CENTRALIZATION VERSUS DECENTRALIZATION OF INFORMATION SYSTEMS: A CASE STUDY INVESTIGATION OF A FRAMEWORK FOR DECISION MAKING

by

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SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
June, 1976

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Alfred P. Sloan School of Management
May 7, 1976

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ABSTRACT

This thesis applies a preliminary framework for decision making in the centralization versus decentralization of information systems question to five case studies in an organization.

Applying the framework consists of four major steps: 1) using a table of constraints to identify those applicable to the situation, 2) identifying the dominant constraints, 3) using the constraints to decompose the centralization/decentralization decision into a set of manageable decisions, and 4) evaluating the alternatives in light of the preferred decisions.

A description of the analysis and decision of each organizational unit is presented, followed by the analysis and decision arrived at using the preliminary framework. A comparison of the two decisions is made and implications are drawn.

The practical application of the framework emphasizes the importance of considering the constraints in light of the existing situational factors, and the flexibility inherent in the directions suggested by the constraints. Some specific suggestions are presented for characterizing the existing data processing function in the constraint table. The utility of the framework as an approach to the centralization/decentralization dilemma is demonstrated.

Thesis Supervisor: John F. Rockart

Title: Senior Lecturer

ACKNOWLEDGEMENTS

The author would like to express her gratitude to Professor John F. Rockart, whose enthusiastic and intuitive approach to this research provided for a creative work environment.

The author also wishes to thank Professor William Gruber for his patience and critical input to the final document, and Joav Leventer, whose role as the devil's advocate was critical to the development of the ideas presented here.

Finally the author would like to thank her husband for his support, insight and comment throughout, and because he was forced to build the fence without the benefit of her advice.

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Chapter 1

INTRODUCTION

The Problem

In recent years, the investigation of the centralization versus decentralization issue in information systems has tended to center around efficiency versus effectiveness. The arguments generally simplify the dilemma to being a choice between a cost and time efficient, large computer, and a responsive, easily accessed small computer. The sophistication of current technology, however, has taken the debate out of this simplified realm and into a complex, many faceted decision process. The terms centralized and decentralized have taken on relative definitions and often merge, with the more recent area of data processing technology - distributed processing.

Basically the dilemma revolves around taking into consideration organizational issues, technology issues, and specific needs of the task, in order to make an effective decision with respect to a data processing configuration. Configuration here is used in a broad sense; that is not simply hardware issues, but also software and management control issues.

Traditionally, the term 'centralized' connoted large, expensive, and at the same time, powerful, sophisticated and efficient. Centralized

computers were used in processing applications that impacted the organization as a whole. Decentralized computers were thought of as minicomputers designed and programmed to do a specific, well defined task, for a segment of the organization. These are naive definitions in the environment of today's technology. The differences between maxicomputers and minicomputers are slowly disappearing. In addition, sophisticated terminal and communications technology has allowed the introduction of distributed processing as a category of data processing that attempts to capture aspects of both of the traditional worlds of centralized and decentralized computers, by locating near the user, a terminal or processor which relies on a centralized computer to some extent. However, distributed processing, in actuality, encompasses a continuum of data processing configurations, ranging from the latter to a network of computers connected via communications technology, with no one computer considered centralized.

The important concept here is that the technology provides for many possibilities of equipment configuration; the question is how does the manager approach the decision making process to determine the best alternative for the task, the organization and the technology.

Purpose and Scope

In response to the need for an approach to decision making in the centralization/decentralization dilemma in the design of computer based information systems, a research project under the direction of

Professor John F. Rockart at the Massachusetts Institute of Technology Center for Information Systems Research (CISR) was initiated. One result of this research is a practical decision-making model outlined in the unpublished master's thesis: Centralization Versus Decentralization of Information Systems: A Framework for Decision Making, by Joav Steve Leventer[1].

As part of the CISR research project, this thesis attempts to apply the preliminary framework to data processing configuration questions currently being analyzed in an organization. The resulting decisions are compared to those actually made in the subject organization, and the insights gained are used to enhance and modify the framework.

Chapter. 2

THE ROCKART-LEVENTER FRAMEWORK

Introduction

The Rockart-Leventer Framework (hereinafter referred to as the R-L Framework) is essentially an orderly technique for dealing with the centralization/decentralization decision problem. The framework has three key elements:

1) a decomposition of the information systems function into subelements, all of which require independent treatment in doing a centralization/decentralization evaluation;

2) a set of environmental and technical constraints which apply throughout the information systems function, and each of which must be evaluated relative to the centralization/decentralization decision; and

3) a mechanism for applying constraints to functional sub-elements to yield centralization/decentralization alternatives, and finally for evaluating alternatives relative to costs, performance and effectiveness.

Decomposition

The framework decomposes the information systems function into two dimensions:

- overall functional processes (and resources used);
- the subject matter of the functional processes; that is, the set of applications to which the information system is applied, and the phases of processing each application must go through;

The first dimension is subdivided into the following three broad processes[1] (please refer to Figure 2-1 , the Decomposition Table):

Systems Development - the process of designing and implementing new computerized information systems;

Systems Operations - the process of 'running' computerized information systems;

Systems Management - the process of managing the information systems function, that is, setting strategy, planning, and doing future research.

		subprocess/ resource	overall	Order Entry	Sales & Marketing	Payroll & Personnel
SYSTEMS DEVELOPMENT	Sub-Processes	functional design				
		detail spec/devel				
		implementation				
		maintenance				
	Resources	personnel				
		hardware				
		budget				
SYSTEMS OPERATIONS	Sub-Processes	processing				
		data base management				
	Resources	hardware and software				
		data base				
		personnel				
		budget				
SYSTEMS MANAGEMENT	Subprocesses	strategic planning				
		management control				
		systems research				
		technical methods				
	Res	personnel				

Figure 2-1 The R-L Framework Decomposition Table

Within each process there are two categories: the group of subprocesses contained within the overall process, and the resources necessary to support them.[2]

Systems Development

- Subprocesses
  - Functional Design
  - Detail Specifications/Development
  - Implementation
  - Maintenance
- Resources
  - Personnel
  - Hardware
  - Budget

Systems Operations

- Subprocesses
  - Processing
  - Data Base management
- Resources
  - Hardware and Software
  - Data Base
  - Personnel
  - Budget

Systems Management

Subprocesses

Strategic Planning

Management Control

Research

Technical Methods

Resources

Personnel

The second dimension of the decomposition consists of the various applications which are processed by the function. Baggeroer and Fox[3] have presented the concept of a Logical Application Group (LAG) to classify the components of the subject matter. An LAG is a grouping of computer programs and their associated files or data bases, that, when combined, form the requisite subsystem for processing a particular function of the organization. For example, the programs that make order entry processing possible, form an LAG.

This subject matter or LAG dimension may be further subdivided into the phases of the processing. In the original thesis, Leventer discusses three phases[4]. However, in the continuing research, four basic phases have been identified:

Edit and Control - the process of entering and verifying current data;

Update – the process of amending the files or data bases;

Processing – the processes of integrating updated information with other LAGs or of reworking already updated information;

Reporting – the process of preparing printed reports.

Constraints

The framework includes a large collection of constraints in three categories:

- organizational constraints deriving from the nature of the relationship between the parent and subunit of the organization involved in the centralization/decentralization decision,

- application constraints deriving from management and other general requirements of the application being implemented,

- technical constraints deriving from processing requirements of the application.

The constraints of the R-L Framework are listed in total in Figure 2-2. These constraints were compiled by Leventer through an extensive literature search. The implications of each constraint are derived from arguments presented in the literature and, although based on empirical data, should be considered hypotheses[5]. The strength rating applied to each (i.e. strong or weak) indicates limits on how far the direction should go. For example, a 'strong' constraint pointing toward centralization implies that complete decentralization should be avoided. A 'weak' constraint implies the direction to a lesser degree.

Note that the list of constraints is extensive; indeed one of the objectives of this thesis was to test the utility of these constraints, and to recommend any addition or changes that might be required.

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT							SYS. OPERATIONS						SYS. MGT.		
				func. des.	det. specs.	implement.	maint.	staff	hardware	budget	processing	D.B. mgt.	h/w & s/w	data base	staff	budget	strat. plan.	mgt. control	res./tech.
ORGANIZATIONAL UNIT	GENERAL																		
	-decentralized from within	decent.	strong	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	-uniformity of planning & control system & other rpts	cent.	weak	✓	✓	✓	✓	✓	✓	✓		✓					✓	✓	✓
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DATA PROCESSING																		
	-currently centralized	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	-currently decentralized	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
SUBUNIT	NATURE OF TASK																		
	-highly specialized	decent.	strong	✓		✓						✓		✓				✓	✓
	-independent	decent.	weak	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓			
	-change/uncertainty	decent.	strong	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	
	-fast growth	decent.	weak	✓		✓				✓		✓		✓					
	-entrepreneurial	decent.	weak	✓		✓				✓		✓		✓				✓	
	-high technology/knowledge workers	decent.	weak	✓		✓				✓		✓		✓				✓	
	OTHER FACTORS																		
	-geographically separate	decent.	weak	✓		✓					✓	✓	✓	✓	✓	✓			
	-political considerations	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
	-organizational size-small	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	-depth of mgt. talent avail.	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	-experience with D.P.	decent.	weak	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

Figure 2-2 Contingent Constraint Table (page 1 of 3)

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT							SYS. OPERATIONS					
				func. des.	det. specs.	implement.	maint.	staff	hardware	budget	processing	D.B. mgt.	h/w & s/w	data base	staff	budget
LOGICAL APPLICATION GROUP	NATURE OF APPLICATION															
	-strategic planning	cent.	strong	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-management control	cent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-operational control	decent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-process control	decent.	strong	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-highly sensitive & critical for subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	-high degree of involvement from subunit mgt.	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-specific to subunit	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-intention to consolidate/ integrate the function	cent.	strong	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	SPECIFIC REQUIREMENTS															
	-high degree of DP expertise required	cent.	weak	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
	*-sophisticated technology/ processing	cent.	weak	✓	✓	✓	✓	✓	✓		✓		✓		✓	
	-reliability or lack of vulnerability critical	decent.	strong								✓	✓	✓	✓	✓	✓
	-response/turnaround time	decent.	strong								✓	✓	✓	✓	✓	✓
	-adaptability to rapid change critical	decent.	weak	✓		✓	✓	✓	✓	✓		✓				
	-integration with files from other LAGs	cent.	strong	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
	*-special equipment required	decent.	weak	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓

Figure 2-2 Contingent Constraint Table (page 2 of 3) *Note these constraints are changes from original.

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT: func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS: processing	D.B. mgt.	h/w & s/w	data base	staff	budget
edit and control	-task complex	decent.	weak								✓		✓	✓		
	-custom tailored user interface	decent.	weak	✓						✓	✓		✓	✓		
	-data communication errors critical	decent.	strong								✓		✓	✓		
update &/or processing	-need for large, complex computing	cent.	strong								✓		✓	✓		
	-large memory required intermittently	cent.	strong								✓		✓	✓		
	-complex processing	cent.	strong		✓	✓	✓	✓			✓		✓	✓	✓	
	-use of data base technology	cent.	weak		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
reporting	-complex variable custom tailored reporting	decent.	weak	✓	✓	✓		✓		✓	✓		✓		✓	

Figure 2-2 Contingent Constraint Table (page 3 of 3)

Yielding and Evaluating Alternatives

Evaluating the centralization/decentralization decision for a particular LAG involves the following steps:

- Select from the available constraints those applicable to the particular LAG and organization under consideration,

- Determine the dominant constraints,

- Fill in the Decomposition Table with the most appropriate decision for each cell, in light of the effects of the identified constraints,

- Evaluate the alternatives in light of the preferred decisions.

These three elements - Decomposition, Constraints and Alternatives - illustrate the basic dimensions of the centralization/decentralization decision, underline the complex nature of the decision, and show how the decision can be decomposed (hence Decomposition Table) into manageable decisions. Since, within each cell of the decision making framework there is a choice of centralization, decentralization or distributed there are in reality many decisions. Of course, some of the combinations of elements are not logical (as discussed by Leventer[5]), however, one is still left with an abundance of possibilities.

Summary

This chapter outlined the decision making framework that is explored in the remainder of this thesis. The basic elements and dimensions of the framework were discussed, with information given about how the framework is applied to a practical situation. In the next chapter the details of the research design are described.

Chapter 3

THE RESEARCH DESIGN

The overall aim of this research is to examine how an organization goes about making the data processing configuration decisions, and to compare the results of those decisions to the results using the R-L Framework. The organization chosen for this research is described in detail in Chapter 4. Briefly, it is a large United States bank located in the north east, with a primarily centralized data processing enviroment.

In order to have the benefit of current, or at worst, recent experiences, I identified those projects in the bank that were in the process of design where centralized, decentralized and/or distributed alternative configurations were being considered. Given, one, that the data processing tradition in this organization is toward centralized operations and, two, that cost/benefit analysis is the primary guideline for approval, it was hypothesized that the bank's project team evaluation of a decentralized or distributed approach would be thorough, and would therefore, be an interesting one to compare with the framework.

Throughout this thesis when a subprocess or resource is characterized as centralized, it should be understood that the comparison is being made not only between the subunit and its parent unit, but also between the subunit and the rest of the organization.

Five current or recent project areas were investigated:

- Money Transfer System
- Consumer Finance Credit Scoring System
- Portfolio Management System
- Commercial Accounts Profitability System
- Foreign Exchange System

The following research design outlines the investigation for each case study:

1) Description of the existing (or former) process.
2) Identification of concerns which served to indicate change.
3) Description of the bank's research and decision.
4) Application of the R-L Framework.
5) Comparison of 3) and 4).
6) Implications for the R-L Framework.

The application of the R-L Framework consists of working through the Constraint Table, identifying the constraints which are appropriate in light of the particular details of the situation. The entire table of Constraints is reproduced for information with each example. Those constraints which are applicable are filled in across the table. The others are listed with the notation 'n/a' standing for 'not applicable.'

From among the applicable ones, the constraints judged dominant are chosen. This judgment is a subjective one based on the details of the situation and the opinions of the individuals interviewed. The

Decomposition Table is then filled in, indicating the most appropriate alternative for each cell, in light of the implications resulting from the identified constraints. For example, if the constraint: SUBUNIT/ NATURE OF TASK/HIGHLY SPECIALIZED is identified, it implies a decentralized approach to functional design and implementation during Systems Development. That constraint is translated into 'distributed' in the cell of the Decomposition Table in that it implies strong user involvement with the centralized EDP design staff. Note that the existing structure of the bank influences this outcome. The subunits of the bank do not contain data processing expertise to the extent that the functional design subprocess could be entirely decentralized.

In some of the case examples the Decomposition Table is used to illustrate the results of a specific alternative along with the ideal decisions. The differences show up in the Update and Processing columns. If a configuration is <u>completely</u> decentralized or <u>completely</u> centralized

then Update and Processing are one phase. Only in the instance of a distributed configuration do the phases involve separate tasks.

Also note that the Systems Management dimension only applies when looking at the information systems function in total, across all LAGs. It is therefore only addressed at the end of the five case studies, in examining the bank as a whole.

The completed Decomposition Table illustrates the preferred alternative for each decision that must be made in the design of the LAG.

Note that when constraints are referred to in the text, the following formate will be used throughout the thesis so that the reader can find the individual entry in the Table:

General Area/Constraint Category/Constraint

Example: SUBUNIT/NATURE OF TASK/HIGHLY SPECIALIZED.

In light of their extravagant use throughout the thesis, the following terms should be clearly defined:

Centralized - Subprocesses that are performed by the parent unit, Resources that are all located with the parent unit.

Distributed - Subprocesses that are performed by a combination of the parent unit and subunit (matrixed), Resources that

are partially located with the parent unit and partially located with the subunit.

Decentralized - Subprocesses that are entirely performed by the subunit, Resources that are all located with the subunit.

The obvious drawbacks for interviewer-based data gathering are two: 1) the influence of subjective analyses of the individuals being interviewed, and 2) the interviewer's personal interpretation of what is being said in the interview. Because of the amount of time spent at the bank, and the number of interviews conducted, on 'both sides' of the issue, I feel these drawbacks have been somewhat mitigated. In addition, what I am examining is the decision making processes of the individuals whom I have interviewed. Therefore, the personal biases of these individuals are relevant to the processes being examined.

Summary

This chapter outlined the aim of the thesis and the research design that is employed throughout. In addition the major drawbacks inherent in the research design have been stated. The next chapter will present a general description of the organization chosen for the in-depth research.

Chapter 4

THE GREAT EASTERN BANK[1]

Background

The organization chosen for the first series of case studies is a major United States bank located in the northeast. The Great Eastern Bank (GEB) is organized into seven line divisions with profit center responsibility, and four service divisions (please see Figure 4-1).

Line Divisions

- Commercial Banking - includes all commercial client accounts (organized by geographic region), real estate investment, and special factoring. This division is the major profit center of the bank.

- Investment - includes the bank portfolio management and customer portfolio management. This division is number two in profitability.

- Retail Banking - includes Consumer Finance (primarily personal loans, automobile loans and Master Charge accounts) and branch banking offices.

- Trusts - includes all trust security portfolios being managed by the bank.

- International - includes the domestic operations for international offices, Edge Act subsidiaries, and the banking operations worldwide.

- Deposit and Corporate Services - includes Operations (check processing, money transfer), shareholder services, mutual funds.

- Public Relations and Advertising - includes all the public relations activities of the bank.

Service Divisions

- Finance - includes the Controller, Accounting, and Tax departments.

- Personnel - includes payroll and personnel.

- General Services - includes buildings, maintenance, transportation, and cafeteria services.

- EDP Services - includes all data processing services for the bank and the corporation.

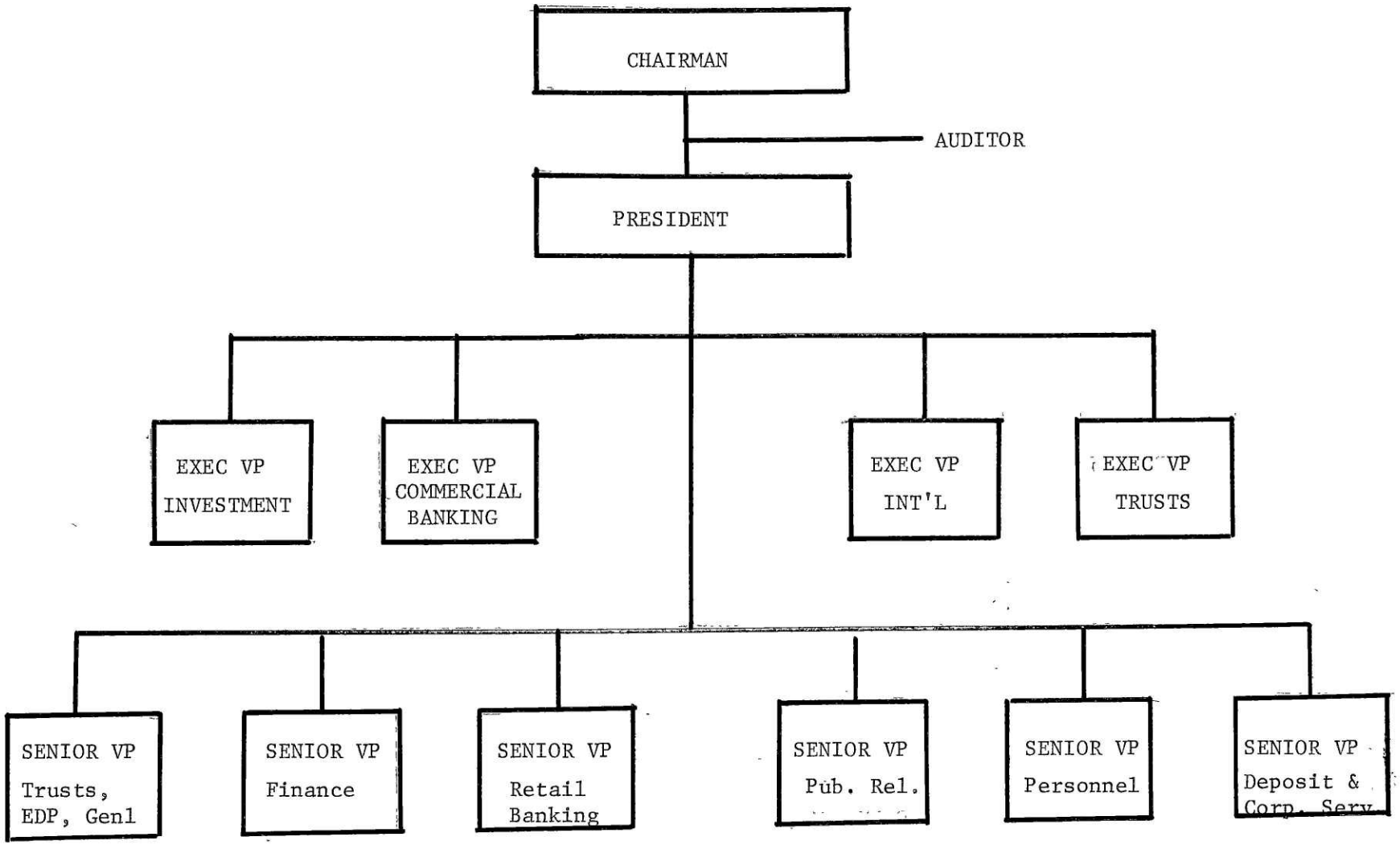

Figure 4-1 Great Eastern Bank Organization Chart

The Great Eastern Bank has been in the forefront of the United States banking industry in using data processing to automate banking functions. Currently the moving force behind GEB's data processing efforts is the head of the EDP Services Division, Mr. Simon Williams, an executive vice president of the bank, experienced in both banking and data processing. This individual is a strong leader and relentless in his desire to demonstrate the applicability of data processing techniques to banking functions.

Mr. Williams is an advocate of long range planning, and has been operating under a five year plan for EDP Services since 1970. The new five year plan to cover the second half of the seventies, states three main objectives:[2]

- Service Assurance - to ensure that the Bank's computer operations are stable and reliable at all times.

- Product Planning - to seek out new and innovative automation frontiers to cut costs and/or lead to better management control.

- Corporate Support - to extend EDP support to the corporation as a whole.[3]

Mr. Williams has successfully supported the objectives while maintaining a stable staff and budget: staff level has been constant at approximately three hundred employees since 1970; budget has been stable, 1970 -$6.8

million and 1974 - $7.6 million. Part of this success is the management control system that he created to serve two ends:

1) Technology Efficiency - that is to develop an efficient solution to a given problem;

2) User Effectiveness - that is to design the system that a user wants.

This management control system is initiated when a project is being developed. However, because of the maintenance and enhancement requirements of data processing applications, the Project Team created by the design effort remains to coordinate the on-going operation of the application.

Within EDP Services is the Systems Research department, headed by Mr. Mark Merwin, a vice president. Systems Research handles the design, building, implementation and maintenance of all data processing for GEB.

For each project undertaken, Mr. Merwin appoints a Project Director from Systems Research and requests that a Systems Coordinator from the user division involved be assigned. Both the Project Director and the System Coordinator are usually at the assistant vice president level, and have the authority to make decisions and commit resources for their respective divisions. The Project Director is responsible for managing a group of analysts and programmers who have been assembled to get the job done. The Systems Coordinator is responsible for the user input to the design and implementation of the application.

Since the Project Management System has been functioning for a number of years, and experience generally leads toward specialization, each division of the bank has a 'permanent' Systems Coordinator who acts as the chief liaison between his or her group and Systems Research. On the EDP Services side, each Project Director has a relatively permanent assignment to certain user groups, and the analysts and programmers generally work in the same functional area from project to project.

Within the framework of the Project Management System the user is generally responsible for the 'what' and the Project Director is responsible for the 'how.' However, depending on the knowledge and interest of the user, he or she may be more involved in the generation of ideas for the 'how.'

Project Life Cycle

The following are the major steps in the process of project initiation and design at the Great Eastern Bank:

1) Project Request from User Area to Systems Research

In general these requests involve enhancements to existing applications and are initiated by the Systems Coordinator. Infrequently, a user area will come up with a totally new idea for employing automated data processing techniques. More often, Mr. Williams initiates this type of project.

The Project Director then puts together cost estimates based on the preliminary design work, while the Systems Coordinator prepares justification for the project in terms of cost/benefit analyses, user requirements, etc.

2) Priorities Committee Review

The Priorities Committee is a creation of Mr. Williams, designed to be one part of the management control system. The committee was conceived of as a long range planning committee to coordinate all data processing project requests over the amount of $2500, based on a bank-wide plan for EDP growth.

Each project is reviewed and a decision made based on the cost/benefit analysis and on the recommendation of Systems Research.

If a project is approved, the Project Team goes ahead with the design, building and implementation stages. If approval is not recieved, the project is abandoned.

3) Design, Building and Implementation

This stage requires close cooperation between the Systems Research staff and the user area in order to implement Mr. Williams' goals of Technological Efficiency and User Effectiveness. The costs for this stage, primarily analyst and programmer time and computing time, are charged to the user. Since Systems Research approximated the costs prior to

Priorities Committee approval, they feel they have a responsibility to perform approximately within the estimated costs. They therefore have a policy of assuming any overrun above 20%.

4) Sign Off

The Systems Coordinator 'signs off' at the completion of the project indicating that the Project Director and Project Team have fulfilled their obligations. However, there is a continuing relationship to coordinate routine maintenance for the application. Any major redesign or enhancement would qualify as a new project.

5) Post Audit

The post audit is the mechanism that exists for review and evaluation of a completed project. The following areas are generally examined:

- timeliness - was the project completed on schedule, or within a reasonable approximation of schedule,
- budget - was the project completed within budget guidelines,
- expectations - did the results of the project development meet expectations,
- lessons - what lessons were learned in the course of the project.

The members of the post audit committee are:

- a representative from the Finance Division
- a representative from the Auditing Department
- a user representative (usually the Systems Coordinator)
- a Systems Research representative (usually the Project Dir.)
- a representative from Corporate EDP Planning and Support.

In recent years only one project has included the post audit stage of the life cycle.

Summary

This chapter has presented an overview of the organization of the Great Eastern Bank and details of the data processing function and its relationship to the rest of the organization.

It is necessary to keep in mind the goals, objectives and operating procedures of the EDP Services Division throughout the next chapter, which deals with the five in-depth case studies.

Chapter 5

FIVE CASE STUDIES

Introduction

This chapter presents the five in-depth case studies at the Great Eastern Bank:

Money Transfer System

Consumer Finance Credit Scoring System

Portfolio Management System

Commercial Accounts Profitability System

Foreign Exchange System,

and ends with an overview of the bank as a whole.
The entire table of Contingent Constraints is reproduced for information with each example. Those constraints which are applicable are filled in across the table. The others are listed with the notation, n/a, standing for 'not applicable.'

In the first case study an attempt has been made to explain the reasoning put forth by Leventer in assigning the direction implied by each constraint. For a complete analysis, the reader is directed to the original thesis. It is hoped that with these explanations the reader will be able to follow the arguments in the other case studies with less detail on the reasoning behind the framework.

THE MONEY TRANSFER SYSTEM - Case Study Number One

Description of the Existing Process

The Money Transfer function is carried out by the Operations area of the Deposit and Corporate Services Division. The function involves handling a low volume of high dollar value corporate customer accounts. The system must get the current information regarding transfers into and out of the accounts reported to the Federal Reserve System (via the Fed Wire) in a timely and accurate manner. The Federal Reserve System currently operates with Burroughs TC500 terminals which are paper tape based.

The processing system in use at the start of this study consisted of the following:

- Quantel minicomputer (8K)
- typewriter terminal
- tape resident files
- paper tape reader/punch

Input to the centralized customer file for updating demand deposit accounts and for management reporting is prepared on punched cards in a separate step.

Identification of Concerns which Served to Indicate Change

The Operations area became dissatisfied with the existing system for the following reasons:

- It was extremely slow, primarily due to the tape resident files.

- The Federal Reserve System was planning to convert to an on-line system, and had published the specifications for such a system.

- Other departments in the bank had much more modern systems. This one was considered archaic.

Description of the Bank's Research and Decision

A Project Director from Systems Research was assigned to analyze the problem. Working together with the Systems Coordinator from the Operations area, the Project Director investigated the functions of the Money Transfer

System and together they designed a normative model that satisfied the user's concept of 'what had to happen.' Primary features of the system included:

- Disk resident files for faster transaction processing,
- Mechanism for automatic updating of the centralized customer file,
- Punched paper tape output for compatibility with the existing Fed Wire terminal,
- Built-in specifications for the anticipated Fed Wire conversion to an on-line system.

The Project Director felt the needs listed could be met with at least two alternatives - an on-line system to the in-house IBM 370/158, or a stand-alone minicomputer based system.

The EDP Services division did not have in-house expertise in minicomputers, but had successfully designed on-line systems to meet the user requirements. In order to compare the two approaches, the Project Director issued an RFP (request for proposal) for a turnkey minicomputer-based system, and initiated in-house research into the design and costs for the on-line alternative.

As noted in Chapter 4, cost justification, and the cost/benefit analysis were key guidelines in deciding how to solve (or <u>if</u> to solve) a particular divisions data processing problems.

The RFP was sent to a variety of vendors and consultants experienced in the area. The bank did not ask for a novel concept in the proposal, because the Project Team had already conceptualized the system. The bank wanted a proposal for the delivered, up-and-running product.

Alternative One - On-Line System

Using the existing bank costing algorithm, and adding in new terminals, paper tape reader/punch, and software development, the Project Team determined an 8-10 year payback period and an unacceptably low rate of return. The bank's minimum rate of return is 6.5% (based on a discounted cash flow analysis) and maximum payback period is five years.

Alternative Two - Stand-Alone Minicomputer Based System

The proposal chosen for comparison to the on-line system consisted of the following:

- DEC PDP 11/35
- 8 CRT terminals
- Disk file storage
- Two 30 cps printers (one is the console)
- Paper tape reader/punch
- Magnetic tape output for updating central customer file.

The return on investment was 8% and the payback period five years. On the cost justification alone the decentralized system won. However, there were additional, less tangible benefits that could be listed in

its favor:

- The bank had DEC minicomputers elsewhere and was proposing an in-house capability in PDP assembly language. An additional DEC system added to the demand for this capability.

- The proposers of the system are located nearby and can handle maintenance and enhancements until an in-house expertise is created.

- The proposal included the readiness to go on-line when the Fed Wire did.

Application of the R-L Framework

1. Identification of Constraints

The Contingent Constraint table is used to examine the proposed system and determine primarily three things:

a) the direction (that is, centralized or decentralized) implied by the constraints,

b) the dominant constraints, that is the ones that bear most heavily on the decision,

c) how critical any of the constraints are in designing the system.

The table, as filled in for this application (see Table 5-1) indicates a direction primarily toward decentralization. Three of the fifteen applicable constraints point toward centralization. However, this

direction is somewhat mitigated by the situational factors as described for each case as follows:

DEPOSITS&CORPORATE SERVICES/GENERAL/UNIFORMITY OF PLANNING AND CONTROL SYSTEMS - "To the extent that an organization requires uniform reporting from its subunit, more centralization of information systems processes should be favored."[1] This is considered a weak constraint because the potential problems can be easily solved. And that is the case here: input of the subunit data (to the centralized reporting system) is carried out in the processing phase via an update tape.

DEPOSITS&CORPORATE SERVICES/DP/CURRENTLY CENTRALIZED - the data processing of the parent unit (Deposits and Corporate Services) is currently centralized. The framework implies that this is a strong constraint pointing toward centralization of the subunit because of the impact of change on the organization[2]. However, in the current situation, the subunit has been decentralized with respect to data processing, and therefore, no change is being proposed.

OPERATIONS/OTHER FACTORS/ORGANIZATIONAL SIZE-SMALL - Because the subunit is small, the framework implies a strong constraint pointing toward centralization. Leventer says, "There exists a lower limit on the size of the subunit to which any information systems subprocess can be completely decentralized."[3] The Money Transfer function is very small compared to the division, however, it is a highly independent function. It would therefore seem that size itself is not the important constraint, but the nature of the task is.

The two following constraints generally point toward decentralization, but because of the nature of the existing data processing environment, can be satisfied by either a centralized or decentralized system. However, it should be noted that both are dominant constraints in the design of the system:

MONEY TRANSFER SYSTEM/SPECIAL REQUIREMENTS/RELIABILITY OR LACK OF VULNERABILITY - This constraint points toward decentralization in the situation where the centralized data processing center is considered less reliable and more vulnerable because it is made up of one large processor.[4] However, at the GEB, not only are there three mainframe computers at the data processing center, but one of the three primary objectives of the EDP Services Division is 'Service Assurance.' The situational factors in this case nullify this constraint.

MONEY TRANSFER SYSTEM/SPECIAL REQUIREMENTS/RESPONSE/TURN AROUND TIME CRITICAL - This constraint points toward decentralization because on a centralized computer, response time depends on "those LAGs running concurrently" and it is therefore concluded that "the response time of a central computer is more variable and less certain."[5] The general validity of that statement cannot be questioned, however, again in this situation, with more than adequate centralized hardware, the data processing center has exhibited excellent response time on those on-line systems in use. Therefore, the user's needs with respect to response time are equally satisfied by a centralized or decentralized system.

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget	SYS. MGT. strat. plan.	mgt. contrl.	res./tech.
DEPOSIT&CORP. SERVICES	GENERAL																		
	-decentralized from within	decent.	strong	n/a															
	-uniformity of planning & control system & other rpt	cent.	weak	✓	✓	✓	✓	✓	✓	✓		✓					✓	✓	✓
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DATA PROCESSING																		
	-currently centralized	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	-currently decentralized	decent.	strong	n/a															
OPERATIONS	NATURE OF TASK																		
	→ -highly specialized	decent.	strong	✓		✓						✓		✓				✓	✓
	→ -independent	decent.	weak	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓			
	-change/uncertainty	decent.	strong	n/a															
	-fast growth	decent.	weak	n/a															
	-entrepreneurial	decent.	weak	n/a															
	-high technology/knowledge workers	decent.	weak	n/a															
	OTHER FACTORS																		
	-geographically separate	decent.	weak	n/a															
	-political considerations	decent.	strong	n/a															
	-organizational size-small	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	-depth of mgt. talent avail.	decent.	strong	n/a															
	-experience with D.P.	decent.	weak	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

Table 5-1 Contingent Constraint Table - Money Transfer System (page 1 of 3)

Key: → indicates dominant constraints

	THE R-LFRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT							SYS. OPERATIONS					
				func. des.	det. specs.	implement.	maint.	staff	hardware	budget	processing	D.B. mgt.	h/w & s/w	data base	staff	budget
MONEY TRANSFER SYSTEM LAG	NATURE OF APPLICATION															
	-strategic planning	cent.	strong	n/a												
	-management control	cent.	weak	n/a												
	-operational control	decent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-process control	decent.	strong	n/a												
	-highly sensitive & critical for subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	-high degree of involvement from subunit mgt.	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-specific to subunit	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-intention to consolidate/ integrate the function	cent.	strong	n/a												
	SPECIFIC REQUIREMENTS															
	-high degree of DP expertise required	cent.	weak	n/a												
	-sophisticated technology/ processing	cent.	weak	n/a												
	→-reliability or lack of vulnerability critical	decent.	strong								✓	✓	✓	✓	✓	✓
	→-response/turnaround time	decent.	strong								✓	✓	✓	✓	✓	✓
	-adaptability to rapid change critical	decent.	weak	n/a												
	-integration with files from other LAGs	cent.	strong	n/a												
	-special equipment required	decent.	weak	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓

Table 5 - 1 Contingent Constraint Table - Money Transfer System (page 2 of 3)
Key: → indicates dominant constraints

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
reporting update &/or processing edit and control	-task complex	decent.	weak	n/a												
	-custom tailored user interface	decent.	weak	✓						✓	✓		✓	✓		✓
	-data communication errors critical	decent.	strong	n/a												
	-need for large, complex computing	cent.	strong	n/a												
	-large memory required intermittently	cent.	strong	n/a												
	-complex processing	cent.	strong	n/a												
	-use of data base technology	cent.	weak	n/a												
	-complex variable custom tailored reporting	decent.	weak	n/a												

Table 5-1 Contingent Constraint Table - Money Transfer System (page 3 of 3)

Two additional dominant constraints in the design of the Money Transfer System LAG were identified: (Note dominant constraints are indicated in the table by arrows)

- Highly specialized task within the subunit
- Independent task within the subunit.

The LAG will be carried out only in this one area of the bank, and the information generated will not be used by any other subunit in the bank. The LAG does not need access to other subunit information, nor to centralized data bases. The only link to the rest of the bank is that the outcome of a day's processing will be used to update the central customer data base, and as input to the management reporting system. This can be accomplished via the daily update tape proposed in the stand-alone minicomputer based system. In this sense the minicomputer based solution can be thought of as distributed rather than totally decentralized.

2. Decomposition of the Decision

Having determined the applicable constraints and which of those are dominant, the cells of the Decomposition Table can be filled in to identify the preferred decisions for each subprocess. Each cell can be 'centralized,' 'decentralized,' or 'distributed':

centralized cells indicate that the task should be primarily carried out at the centralized data processing center and/or by centralized data processing personnel,

decentralized cells indicate that the task should be primarily carried out at the decentralized user area, and/or by decentralized user personnel,

distributed cells indicate some combination of centralized and decentralized locations and/or personnel.

The nature of each cell is determined by the constraints identified together with the situational factors discussed.

The first process examined with the Decomposition Table (see table 5-2), Systems Development, reflects the project team concept at the bank. Each cell under Subprocesses is either distributed or centralized:

distributed cells indicate where the task design should be addressed by both the user and the data processing experts,

centralized cells indicate where the task design should be primarily carried out by data processing experts.

The cells under Resources also indicate the mixture of resources desired:

distributed or centralized, as above, for personnel,

decentralized hardware is desired except when the LAG is integrated with the centralized data base (Processing),

		subprocess/ resource	edit & control	update	processing	reporting
SYSTEMS DEVELOPMENT	Subprocess	functional design	dist.	dist.	c	dist.
		Detail specs/ development	c	c	c	c
		implementation	dist.	dist.	c	dist.
		maintenance	c	c	c	c
	Resources	personnel	dist.	dist.	c	dist.
		hardware	dc	dc	c	dist.
		budget	dc	dc	dc	dc
SYSTEMS OPERATIONS	Sub-process	processing	dc	dc	c	dist.
		data base mgt.	-----	c	c	-----
	Resources	hardware and software	dc	dc	c	dist.
		data base	dc	dc	c	dist.
		personnel	dc	dc	c	dist.
		budget	dc	dc	dc	dc

Table 5-2 Decomposition Table - Money Transfer System
Key: c-centralized dc-decentralized dist.-distributed

distributed hardware is indicated under Reporting because the phase should be carried out both centrally and decentrally,

decentralized budget indicates that all charges for Systems Development will be carried by the line division, in accordance with the bank procedures.

The Systems Operations process can be analyzed in the same manner and presents a snapshot of the 'ideal' (ideal in that it satifies the user's needs as expressed by him/her) configuration as it will operate on a day-to-day basis. The Decomposition Table illustrates that the phases of Edit and Control and Update are primarily the responsibility of the user, Processing is primarily the responsibility of EDP Services, and Reporting involves tasks at both levels in the organization.

This analysis clearly demonstrates the preference for a primarily decentralized approach to the design and operation of the Money Transfer System.

3. Comparison of Alternatives

Once the constraints and decision characteristics are examined, three dimensions are recommended for comparing the alternative configurations[6]:

- Cost - of performing a given process
- Time - to perform the process
- Effectiveness - of the process.

Because of the configuration of the data processing center, its reliability and capacity to handle on-line systems, there is no difference in performance between the two alternatives along the dimensions of time and effectiveness. Both the on-line system and the minicomputer based system will get the job done effectively and within the time requirements of the user.

The differences arise only along the cost dimension. The bank looks at two aspects of cost:

- Actual dollar costs, which include savings in number of people and in time which together allow staff to be moved to other functions.

- Intangible benefits, e.g., customer service, response to regulatory requirements.

Because the proposed system is in effect an upgrading of an existing system, the savings in people turns out to be very small - primarily in the area of faster processing. The costing algorithm for the on-line system, in addition to actual charges for CPU time, core usage, disk usage, etc., includes an 'application charge' which is a flat rate for processing each application, regardless of size. Therefore, small applications

share in the operating costs of the data processing center and bear the same burden (in terms of application charge) as large ones. Since there is no appreciable people-savings to offset the development and operating charges from EDP Services, the costs of the on-line alternative are high. Using discounted cash flow analysis, an 8-10 year payback period, and a rate of return less than the bank's minimum were calculated. In comparison the cost of the minicomputer based system was low enough to generate a 5 year payback period and an 8% rate of return. Therefore, in this example, the importance of the costing algorithm in making the final decision is paramount.
The important intangible benefit in this situation is the readiness to go on-line when the Fed Wire does.

As a result of the analysis using the R-L Framework, the decision would be to implement alternative number two, the decentralized minicomputer based system.

Comparison of the Two Decisions

Prior to the cost/benefit analysis, the R-L Framework indicated that a decentralized approach to the Money Transfer System was preferred. The bank's decision was really made on the basis of the cost/benefit analysis. Therefore, an interesting question in this case is, what if, in light of the strong indication from the framework toward decentralization, the cost had tipped the scales toward centralization. This could easily be true if the alogorithm employed to charge users were changed, or

if transfer pricing were not used at all. The answer lies in judging how critical any of the constraints really are in this decision.

The two dominant constraints - highly specialized task and independent task - are not critical in making the decision between centralized on-line and decentralized minicomputer based. In either instance the user's need, demonstrated by these two constraints, would be served.

Implications for the R-L Framework

One hypothesis that might be proposed as a result of this case study is that the preferred decision indicated by the R-L Framework will always be the less expensive alternative.

In order to fully investigate this hypothesis, it would be necessary to gain access to the real costs involved in each decision.

However, given that the majority of data processing centers today use some form of transfer pricing for charging users, unless the LAG uses the mainframe efficiently (e.g., accesses central data bases, integrates with files from other LAGs, needs complex computations) the costs are going to be higher than on a decentralized system. In other words, the economies of scale are lost if the application is too 'easily' processed. A parallel problem in another industry is that of using an offset press for a run of 15 copies. Therefore, this example suggests the need for an additional constraint relative to costing.

Another observation resulting from this case study is that the organizational size constraint had no bearing on the decision. Theoretically, the argument offered by Leventer with respect to this constraint is reasonable, however, perhaps not critical. It would seem, in most cases, that in the tradeoff between size and other constraints, such as nature of the application, size would be inconsequential.

On this basis it is recommended that the organizational size constraint is not necessary and should be eliminated.

THE CONSUMER FINANCE CREDIT SCORING SYSTEM - Case Study Number Two

Description of the Existing Process

Consumer Finance is located in the Retail Banking Division and is the number one customer of Systems Research in terms of number of data processing projects.

Currently Consumer Finance employs 10-12 people who process incoming applications for credit. The applications are of four major types: personal loans, automobile loans, revolving credit, and Master Charge. A manual scoring system, designed by the leading firm in consumer credit scoring systems, is used to differentiate the applications into three categories: definite approvals, definite rejections and those applications that need more analysis in order for a decision to be made. The results of this manual procedure are batched and coded, then sent to the data processing center for processing. Processing involves keypunching and running on the computer. The computer system sets up new customer files for those applications that are approved, maintains a file of rejected applications and maintains a file of those applications still in process.

Identification of Concerns which Served to Indicate Change

There are five major factors that led to the examination of this process for possible automation:

- The credit scoring system is very labor intensive, and therefore, time consuming and error prone. In addition there is a high customer service aspect of the system because of numerous customer inquiries as to the status of their applications.

- The Consumer Finance area is heavily regulated by both state and federal governments and is, therefore, subject to constant change. The changes entail teaching the credit scorers new systems and having them use newly designed forms.

- The Consumer Finance area is competitive with that of other banks, and is therefore subject to marketing pressure for change.

- The application seemed to be a natural one for automation.

- The leading firm in consumer credit scoring systems (CCSS, Inc.) has a newly designed, computer based approach to automating the task.

Description of the Bank's Research and Decision

Initially the bank did no analysis of the alternatives. Consumer Finance had worked with CCSS in the past, felt that CCSS had an excellent track

record, and decided to buy the new system CCSS had to offer. Systems Research did not have any particular expertise in the area, and could not respond within the time period that Consumer Finance wanted to work. Therefore, Systems Research raised no objection to the proposal to purchase the CCSS system.

The CCSS system, 'Automated Applications Processing' is currently installed and successfully running at a major United States bank on the West Coast. It is described as a stand alone minicomputer based system consisting of the following:

Data General Nova minicomputer

Ampex disk

Wangco Tape Drive

G.E. printer

Hazeltine CRT

Western Electric communications equipment

CCSS proposed to have the system running at GEB in six months. The hardware costs were approximately $70,000. The installed system would perform the following tasks:

- credit scoring
- applications processing consisting of a record of each application, what stage it was in, what decision had been made
- automated customer inquiry

- communications with the bank's mainframe to set up new customer files
- the printing and sending out of rejection notices
- maintaining operator statistics.

The hardware required a specially designed operating area where temperature, humidity, dust, and vibration were controlled. And, in addition, the proposed system would involve a dedicated trunk line to CCSS headquarters in California, in order to enlist their aid in troubleshooting and debugging.

When the details of the CCSS system and its requirements became known to Systems Research, the department started to question the quality of the proposed configuration, and had some apprehensions about going ahead without analysis. Systems Research convinced Consumer Finance to back up and examine the requirements and alternatives for providing solutions.

A Project Director was assigned to work with the Consumer Finance Systems Coordinator in order to define requirements and then look at the CCSS system in detail, along with other feasible alternatives.

Consumer Finance expressed its needs in terms of a system that could resolve the concerns listed previously:

- automate a labor intensive area
- improve speed and accuracy

- be able to respond to customer inquiries
- have a system flexible enough to respond to regulatory and marketing-based pressures.

The time constraint previously stated was somewhat lessened because Consumer Finance was involved in a large number of data processing projects and could not support the credit scoring system project immediately.

Since the CCSS system was highly admired, the Project Director looked closely at its details. However, he identified the following problems specific to this situation:

1) The stand-alone minicomputer based system was not stand alone. The proposed system would be heavily dependent on the centralized customer data base, and would be tied into the bank's existing inquiry system, CIS (Central Inquiry System).

2) The bank would be entirely dependent on CCSS for maintenance and enhancements because of the unusual equipment configuration and because the system language is one created by CCSS called 'PROSPER.' This was troublesome because CCSS is located in California and the Consumer Finance area is a highly volatile one, due to regulatory and market pressures.

3) The proposed configuration was an unusual conglomeration of equipment that had only been installed in one location. This raised questions about its reliability. It also had a high price tag.

4) The proposed system posed a security question in that CCSS would have access, via the dedicated trunk line, to the bank's entire customer files.

Because of these concerns, the Project Director decided to make a counter proposal to design and build the system in-house. Since the centralized customer file is maintained on-line all day, with access via CIS, the proposed system would be tied into it with CRT terminals. Credit scoring and applications processing would be handled by the mainframe. The cost of the proposed on-line system was much less than the CCSS system for the following reasons:

- there is no incremental cost in using CIS,
- the programming effort required is standard,
- the only hardware that will be purchased is additional CRTs,
- CPU time to run the application is very low, therefore not expensive to the user.

The Systems Research on-line proposal was chosen by Consumer Finance for the following five reasons:

1) The on-line system was <u>much</u> cheaper.

2) The development work would be creating an in-house expertise in an area where future support and enhancement is expected to be high.

3) The system would tie together all the customer 'balance and status' inquiries, and thereby simplify the customer relations task in all banking areas.

4) The new system would involve fewer people to operate, would reduce

errors, and therefore, could be shown to reduce collection charges for delinquent accounts.

5) The proposed system eliminated the question of security of the customer data base.

The only drawback as far as Consumer Finance was concerned, was the 12-15 month development schedule. Since Consumer Finance could not support the effort immediately anyway, they were willing to accept the delay.

Application of the R-L Framework

1. Identification of Constraints

Working through the Contingent Constraint Table (please see Table 5-3), there are eleven constraints that point toward decentralization and nine constraints that point toward centralization - virtually a draw! However, of the dominant constraints (indicated with arrows), three point toward decentralization, while five point toward centralization. A discussion of the dominant constraints follows.

Constraints Leading Toward Decentralization:

CREDIT SCORING/NATURE OF APPLICATION/HIGHLY SENSITIVE AND CRITICAL FOR SUBUNIT - The credit scoring process has an important impact on the profitability of Consumer Finance. If errors lead toward a large number of delinquent accounts, Consumer Finance will have trouble reaching its profit goal. This constraint is classified as one leaning toward decentralization because the subunit has more 'invested' in the application

than the parent unit, and therefore, wants to have more control over it. However, at Great Eastern Bank, the user Systems Coordinator works closely with the Project Director to ensure the proper design of the function. Therefore, at GEB, this constraint does not necessarily lead toward decentralization. If, however, the project team were not 'distributed' this would be a significant constraint.

CREDIT SCORING/SPECIFIC REQUIREMENTS/RELIABILITY OR LACK OF VULNERABILITY CRITICAL - Consumer Finance expects a new Fair Credit Billing law to go into effect shortly which would require instantaneous access to account status information in order to reply to customer inquiries. Because the centralized data processing center has three IBM 370/158s, and also has an excellent track record for reliability, the user has no fears of an on-line system failing at a critical point. Therefore, this constraint does not point toward decentralization at GEB. Again, however, if GEB did have data processing center reliability problems, this would be a very significant constraint.

CREDIT SCORING/SPECIFIC REQUIREMENTS/ADAPTABILITY TO RAPID CHANGE CRITICAL- Because the distributed project team remains in existence for maintenance and enhancements, the user has access to expertise for rapid adaptation. This again is the particular situation at GEB which causes this significant decentralization constraint to not lead toward decentralization. Further, considering the particular alternative of the CCSS system, this constraint points away from decentralization.

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget	SYS. MGT. strat. plan.	mgt. control	res./tech.
RETAIL BANKING DIV.	GENERAL																		
	-decentralized from within	decent.	strong	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	-uniformity of planning & control system & other rpts	cent.	weak	✓	✓	✓	✓	✓	✓	✓		✓					✓	✓	✓
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	n/a															
	DATA PROCESSING																		
	-currently centralized	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	-currently decentralized	decent.	strong	n/a															
CONSUMER FINANCE	NATURE OF TASK																		
	-highly specialized	decent.	strong	✓		✓						✓		✓				✓	✓
	-independent	decent.	weak	n/a															
	-change/uncertainty	decent.	strong	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	
	-fast growth	decent.	weak	✓		✓				✓		✓		✓					
	-entrepreneurial	decent.	weak	n/a															
	-high technology/knowledge workers	decent.	weak	n/a															
	OTHER FACTORS																		
	-geographically separate	decent.	weak	n/a															
	-political considerations	decent.	strong	n/a															
	-organizational size-small	cent.	strong	n/a															
	-depth of mgt. talent avail.	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	-experience with D.P.	decent.	weak	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

Table 5-3 Contingent Constraint Table - Consumer Finance Credit Scoring System (page 1 of 3)

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
CONSUMER FINANCE CREDIT SCORING SYSTEM LAG	NATURE OF APPLICATION															
	-strategic planning	cent.	strong	n/a												
	-management control	cent.	weak	n/a												
	-operational control	decent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-process control	decent.	strong	n/a												
→	-highly sensitive & critical for subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	-high degree of involvement from subunit mgt.	decent.	weak	n/a												
	-specific to subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
→	-intention to consolidate/ integrate the function	cent.	strong	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	SPECIFIC REQUIREMENTS															
→	-high degree of DP expertise required	cent.	weak	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
→	-sophisticated technology/ processing	cent.	weak	✓	✓	✓	✓	✓	✓		✓		✓		✓	
→	-reliability or lack of vulnerability critical	decent.	strong								✓	✓	✓	✓	✓	✓
	-response/turnaround time	decent.	strong	n/a												
→	-adaptability to rapid change critical	decent.	weak	✓		✓	✓	✓	✓	✓		✓				
→	-integration with files from other LAGs	cent.	strong	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
	-special equipment required	decent.	weak	n/a												

Table 5-3 Contingent Constraint Table - Consumer Finance Credit Scoring System (page 2 of 3)
Key: → indicates dominant constraints

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
edit and control	-task complex	decent.	weak	n/a												
	-custom tailored user interface	decent.	weak	n/a												
	-data communication errors critical	decent.	strong	n/a												
update &/or processing	-need for large, complex computing	cent.	strong	n/a												
	-large memory required intermittently ←	cent.	strong								✓		✓	✓		
	-complex processing	cent.	strong		✓	✓	✓	✓			✓		✓	✓	✓	
	-use of data base technology	cent.	weak		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
reporting	-complex variable custom tailored reporting	decent.	weak	n/a												

Table 5-3 Contingent Constraint Table - Consumer Finance Credit Scoring System (page 3 of 3)
Key: ← indicates dominant constraints

Constraints Leading Toward Centralization:

CREDIT SCORING/NATURE OF APPLICATION/INTENTION TO CONSOLIDATE/INTEGRATE THE FUNCTION - The integration of the customer relations areas for efficient 'balance and status' inquiries is important to the Retail Banking Division as a whole.

CREDIT SCORING/SPECIFIC REQUIREMENTS/HIGH DEGREE OF DATA PROCESSING EXPERTISE REQUIRED - In order to respond to the changes required by regulatory and marketing pressures, the credit scoring function will have to call on data processing expertise frequently.

CREDIT SCORING/SPECIFIC REQUIREMENTS/SOPHISTICATED TECHNOLOGY/PROCESSING - An important aspect of the system is its inquiry nature, therefore, it will be depending on CIS.

CREDIT SCORING/SPECIFIC REQUIREMENTS/INTEGRATION WITH FILES FROM OTHER LAGs- The output of the credit scoring system must be integrated with the centralized customer data base.

UPDATE AND/OR PROCESSING/LARGE MEMORY REQUIRED INTERMITTENTLY - The credit scoring function relies on large files of demographic information, that can only be maintained on a large mainframe computer.

This analysis of the dominant constraints points strongly in the direction of a centralized information system approach to the credit scoring LAG.

2. Decomposition of Decision

With the important constraints in mind, the Decomposition Table can be filled in (see Table 5-4). The phases of Update and Processing are separate in the case of the CCSS proposal because there is remote processing for some of the credit scoring function. It is filled in only to show how that alternative would look if considered while filling in the table.

Ignoring the Update column, the analyis shows the following:

1) Edit and Control should be distributed during Systems Development to include the user's input (except for detailed specifications). Maintenance would be carried out primarily by the centralized data processing staff. Other than in the area of data base management, which requires a high degree of expertise, Systems Operations is entirely distributed.

2) Processing and Reporting should be developed and carried out entirely at the centralized level, except in instances during Operations when remote operating personnel may be involved in processing.

3) The budget throughout is decentralized to the user, Consumer Finance.

Filling out the Decomposition Table in order to show the preferred decisions if the specific CCSS system is considered, really only serves to add the Update phase.

		subprocess/ resource	edit & control	update *	processing	reporting
SYSTEMS DEVELOPMENT	Subprocess	functional design	dist.	c	c	c
		Detail specs/ development	c	c	c	c
		implementation	dist.	c	c	c
		maintenance	c	c	c	c
	Resources	personnel	dist.	c	c	c
		hardware	dist.	dc	c	c
		budget	dc	dc	dc	dc
SYSTEMS OPERATIONS	Sub-process	processing	dist.	dc	c	c
		data base mgt.	c	c	c	---
	Resources	hardware and software	dist.	dist.	c	c
		data base	c	dist.	c	c
		personnel	dist.	dc	dist.	c
		budget	dc	dc	dc	dc

Table 5-4 Decomposition Table - Consumer Finance Credit Scoring System
*Note this phase only included for information regarding CCSS system.

3. Comparison of Alternatives

Looking at the three dimensions for comparing alternatives, cost, time, and effectiveness, the important difference can be ascertained. Both the CCSS system and the on-line system are effective in getting the application processed, and take approximately the same amount of time to perform the process. The major difference between the two proposals is cost. For the reasons pointed out in the discussion of the bank's analysis, the on-line system was fantastically less expensive:

- no incremental cost in using CIS
- minimal programming effort
- only new hardware to be purchased is CRTs
- CPU time to run LAG on the mainframe is low.

The R-L Framework analysis would chose the on-line system as better suited to the needs of the situation.

Comparison of the Two Decisions

Both the bank analysis and the framework analysis lead to the choice of the on-line system. This would appear to be so because the project team clearly identified the requirements of the credit scoring system, and clearly identified the constraints that pushed the decision toward an on-line, centralized system. In addition, cost played an important role.

However, again, the interesting question is, what if, the CCSS system had been less expensive that the on-line system. In this particular case,

that's an intriguing questions because the costing algorithm is not parallel to that of the Money Transfer System. In the Money Transfer case, the user was charged for all 'aspects' of the data processing involved in running the application. In the credit scoring case, there was no charge for using CIS because it was already maintained on-line all day. The CCSS system perhaps would have been designed differently if there had been a charge for CIS and the then the cost comparisons could have been quite changed.

The R-L Framework analysis would still be a strong indication to go centralized, unless the decentralized alternative was so much less expensive as to allow the subunit to build its own in-house expertise to respond to changes in its environment.

As pointed out in the discussion of the individual constraints, the R-L Framework analysis would bear strong evidence for decentralizing this application in a different organizational climate.

Implications for the R-L Framework

This case study points out the situational influences that can alter the nature of a constraint. It is important to consider the constraints, however, it is critical to consider them in light of the individual organization.

An additional constraint suggested here is one indicating whether or not data processing expertise is already available in the subunit. If it is, a direction toward decentralization would be implied.

The last two case examples suggest an important implication for the framework: the direction indicated by some constraints may be contingent on organizational factors. An example of this is the constraint 'reliability or lack of vulnerability' shown to be a strong constraint indicating decentralization. If an organization, as in the case of the bank, has a proven reliable and not vulnerable centralized data processing environment, then the constraint is a strong one indicating centralization.

THE PORTFOLIO MANAGEMENT SYSTEM - Case Study Number Three

Description of the Former Process

The Trust Division of the Great Eastern Bank employs approximately 50 portfolio managers who must analyze a wide variety of data in order to make decisions about investments for the security portfolios each one manages. The portfolios are owned by a range of customers, running the gamut from individuals to pension funds. The job of the portfolio manager is highly unstructured and experience-based. No aspects of the job were automated, nor did many people think they could be.

Identification of Concerns which Served to Indicate Change

The head of EDP Services heard about some academic research that was being done at a large mid-west bank to aid portfolio managers in their work. It sounded interesting to him, so he invited the researchers to give a demonstration at Great Eastern Bank.

Despcription of the Bank's Research and Decision

The situation here is an example of a go-no go decision, not an examination of alternatives. No one else in the country had a system that would do anything like the proposed Portfolio Management System.

The cost/benefit analysis consisted of hard and soft data. In the hard, quantifiable area were the following:

- Elimination of the existing time sharing service that some portfolio managers were using.

- Freeing up the staff performing clerical analyses to support the portfolio managers.

- Allowing each portfolio manager to increase the number of accounts he or she could effectively manage.

The less quantifiable areas were:

- Prediction of investment performance improvements, that is better overall performance as well as avoiding major disasters.

- Prediction of increased sales based on better performance, improved customer service, and use of the system as a marketing tool.

- Prediction that banks would have to go in this direction sometime in the future.

The proposed system consisted of:

Data General Nova minicomputer

Tektronix CRTs

Hard copy terminals attached to the CRTs

Disk.

The minicomputer and disk were designed to provide an interface between the terminals and the centralized mainframe computer in order to minimize any degradation of the bank's centralized data processing capabilities. In this system the mainframe was to be used for the major computational tasks that the minicomputer could not perform, while the minicomputer handled the local I/O which would tie up the mainframe unnecessarily. The data base would be batch updated nightly, except for any changes a portfolio manager might make to his or her own files, from the terminal.

The bank decided to go ahead with the experimental distributed system.

Application of the R-L Framework

Applying the framework in this situation, the subunit is the Trust Division, while the organizational unit is the bank as a whole.

1. Identification of Constraints

Out of the twenty appropriate constraints from the table (see table 5-5), four point in the direction of centralization, the first three

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT							SYS. OPERATIONS						SYS. MGT.		
				func. des.	det. specs.	implement.	maint.	staff	hardware	budget	processing	D.B. mgt.	h/w & s/w	data base	staff	budget	strat. plan.	mgt. control	res./tech.
GREAT EASTERN BANK	GENERAL																		
	-decentralized from within	decent.	strong	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	-uniformity of planning & control system & other rpts	cent.	weak	n/a															
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DATA PROCESSING																		
	-currently centralized	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	-currently decentralized	decent.	strong	n/a															
TRUST DIVISION	NATURE OF TASK																		
	-highly specialized	decent.	strong	✓		✓						✓		✓				✓	✓
	-independent	decent.	weak	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓			
	-change/uncertainty	decent.	strong	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	
	-fast growth	decent.	weak	n/a															
	-entrepreneurial	decent.	weak	✓		✓				✓		✓		✓				✓	
	→-high technology/knowledge workers	decent.	weak	✓		✓				✓		✓		✓				✓	
	OTHER FACTORS																		
	-geographically separate	decent.	weak	n/a															
	-political considerations	decent.	strong	n/a															
	-organizational size-small	cent.	strong	n/a															
	-depth of mgt. talent avail.	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	-experience with D.P.	decent.	weak	n/a															

Table 5-5 Contingent Constraint Table - Portfolio Management System (page 1 of 3)

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT							SYS. OPERATIONS					
				func. des.	det. specs.	implement.	maint.	staff	hardware	budget	processing	D.B. mgt.	h/w & s/w	data base	staff	budget
PORTFOLIO MANAGEMENT SYSTEM LAG	NATURE OF APPLICATION															
	-strategic planning	cent.	strong	n/a												
	-management control	cent.	weak	n/a												
	-operational control	decent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-process control	decent.	strong	n/a												
→	-highly sensitive & critical for subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	-high degree of involvement from subunit mgt.	decent.	weak	n/a												
	-specific to subunit	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-intention to consolidate/ integrate the function	cent.	strong	n/a												
	SPECIFIC REQUIREMENTS															
	-high degree of DP expertise required	cent.	weak	n/a												
	-sophisticated technology/ processing	cent.	weak	n/a												
→	-reliability or lack of vulnerability critical	decent.	strong								✓	✓	✓	✓	✓	✓
→	-response/turnaround time	decent.	strong								✓	✓	✓	✓	✓	✓
	-adaptability to rapid change critical	decent.	weak	n/a												
	-integration with files from other LAGs	cent.	strong	n/a												
→	-special equipment required	decent.	weak	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓

Table 5-5 Contingent Constraint Table - Portfolio Management System (page 2 of 3)
Key: → indicates dominant constraints

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
edit and control	-task complex	decent.	weak	n/a												
	-custom tailored user interface	decent.	weak	✓						✓	✓		✓	✓		✓
	-data communication errors critical	decent.	strong	n/a												
update &/or processing	-need for large, complex computing ←	cent.	strong								✓		✓	✓		
	-large memory required intermittently ←	cent.	strong								✓		✓	✓		
	-complex processing	cent.	strong	n/a												
	-use of data base technology ←	cent.	weak		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
reporting	-complex variable custom tailored reporting	decent.	weak	✓	✓	✓		✓	✓		✓		✓		✓	

Table 5-5 Contingent Constraint Table - Portfolio Management System (page 3 of 3)
Key: ← indicates dominant constraints

of these are dominant constraints:

UPDATE AND/OR PROCESSING/NEED FOR LARGE COMPLEX COMPUTER - the mini-computer cannot perform the computational tasks, it is only for handling the I/O requirements. In this situation a large computer is necessary for computation but would be bogged down by the on-line CRT graphics requirement. A kind of distributed processing system is the result. The constraint points out the need for a large mainframe.

UPDATE AND/OR PROCESSING/LARGE MEMORY REQUIRED INTERMITTENTLY - the same argument as in the constraint above applies. Each portfolio manager also maintains large files of client data.

UPDATE AND/OR PROCESSING/USE OF DATA BASE TECHNOLOGY - The data base necessary for the PMS would have to be resident on a large mainframe computer.

GEB/DATA PROCESSING/CURRENTLY CENTRALIZED - data processing for the bank as a whole is primarily centralized. However, the task being examined here is a specialized and independent one from other computer-based applications. Therefore, this constraint is not particularly important.

The three dominant constraints (the first three) can be accomodated by a distributed system that relies heavily on a large mainframe computer.

The other dominant constraints all support a decentralized approach according to the framework:

TRUST/NATURE OF TASK/HIGH TECHNOLOGY/KNOWLEDGE WORKERS - the primary users of the system will be professional portfolio managers.

PMS/NATURE OF APPLICATION/HIGHLY SENSITIVE AND CRITICAL FOR THE SUBUNIT - the decisions that the portfolio managers make entirely determine the performance of the security portfolios, which, in turn, entirely determine the profit of the divisions.

PMS/SPECIFIC REQUIREMENTS/RELIABILITY OR LACK OF VULNERABILITY and RESPONSE TIME/TURN AROUND TIME CRITICAL - both of these constraints are critical in the acceptance of the system by the portfolio managers. This system is a whole new approach to what portfolio managers have been doing for decades. If the portfolio managers must be subjected to computer failures three-quarters of the way through an analysis, or if they must wait fifteen seconds for a simple response, it is unlikely they will use the system very often. However, at GEB, this constraint does not necessarily imply decentralization.

PMS/SPECIFIC REQUIREMENTS/SPECIAL EQUIPMENT - PMS requires a great deal of special graphics work.

2. Decomposition of the Decision

The Decomposition Table for this example (see Table 5-6) clearly shows that the decision process the R-L Framework is designed to aid, is composed of many separate and independent decisions. The combination of all these preferred decisions implies a distributed processing system, that locates terminals and a minicomputer with the user which can support sophisticated graphics work, and relies on a large mainframe computer for complex processing and large data base management.

Comparison of the Two Decisions

This is a somewhat more difficult decision to analyze that the other case studies since the technology proposed was at the forefront of the state of the art at that time. As mentioned earlier, GEB did not have the choice of alternative approaches, it was a go-no go decision. However, the combination of the requirements of the organization, the LAG, and the hardware together indicates a distributed processing system. Therefore, the R-L Framework would support the PMS as a viable alternative.

		subprocess/ resource	edit & control	update	processing	reporting
SYSTEMS DEVELOPMENT	Subprocess	functional design	dist.	dist.	dist.	dist.
		Detail specs/ development	c	c	c	dist.
		implementation	dist.	dist.	dist.	dist.
		maintenance	c	c	c	dist.
	Resources	personnel	dist.	dist.	dist.	dist.
		hardware	dc	dc	c	dc
		budget	dc	dc	dc	dc
SYSTEMS OPERATIONS	Sub-process	processing	dc	dc	c	dc
		data base mgt.	c	c	c	-----
	Resources	hardware and software	dist.	dc	c	dc
		data base	c	c	c	c
		personnel	dc	dc	c	dc
		budget	dc	dc	dc	dc

Table 5-6 Decomposition Table - Portfolio Management System

Implications for the R-L Framework

This example points out the importance of looking at all the constraints together, and with a view toward the situational factors. It also brings up the complication of dealing with the middle ground of distributed processing. Distributed processing itself could be classified as relatively more centralized or decentralized. In this example, the data base was entirely resident at the centralized computer. The minicomputer merely assisted the mainframe. This could be classified as a more centralized distributed processing system. On another side of the argument is the distributed system composed of equal capacity processors, linked together by a communications network. Such a system would be relatively more decentralized if each processor were located in its own subunit.

The framework is still viable in these situations, as long as the implication toward centralization or decentralization is investigated in light of the wide range of configurations possible in each direction.

THE COMMERCIAL ACCOUNTS PROFITABILITY SYSTEM - Case Study Number Four

Description of the Existing Process

Operations Research (OR) is an area under the Controller's office in the Finance Division. OR has traditionally been involved in designing computer based models to aid such areas as financial planning, marketing, and commercial banking.

The OR effort began in 1969 running on an outside time sharing service. Tapes had to be hand carried back and forth to the company, which was somewhat inconvenient. However, at this time the data processing center could not support the time sharing function necessary to serve OR's needs. The OR work was being done primarily for the Commercial Banking Division.

In the course of monitoring the costs of the time sharing, it was discovered that the bulk of the expense was for storage charges. On examining the situation, the Commercial Banking Division decided it would be cheaper to bring a minicomputer based system in-house for its modelling efforts. The head of Commercial Banking was also intrigued by the potential use of minicomputers in the banking industry and wanted to be among the early users.

The project was argued before the Priorities Committee and approved for the following reasons:

- EDP Services was so bogged down they could not respond to the request for time sharing support in-house.

- The in-house minicomputer could be shown to be less expensive than the time sharing service.

- The marketing staff of Commercial Banking Division wanted it, and since Commercial Banking is the number one profit center, they have the political power to wield.

The system was obtained, officially resides in Financial Planning (under the Controller) and consists of:

HP 2100A
Printer
two disk drives
tape drive
paper tape reader/punch

Identification of Concerns which Served to Indicate Change

After bringing the minicomputer in-house, Commercial Banking discovered all the existing modelling programs together only used 50% of the capacity.

Commercial Banking was interested in designing a new model for analyzing the profitability of commercial accounts.

Description of the Bank's Research and Decision

Operations Research analyzed the problem and realized that in order to build a good model for the analysis of profitability of commercial accounts, it would have to include the financial planning structure of the bank, transfer pricing, and tax implications. The model would need access to centralized files for financial planning. It was believed 80% of the input to the model would be from the centralized files with the remaining 20% input via the minicomputer terminals.

The Marketing staff for Commercial Banking would be the primary users and wanted terminal access to the model.

Since the minicomputer was there, and 50% available, the model was designed and built on it.

Application of the R-L Framework

In analyzing the Profitability of Commercial Accounts LAG the following points should be remembered:

- OR staff are centralized in relation to Commercial Banking marketing staff, even though OR is not part of EDP Services,
- The minicomputer is decentralized in relation to the data processing center even though it resides in a centralized service division, because its primary use is by the Commercial Banking Division.

1. Identification of Constraints

The Contingent Constraint table (Table 5-7) shows the majority of constraints implying centralization. In addition, the five dominant constraints all lean toward centralization.

COMMERCIAL ACCOUNTS PROFITABILITY/NATURE OF APPLICATION/MANAGEMENT CONTROL- Investigation of the profitability of commercial accounts and the implications found from such an investigation are clearly important inputs to the management control aspect of planning and control for the division as a whole. Therefore, there is a tendency to favor a centralized approach.

COMMERCIAL ACCOUNTS PROFITABILITY/SPECIFIC REQUIREMENTS/INTEGRATION WITH FILES FROM OTHER LAGs - This is probably the most critical constraint. Prior to implementation, OR believed input from centralized files would be approximately 80%. It turned out in practice to be 95%. With that amount of interaction with centralized files, it is somewhat inefficient to consider decentralized processing for the application.

UPDATE AND/OR PROCESSING/LARGE MEMORY REQUIRED INTERMITTENTLY - The model is based on linear programming, and therefore does at times require the use of large amounts of memory.

UPDATE AND/OR PROCESSING/COMPLEX PROCESSING - Because of the wide variety of input from various other LAGs, much use of intermediate files is made.

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget	SYS. MGT. strat. plan.	mgt. control	res./tech.
COMMERCIAL BANKING	GENERAL																		
	-decentralized from within	decent.	strong	n/a															
	-uniformity of planning & control system & other rpts	cent.	weak	n/a															
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	n/a															
	DATA PROCESSING																		
	-currently centralized	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	-currently decentralized	decent.	strong	n/a															
MARKETING	NATURE OF TASK																		
	-highly specialized	decent.	strong	✓		✓						✓			✓				✓	✓
	-independent	decent.	weak	n/a															
	-change/uncertainty	decent.	strong	n/a															
	-fast growth	decent.	weak	n/a															
	-entrepreneurial	decent.	weak	n/a															
	-high technology/knowledge workers	decent.	weak	n/a															
	OTHER FACTORS																		
	-geographically separate	decent.	weak	n/a															
	-political considerations	decent.	strong	n/a															
	-organizational size-small	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		
	-depth of mgt. talent avail.	decent.	strong	n/a															
	-experience with D.P.	decent.	weak	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		

Table 5-7 Contingent Constraint Table - Commercial Accounts Profitability System (page 1 of 3)

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
COMMERCIAL ACCOUNTS PROFITABILITY LAG	NATURE OF APPLICATION															
	-strategic planning	cent.	strong	n/a												
	→ -management control	cent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-operational control	decent.	weak	n/a												
	-process control	decent.	strong	n/a												
	-highly sensitive & critical for subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	-high degree of involvement from subunit mgt.	decent.	weak	n/a												
	-specific to subunit	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-intention to consolidate/ integrate the function	cent.	strong	n/a												
	SPECIFIC REQUIREMENTS															
	-high degree of DP expertise required	cent.	weak	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
	-sophisticated technology/ processing	cent.	weak	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	
	-reliability or lack of vulnerability critical	decent.	strong	n/a												
	-response/turnaround time	decent.	strong	n/a												
	-adaptability to rapid change critical	decent.	weak	n/a												
	→ -integration with files from other LAGs	cent.	strong	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
	-special equipment required	decent.	weak	n/a												

Table 5-7 Contingent Constraint Table – Commercial Accounts Profitability System (page 2 of 3)
Key: → indicates dominant constraints

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
reporting update &/or edit and processing control	-task complex	decent.	weak	n/a												
	-custom tailored user interface	decent.	weak	✓						✓	✓		✓	✓		✓
	-data communication errors critical	decent.	strong	n/a												
	-need for large, complex computing	cent.	strong	n/a												
	-large memory required ← intermittently	cent.	strong								✓		✓	✓		
	-complex processing ←	cent.	strong		✓	✓	✓	✓			✓		✓	✓	✓	
	-use of data base technology	cent.	weak	n/a												
	-complex variable custom tailored reporting	decent.	weak	n/a												

Table 5-7 Contingent Constraint Table - Commercial Accounts Profitability System (page 3 of 3)
Key: ← indicates dominant constraints

2. Decomposition of the Decision

The Decomposition Table (please see Table 5-8) shows the preferred choices for each decision. Note that Update would not be separated out from Processing were it not for the presence of the minicomputer. In other words, the application could be entirely centralized. The distributed cells under Reporting and Edit and Control could be satisfied through the use of a remote printer and a Remote Job Entry terminal. The framework indicates only centralized alternatives as reasonable, however, since alternatives were not investigated by the bank, there is no cost data to use for making the tradeoffs.

Comparison of the Two Decisions

An important part of the bank's decision to put the application on the minicomputer was the fact that the minicomputer was there. The bank really did not analyze the alternatives, and actually did not make a decision to implement the LAG on the minicomputer. It was understood from the start that it would go on the minicomputer.

The current sentiments expressed by OR are that it would be better to have the LAG on the mainframe computer because the sophistication of the application could be substantially improved. In addition, the effort currently being expended to input the 5% of the data via the minicomputer terminal is timeconsuming and inefficient.

The R-L Framework analysis points strongly in the direction of centralization and would have indicated not implementing the Commercial Accounts

		subprocess/ resource	edit & control	update	processing	reporting
SYSTEMS DEVELOPMENT	Subprocess	functional design	c	c	c	dist.
		Detail specs/ development	c	c	c	dist.
		implementation	c	c	c	dist.
		maintenance	c	c	c	c
	Resources	personnel	c	c	c	dist.
		hardware	dc	dc	c	dc
		budget	dc	dc	dc	dc
SYSTEMS OPERATIONS	Sub-process	processing	dist.	dc	c	dc
		data base mgt.	c	c	c	-----
	Resources	hardware and software	dist.	dc	c	dc
		data base	dist.	dc	c	dist.
		personnel	c	c	c	c
		budget	dc	dc	dc	dc

Table 5-8 Decomposition Table - Commercial Accounts Profitability System

Profitability LAG on the minicomputer. It is interesting to note that the LAG may be moved over to the mainframe.

Implications for the R-L Framework

As in the previous case studies, the importance of constraints differs with differing situational factors. One of the more important constraints that pointed toward decentralization was 'highly sensitive and critical for the subunit.' Since the subunit is marketing, and the subject matter is profitability of accounts, the area is surely highly sensitive. However, the application is in the realm of management control. It would seem that if this were operational control, the push toward decentralization would be stronger. Perhaps there are other ways in which constraints are 'linked' such that the push toward centralization or decentralization is stronger.

THE FOREIGN EXCHANGE SYSTEM - Case Study Number Five

Description of the Former Process

The European operations of the Great Eastern Bank consist of four banks located in London, Paris, Frankfort and Luxembourg. At the end of each day's transactions, each bank sent a report to GEB headquarters in the United States with the information about the daily transactions and profit and loss based on exchange rates. Each bank communicated the information that it perceived as vital to the head office. There was no uniform system, format, or use of media.

London is the largest bank and the only one with an EDP department. There is a staff of nine people and an ICL computer. The other three locations had access to a GE time sharing system for whatever computing power each one needs.

Identification of Concerns which Served to Indicate Change

The head of EDP Services Division, Mr. Simon Williams, has stated that one of his main objectives is:

> 'Corporate Support - to extend EDP support to the corporation as a whole.'

Toward this end he established the Corporate EDP Planning and Support group within EDP Services to begin to research the banking industry worldwide.

One of the major concerns identified was the vulnerability of profits to fluctuations in the exchange rates. In addition, the lack of uniformity and poor timeliness of foreign exchange information that was reported, complicated the process and errors.

Description of the Bank's Research and Decision

The Corporate EDP Planning and Support group looked at the problem of foreign exchange worldwide (GEB has subsidiary banks in South America, and the Far East as well as in Europe). Discovering that the European offices had the greatest resident expertise in data processing, it was decided to use Europe as a pilot project for an automated foreign exchange system.

The following were key factors to be considered:

- Geography - There were two aspects of this factor,
  1) the banks were all located in different countries, and
  2) the corporate EDP staff with the expertise, was located in the U.S.

- Autonomy of local banks - Each bank had always operated as an independent entity without regulations or guidence from the U.S. Each bank was a profit center and the EDP Services Division did not want to threaten profitability with head office red tape. Each local bank had plenty of time in the

past to 'massage' the numbers to its own satisfaction prior to transmitting the information to the U.S. The new system would present the threat of the head office seeing the work-in-process figures. A clear understanding of what the head office would do with the information, and of what the banks were being held responsible for, was required.

- Nationality - The inherent national pride of the individual bank people threatened to lead to problems of trust and of working together with each other as well as with the U.S. staff. In addition the head office staff did not always recognize the different way of doing things abroad.

These factors implied a large investment on the part of the EDP Services Division in terms of organizational behavior issues as well as data processing technology issues. However, because of the high degree of risk inherent in the foreign exchange transactions, Corporate EDP Planning and Support was able to demonstrate a good rate of return and thereby received permission to go ahead with the project.

A Sanders 8100 minicomputer was installed in each bank. In London the minicomputer was tied in with the ICL as a front end processor. Processing is entirely decentralized, however, each day's transactions are sent over a communications network to London. The London office consolidates the information, and sends it to the U.S. The London office data processing staff support the majority of maintenance, however, the U.S. data processing

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget	SYS. MGT. strat. plan.	mgt. control	res./tech.
INTERNATIONAL DIV.	GENERAL																		
	-decentralized from within	decent.	strong	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	-uniformity of planning & control system & other rpts	cent.	weak	n/a																
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	DATA PROCESSING																			
	-currently centralized	cent.	strong	n/a																
	-currently decentralized	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
EUROPE	NATURE OF TASK																			
	-highly specialized	decent.	strong	n/a																
→	-independent	decent.	weak	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓			
	-change/uncertainty	decent.	strong	✓		✓	✓			✓	✓	✓		✓	✓	✓	✓		✓	
	-fast growth	decent.	weak	✓		✓				✓		✓			✓					
	-entrepreneurial	decent.	weak	✓		✓				✓		✓			✓				✓	
	-high technology/knowledge workers	decent.	weak	n/a																
	OTHER FACTORS																			
→	-geographically separate	decent.	weak	✓		✓					✓	✓		✓	✓	✓	✓			
→	-political considerations	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	
	-organizational size-small	cent.	strong	n/a																
	-depth of mgt. talent avail.	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			
	-experience with D.P.	decent.	weak	n/a																

Table 5-9 Contingent Constraint Table - Foreign Exchange System (page 1 of 3)
Key:→ indicates dominant constraints

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT: func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS: processing	D.B. mgt.	h/w & s/w	data base	staff	budget
FOREIGN EXCHANGE SYSTEM LAG	NATURE OF APPLICATION															
	-strategic planning	cent.	strong	n/a												
	-management control	cent.	weak	n/a												
	→ -operational control	decent.	weak	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
	-process control	decent.	strong	n/a												
	→ -highly sensitive & critical for subunit	decent.	weak	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓
	-high degree of involvement from subunit mgt.	decent.	weak	✓		✓				✓	✓	✓		✓		✓
	-specific to subunit	decent.	weak	n/a												
	-intention to consolidate/ integrate the function	cent.	strong	n/a												
	SPECIFIC REQUIREMENTS															
	-high degree of DP expertise required	cent.	weak	n/a												
	-sophisticated technology/ processing	cent.	weak	n/a												
	-reliability or lack of vulnerability critical	decent.	strong								✓	✓	✓	✓	✓	✓
	-response/turnaround time	decent.	strong								✓	✓	✓	✓	✓	✓
	→ -adaptability to rapid change critical	decent.	weak	✓		✓	✓	✓	✓	✓		✓				
	-integration with files from other LAGs	cent.	strong	n/a												
	-special equipment required	decent.	weak	n/a												

Table 5-9 Contingent Constraint Table - Foreign Exchange System (page 2 of 3)
Key: → indicates dominant constraints

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT func. des.	det. specs.	implement.	maint.	staff	hardware	budget	SYS. OPERATIONS processing	D.B. mgt.	h/w & s/w	data base	staff	budget
edit and control	-task complex	decent.	weak	n/a												
	-custom tailored user interface	decent.	weak	✓						✓	✓		✓	✓		✓
	-data communication errors critical	decent.	strong								✓		✓	✓		
update &/or processing	-need for large, complex computing	cent.	strong	n/a												
	-large memory required intermittently	cent.	strong	n/a												
	-complex processing	cent.	strong	n/a												
	-use of data base technology	cent.	weak	n/a												
reporting	-complex variable custom tailored reporting	decent.	weak	n/a												

Table 5-9 Contingent Constraint Table - Foreign Exchange System (page 3 of 3)
Key: ← indicates dominant constraints

staff is available when needed.

Application of the R-L Framework

In using the framework the following are necessary guidelines:

Organizational Unit = International Division

Subunit = Europe

Centralized = U.S. EDP Staff and computers

Decentralized = Staff and computers located in any of the four European banks. Technically the London EDP staff could be considered centralized with respect to the other three banks, however this distinction is not important to the application being considered.

1. Identification of Constraints

The Constraint Table shows (see Table 5-9) all constraints imply a decentralized approach to the LAG. The dominant ones are:

EUROPE/NATURE OF TASK/INDEPENDENT - The task is an independent one for Europe.

EUROPE/OTHER FACTORS/GEOGRAPHIC SEPARATION - The geographic separation in this case means Europe is dealing with different monetary systems and moreover each bank is dealing with different monetary systems in relation to each other.

EUROPE/OTHER FACTORS/POLITICAL CONSIDERATIONS - The importance of autonomy and nationality in this instance cannot be emphasized enough.

FOREIGN EXCHANGE/NATURE OF APPLICATION/OPERATIONAL CONTROL - The system is to be part of a daily operational function.

FOREIGN EXCHANGE/NATURE OF APPLICATION/HIGHLY SENSITIVE AND CRITICAL FOR SUBUNIT - The entire operating position of the European banks and Europe as a whole depends on the fluctuations of exchange rates.

2. Decomposition of the Decision

Reviewing the Decomposition Table (see Table 5-10) distributed cells indicate areas where the expertise of the centralized data processing staff is needed in the design and implementation of the system. All operations are to be decentralized. Since there is no Processing phase, that column is blank.

The definite direction indicated by the R-L Framework is to a decentralized system. The alternatives to be considered are simply how to get the job done for the least cost.

		subprocess/ resource	edit & control	update	processing	reporting
SYSTEMS DEVELOPMENT	Subprocess	functional design	dist.	dist.		dist.
		Detail specs/ development	c	c		c
		implementation	dist.	dist.		dist.
		maintenance	dist.	dist.		dist.
	Resources	personnel	dist.	dist.		dist.
		hardware	dc	dc		dc
		budget	dist.	dist.		dist.
SYSTEMS OPERATIONS	Sub-process	processing	dc	dc		dc
		data base mgt.	dc	dc		dc
	Resources	hardware and software	dc	dc		dc
		data base	dc	dc		dc
		personnel	dc	dc		dc
		budget	dc	dc		dc

Table 5-10 Decomposition Table - Foreign Exchange System

Comparison of the Two Decisions

The analysis the bank performed clearly noted the important constraints that pointed toward decentralization. Therefore the results of the two analyses agree. If the bank had seen the problem and simply tried to apply 'headquarters pressure' to get compliance, the situation could have led toward disaster. For example, one alternative would have been to have each foreign bank send through the 'raw' data and have the data processing center in the U.S. compute the individual banks' positions. This total removal of autonomy would probably result in phony raw data as a protection mechanism. The Foreign Exchange solution allows the individual banks to compute the results themselves and therefore have more faith in their accuracy.

Implications for the R-L Framework

This last example fits very well into the framework. This is because the framework was designed to be a general one and accomodate large, multinational organizations. This is the only example investigated at the bank that matches the industrial notion of a large multinational.

THE GREAT EASTERN BANK AS A WHOLE

In order to tie together this analysis, it is necessary to look at the organization as a whole using the first section of the Contingent Constraint table (please see Table 5-11). The table indicates that the bank's business and structure include areas that imply both centralization and decentralization of the information systems function. Using this information together with the background of the Great Eastern Bank, to fill in the Decomposition Table (please see Table 5-12), the resulting picture is one that does reflect the alternatives available to the bank in making the centralization/decentralization decisions.

The important dimension here is Systems Management. Systems Management as defined in chapter one is the process of managing the information systems function. At Great Eastern Bank that is carried out by Mr. Simon Williams, the head of the EDP Service Division. However, one aspect of the Systems Managment dimension of GEB that keeps it from being totally centralized is the role of the Priorities Committee in planning data processing growth. This factor accounts for the cell under strategic planning being characterized as 'distributed.' Mr. Williams in conjunction with representatives from the user divisions who sit on the Priorities Committee, sets the overall strategy and planning for the information systems function throughout the bank.

In addition, Mr. Williams and the EDP Services Division management are important influences in the data processing decisions that take place.

	THE R-L FRAMEWORK CONSTRAINT	IMPLIES		SYSTEMS DEVELOPMENT							SYS. OPERATIONS						SYS. MGT		
				func. des.	det. specs.	implement.	maint.	staff	hardware	budget	processing	D.B. mgt.	h/w & s/w	data base	staff	budget	strat. plan.	mgt. control	res./tech.
GREAT EASTERN BANK	GENERAL																		
	-decentralized from within	decent.	strong	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	-uniformity of planning & control system & other rpts	cent.	weak	✓	✓	✓	✓	✓	✓	✓		✓					✓	✓	✓
	-multiproduct/multitechnology/multimarket/multinational	decent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DATA PROCESSING																		
	-currently centralized	cent.	strong	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	-currently decentralized	decent.	strong	n/a															
	NATURE OF TASK																		
	-highly specialized	decent.	strong																
	-independent	decent.	weak																
	-change/uncertainty	decent.	strong																
	-fast growth	decent.	weak																
	-entrepreneurial	decent.	weak																
	-high technology/knowledge workers	decent.	weak																
	OTHER FACTORS																		
	-geographically separate	decent.	weak																
	-political considerations	decent.	strong																
	-organizational size-small	cent.	strong																
	-depth of mgt. talent avail.	decent.	strong																
	-experience with D.P.	decent.	weak																

Table 5-11 Contingent Constraint Table - Great Eastern Bank as a whole (page 1 of 1)

		subprocess/ resource	overall			
SYSTEMS DEVELOPMENT	Sub-processes	functional design	dist.			
		detail specs/devel	c			
		implementation	dist.			
		maintenance	c			
	Resources	personnel	dist.			
		hardware	c/dc/dist			
		budget	dc			
SYSTEMS OPERATIONS	Sub-processes	processing	c/dc/dist			
		data base management	c			
	Resources	hardware and software	c/dc/dist			
		data base	c/dc/dist			
		personnel	dist.			
		budget	dc			
SYSTEMS MANAGEMENT	Subprocesses	strategic planning	dist.			
		management constrol	c			
		systems research	c			
		technical methods	c			
	Res	personnel	dist.			

Table 5-12 Decomposition Table - Great Eastern Bank as a whole

There appear to be three major factors at work here:

- Mr. Williams is a strong leader and a capable manager with both data processing and banking experience.

- A spirit of cooperation exists between EDP Services and the line divisions of the bank.

- The opinions of Mr. Williams and his managers are respected throughout the organization. (It was not unusual for an interviewee to state that as a user he or she did not care how the system was designed as long as it satisfied the group's needs, and he or she would rely totally on the EDP Services Division to achieve that end.)

In summary there exists at GEB very strong and capable data processing management. The presence or absence of strong data processing management is an important organizational constraint, and should be considered as as addition to the constraint table. A way to break down the perception of strong management is into three characteristics: reliability, accessibility and respected expertise. Reliability is shown by a demonstrated track record of good service. Accessibility describes the users ability to get central data processing help and/or advice on development projects. Respected expertise represents a history of making good decisions with respect to systems development throughout the organization. All three of these new constraints are strong ones indicating centralization.

Another area that examining the bank as a whole brings to mind, is the characterization of the data processing business. Even though the bank is decentralized from within, and has a multiproduct, multi-market environment, its overall data processing business can be generalized as being high volume, repetitive and undifferentiated. This characteristic suggests the addition of another constraint in the 'Data Processing' area: 'high volume, repetitive, undifferentiated business' as a weak constraint implying centralization across the sub-processes and resources.

Summary

This chapter has presented the five in-depth case studies making the comparison between the decisions of the organization and the decision suggested by the use of the R-L Framework. The chapter ended with an overview of the range of alternatives when looking at the information systems function for Great Eastern Bank as a whole. The next chapter will summarize the implications identified by these case studies for the framework.

Chapter 6

SUMMARY OF IMPLICATIONS FOR THE R-L FRAMEWORK

The utility of the R-L Framework has been demonstrated by the case studies in this thesis. The following is a summary of the implications for using and changing the framework that have been identified.

1) Situational factors can alter the nature of a constraint. Therefore it is critical to consider a constraint in view of the organization as a whole, and in conjunction with the other constraints. For example, even though the size of the subunit was small in the Money Transfer System, the nature of the application was independent and specialized, and that took precedence.

2) In the second case study the concept of a contingency aspect of some constraints was introduced. It was suggested that although the directions indicated by the constraint table are generally true, there are situations where they are not. For example, under 'reliability or lack of vulnerability critical' the table indicates that this constraint generally implies decentralization. However, where the organization has demonstrated both reliability and lack of vulnerability with a centralized data processing environment, this constraint implies centralization. A second constraint in this category is 'response/ turn around time critical.' Adding contingencies on to constraints in this way, can allow for building in some of the situational factors discussed in number one.

3) Four constraints are put forth as additions to the organizational unit section of the Constraint Table. These are a direct result of the organization studied, however, they appear to have a generalizeable value to the framework:

Data Processing

- Demonstrated reliability
- Accessible to user
- Expertise respected
- High volume, repetitive, undifferentiated business

All four constraints point toward centralization.

4) The problem of the makeup of costing algorithms was discussed in several case studies. Ideally cost should be used in making the tradeoffs among different viable alternatives. Unfortunately in the example of the Great Eastern Bank, the costing algorithm could rule out alternatives early in the analysis. More research should be done to determine a method for dealing with this particular problem. One alternative would be to include a constraint that deals with the existence of a costing algorithm for a centralized data processing center that penalizes small applications. Another alternative would be to direct that the R-L Framework be used with only real costs (e.g. new hardware, software, staff time, etc.) and ignoring artificial transfer pricing. Research should be conducted to determine the effects of these kinds of alternatives.

5) Constraints indicate directions toward centralization or decentralization and are very flexible within these directions. For example, 'distributed' can be indicated by many combinations of centralized and decentralized constraints.

6) The framework performs extremely well in a complex multinational setting.

One hypothesis was formulated: the preferred decision or decisions indicated by the R-L Framework will always be the least expensive alternative(s). Such an hypothesis remains to be supported with additional research and good cost/benefit information. It seems logical however, that once the environmental and technical constraints have been accounted for, the resulting feasible alternatives will be efficient and effective, hence superior in a cost/benefit analysis.

Summary

This chapter summarized the major implications identified for the R-L Framework, and discussed the addition of four constraints that address the characterization of the centralized data processing area. In addition, one hypothesis was presented for future research. The next chapter will present the major conclusions and some suggestions for additional research.

Chapter 7

CONCLUSIONS

This thesis has taken the preliminary framework for decision making in centralization versus decentralization of information systems decisions, and applied it to five current situations in one organization. In each example a complete description of the process was obtained through personal interviews. A comparison was then made between the organization's analysis and decision and that obtained via application of the framework.

The overall conclusion of the research outlined in this thesis is that the R-L Framework is a useful preliminary approach to decision making in the area of centralization versus decentralization of the information systems function. The framework is valuable as a method for approaching the decision problem in the following ways:

- by summarizing the most important constraints, and the general directions implied by them, in order to ensure their consideration in the various decisions;

- by breaking down the complex overall centralization/ decentralization decision into several manageable decisions along the three important dimensions of the information systems function: Systems Development, Systems Operations, and Systems Management;

- by providing alternatives through the interaction of the constraints and the decisions required.

Some areas have been presented where the framework can be enhanced and better understood in the actual application. However, until additional research has been performed, which supports these ideas, they should remain merely suggestions.

Additional research should take the form of in-depth case studies of current decision making in organizations. It is important to obtain as complete a description of the process as possible prior to indicating the details of the framework. This suggestion is clearly made to prevent the interviewee from thinking he or she should have done it 'that way' and therefore modifying the account of the process. Additional research will provide more evidence pro and con the utility of individual constraints and will hopefully also shed light on the hypothesis proposed in Chapter 6, that preferred alternatives as indicated by the framework, will be the least costly.

Until the framework is rigorously applied in a variety of organizations, across industry and size, it will remain preliminary.

FOOTNOTES

Chapter 1

[1]Leventer, Joav Steve, Centralization Versus Decentralization of Information Systems: A Framework for Decision Making, unpublished master's thesis, Massachusetts Institute of Technology, Alfred P. Sloan School of Management, Cambridge, Massachusetts, 1976.

Chapter 2

[1]Ibid., p. 37.

[2]Ibid., pp. 53-57.

[3]Baggeroer, William L., and Fox, John M., Centralized, Decentralized or Distributed: A Preliminary Model for Computer System Configuration, unpublished master's thesis, Massachusetts Institute of Technology, Alfred P. Sloan School of Management, Cambridge, Massachusetts, 1975.

[4]Op. cit., Leventer, p. 48.

[5]Ibid., pp. 10-33.

[6]Ibid., pp. 67-68.

Chapter 4

[1]Corporate and individual names throughout the thesis have been disguised to maintain confidentiality of information.

[2]Presentation made by Mr. Williams at the Alfred P. Sloan School of Management, November 12, 1975.

[3]The Great Eastern Bank itself is referred to as the Bank. It is to be distinguished from the Corporation, which is the parent bank holding company.

Chapter 5

[1]Op.cit. Leventer, p.78.

[2]Ibid., p. 79.

[3]Ibid., p. 84.

[4]Ibid., p. 88.

[5]Ibid., p. 89.

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