to know *a priori* how we will measure success we also want to have in hand a mechanism for managing the information technology investment process.

The final principle is that information technology is increasingly less about the technology and more about process, skills, tools, and, most interesting of all, culture.

There is a real need to understand the impact of global cultures on our businesses.

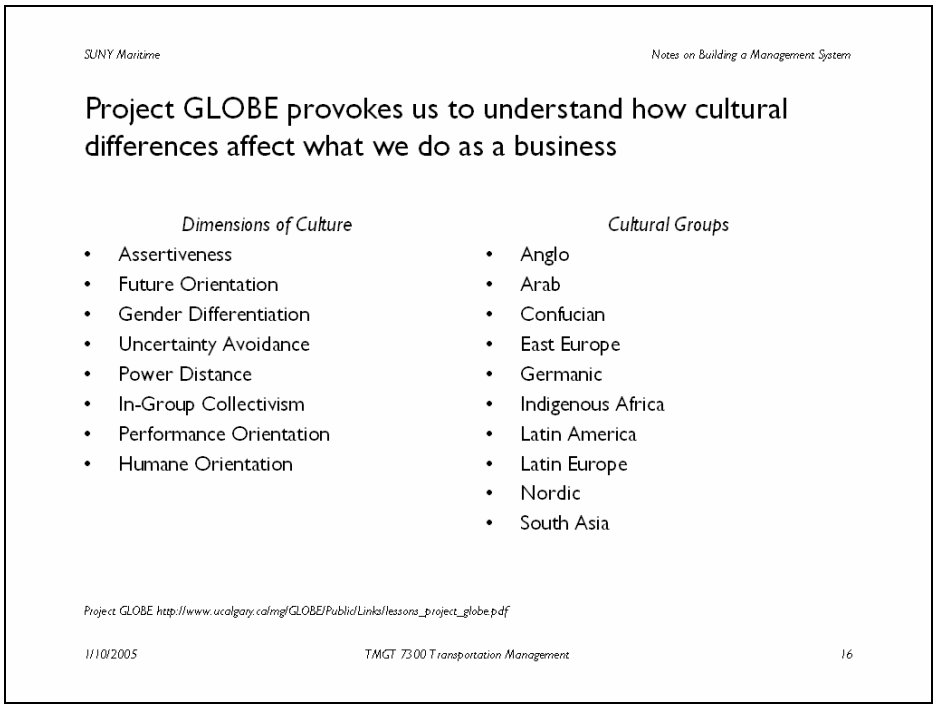

Figure 17 Consideration of Culture

I'm reminded here of the statement that "Systems aligned with human motivational factors will sometimes work. Systems opposing such vectors will work poorly or not at all."[6] Business systems are all about alignment. It seems prudent, therefore, to consider how the dimensions of culture affect our business and hence our business design and hence our use of information technology.

Consider, for example, the Power Distance dimension of culture.

Project GLOBE defines Power Distance as:

> *"Power Distance is defined as the degree to which members of a society expect power to be unequally shared. It represents the extent to which a community maintains inequality amongst its members by stratification of individuals and groups with respect to power, authority prestige, status, wealth, and material possessions. It also reflects the establishment and maintenance of dominance and control of the less powerful by the more powerful."*[7]

Lowest power distance countries included Denmark and the Netherlands; highest power distance countries included Russia and Spain.

To what extent would you implement information sharing if one were operating in a high power distance country?

With the principles in mind we can decide on the aspects of the business system that should be automated (i.e., to which portions of the business system information technology can be applied.)?

Two points seem evident.

1. Automation must improve the performance of a process. A description of a process is given in Figure 8 A Process and Its Metrics on p 7. Thus, the question becomes one of seeing how automation affects the metrics, then translating this effect into statements of financial and strategic impact.
2. Automation must allow us to do something of significance that we would otherwise be unable to do. By significance, we mean in terms of affect on financial statements and strategic positioning.

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[6] 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), IBM, published in draft form.

[7] Javidan, M. and R. J. House (2001). "Cultural Acumen for the Global Manager: Lessons from Project GLOBE." Organizational Dynamics 29(4): 295-296.

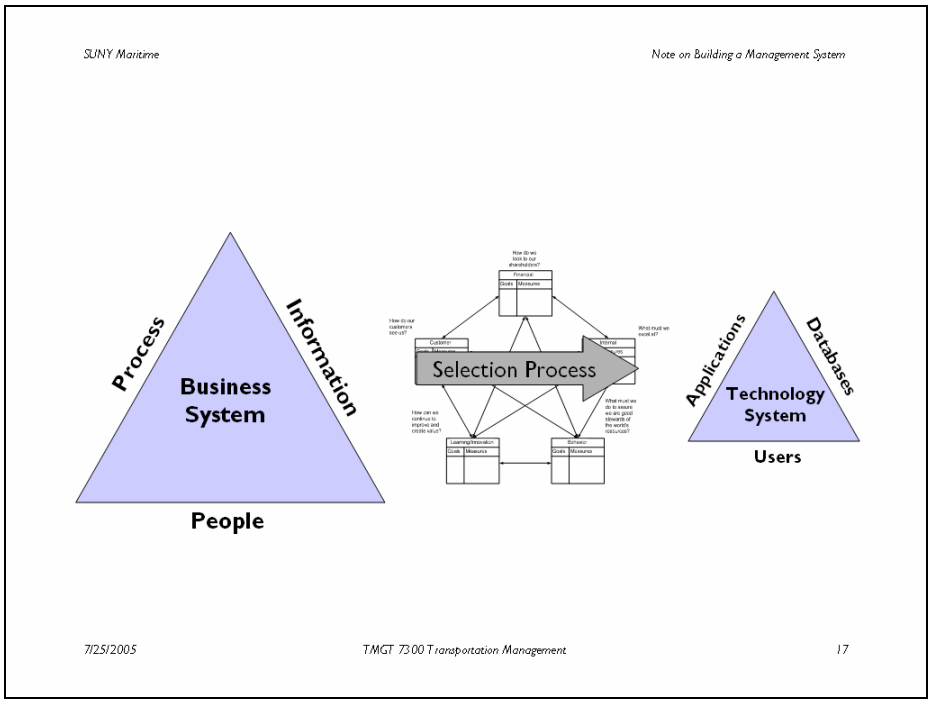

Figure 18 Automation Selection Process

It should be clear that the process of selecting aspects of the business system to be automated needs to be conducted in the context whereby the firm is measuring its success. The arrow (Selection Process) against the backdrop of the augmented balanced scorecard (see p 13) is to remind us of this.

The selection process itself can take place in one of two ways.

1. One could take a look at what process have been automated by similar companies and decide that those processes are candidates for automation in one's firm.
2. One could select processes in one's firm to be automated by inspection.

I tend to favor the second approach. It requires that one have an understanding of the business and of technology, and I think it more rational than saying "because so-in-so has automated this process we should also."

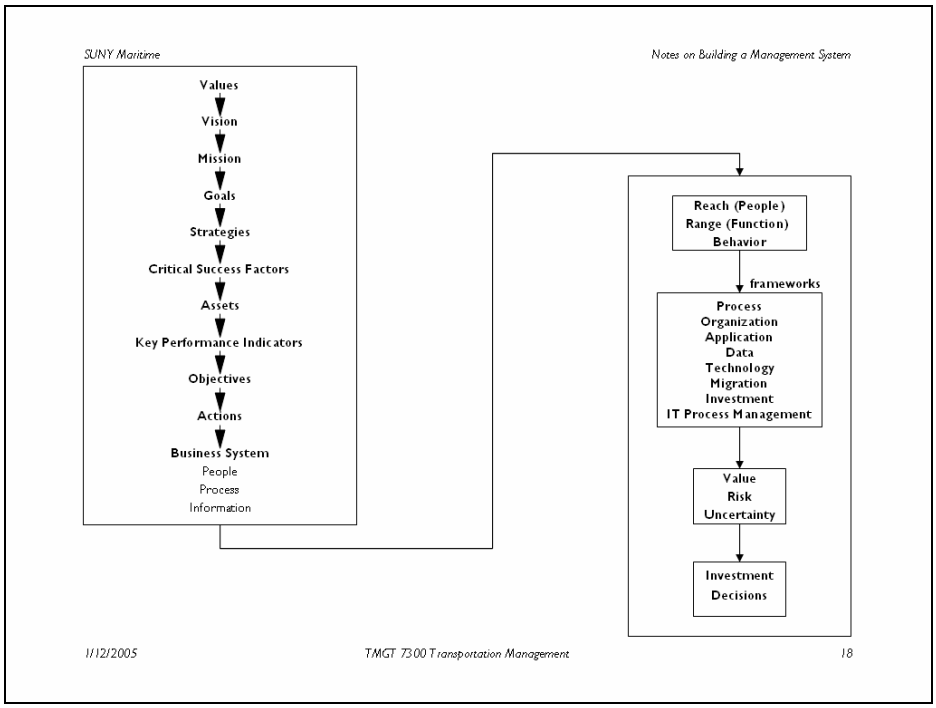

Figure 19 Connecting Business and Technology

The selection process I described above is one of the key linkages between the business system and the application of technology.

In Figure 19 Connecting Business and Technology above the large rectangle to the left is the configuration of the business. It starts with the values the firm stands for and ends with the business system that actually gets the work of the business done.

The rectangle on the right represents the process of arriving at information technology investment decisions. Sometimes this rectangle is described as information technology strategy.

The selection process described in Figure 18 Automation Selection Process on p 16 results in statements of reach (people), range (business processes supported), and behavior (how the complete system should generally behave) that the business people desire from the application of information technology to the business.

This is about as far as I want to go with this note at the moment.

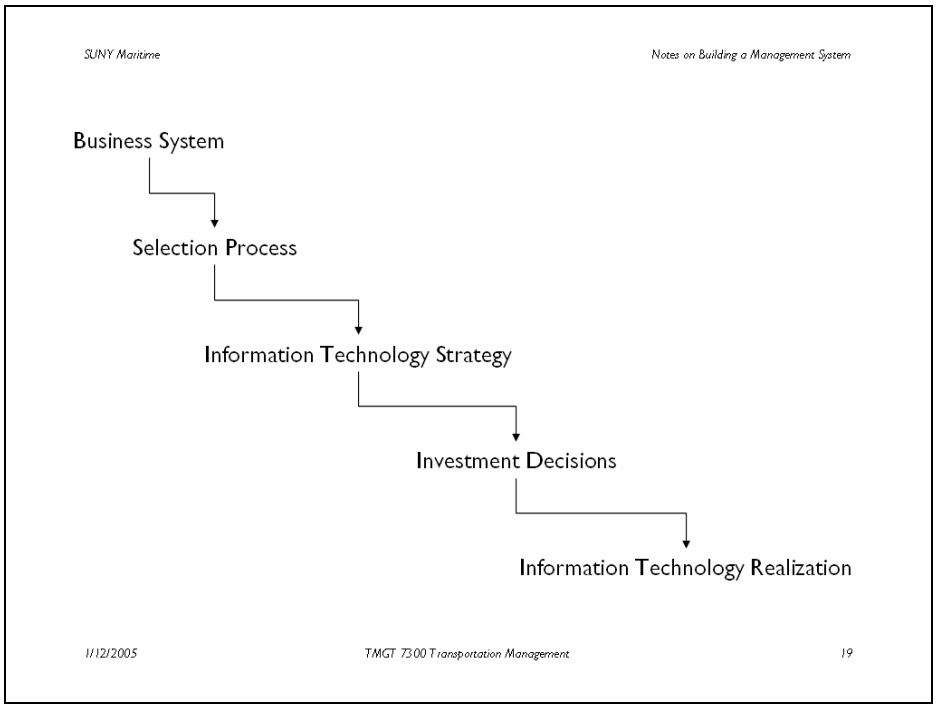

Figure 20 Summary

I've described herein my view of a business system, its components, and how it might be defined based upon a parsing of the words "management system" given appropriate consideration, of course, to the context in which the firm resides.

The result of this is a set of processes, people, and information that collaborate to carry out the business of the company.

I then considered the notion of applying information technology to the business system through a selection process.

Finally, very, very briefly I touched on the connection between the business and technology as reach, range, and behavior. I ended on the matter of how this trinity connects to an information technology strategy process that ends with investment decisions for the realization of automation.

This note is predominantly about describing the management system. Nevertheless, it seemed to me to be somewhat incomplete without the description of the connection to information technology.

The final note of caution comes from Michael Scott-Morton.

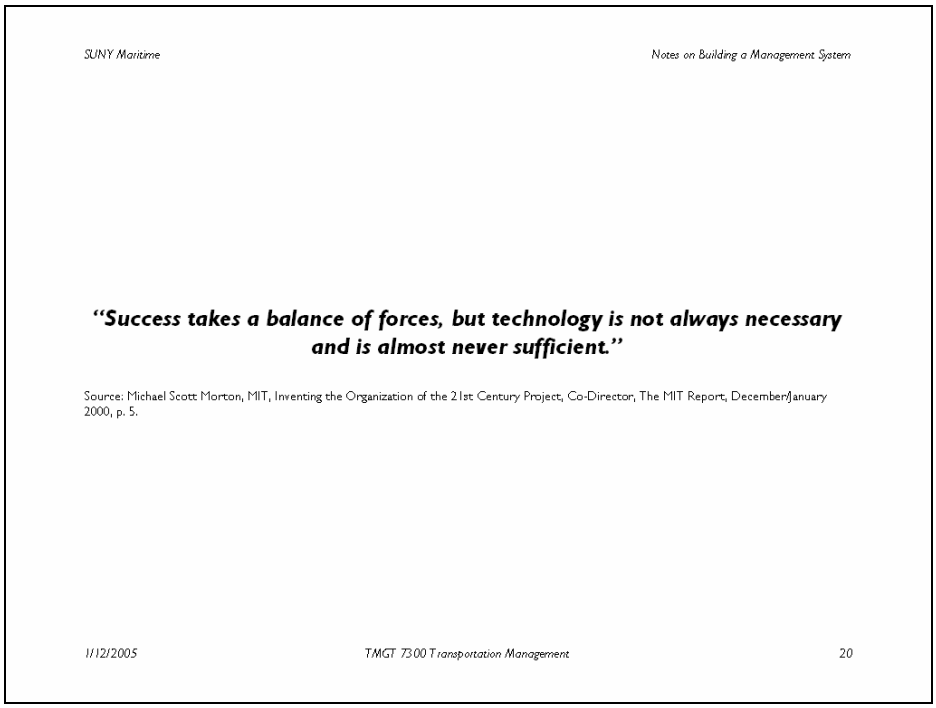

Figure 21 Apt Advice

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