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Results of a Case Study on Information Technology at a University

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Abstract

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Keywords

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Results of a Case Study on Information Technology at a University

by

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Introduction

Fairfield University is a private liberal arts institution consisting of 3,000 undergraduate students and about 1,000 graduate students. The university is composed of a College of Arts and Sciences, School of Business, School of Nursing, School of Continuing Education, BEI School of Engineering, Graduate School of Education and Allied Professions, Graduate School of Business, and Graduate School of Nursing.

The university first acquired an IBM 1500 computer in 1968, which served the institution for its academic and administrative applications until 1979. In 1979, a DEC System 2060 was acquired followed by a DEC VAX in 1986. Most of the departments on campus were connected to the main system through data lines, and used terminals for access to the data stored on the central system.

In 1992, a change was instituted that led to the installation of a fiber optic backbone, and every building on campus was connected through this backbone. The plan was for every building to be connected through local area networks (LAN). Thus the terminals were to be replaced by personal computers connected to the LAN.

Goal

The goal of this study is to examine managerial and economic aspects of the introduction of information technology at Fairfield University, its recent rapid growth, and to draw conclusions about Fairfield University's needs. To ensure a logical and consistent research design, the

research in this study replicated the work of Levy (1988) at the University of Arizona. This study also extended the Levy study in its investigation of the aspects of the Internet, the World Wide Web, and client/server computing. The replication of the Levy study at Fairfield University is also an extension of the original study from a large university to a small private institution.

Managerial issues examined included the level of managerial and faculty commitment to information technologies. In addition, the degree of centralization/ decentralization, the allocation and financing of resources, and the planning process for acquisition and maintenance are examined.

Economic aspects include an examination of supply and demand factors in the acquisition of computing resources. A cost-benefit analysis of computing, the cost of services foregone because of information technology acquisition, computing budget baselines, and the value of information technology as a strategic resource are examined.

Objectives

The primary objectives of this study are:

1. To examine the characteristics of the rapid acquisition of technology in higher education,
2. To assess the categories of computer use in higher education organizations,
3. To evaluate managerial issues of computing in higher education, including the issues of centralization and decentralization. Particular attention will be paid to client/server computing and the Internet as a result of widespread access to the World Wide Web (WWW), and
4. To establish a basis for understanding current and future economic issues of information technology acquisition.

Research Questions Generated by the Objectives

Arising from the previously stated objectives, the research questions that were examined are:

1. What patterns of acquisition emerge from the current computing environment and the perceived needs for computing?
2. What characteristics of the categories of computing use contribute to the patterns of acquisition?
3. What managerial issues arise from the rapid acquisition of information technology and how important have those technologies become to the organization?
4. How will the institution balance the need for technological changes with the need to continue the accomplishment of routine tasks?

Methodology

The methodology used in this case study and presented in detail in The Quality Report (1997, v222) followed the recommendation of Yin (1994) and has four stages:

1. Design the case study,
2. Conduct the case study,
3. Analyze the case study evidence, and
4. Develop the conclusions, recommendations and implications.

Case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991). Case studies have been used in varied investigations, particularly in sociological studies, but increasingly, in instruction. Yin, Stake, and others who have wide experience in this methodology have developed robust procedures. When these procedures are followed, the researcher will be following methods as well developed and tested as any in the scientific field. Whether the study is experimental or quasi-experimental, the data collection and analysis methods are known to hide some details (Stake, 1995). Case studies, on the other hand, are designed to bring out the details from the viewpoint of the participants using multiple sources of data.

Case study is known as a triangulated research strategy. Snow and Anderson (1991) asserted that triangulation can occur with data, investigators, theories, and even methodologies. Stake (1995) stated that the protocols that are used to ensure accuracy and alternative explanations are called triangulation. The need for triangulation arises from the ethical need to confirm the validity of the processes. In case studies, this could be done by using multiple sources of data (Yin, 1984). The problem in case studies is to establish meaning rather than location.

The issue of generalization has appeared in the literature with regularity. It is a frequent criticism of case study research that the results are not widely applicable in real life. Yin in particular refuted that criticism by presenting a well constructed explanation of the difference between analytic generalization and statistical generalization: "In analytic generalization, previously developed theory is used as a template against which to compare the empirical results of the case study" (Yin, 1984).

Yin (1994) presented at least four applications for a case study model:

1. To explain complex causal links in real-life interventions
2. To describe the real-life context in which the intervention has occurred
3. To describe the intervention itself
4. To explore those situations in which the intervention being evaluated has no clear set of outcomes.

Information technologies involve all four of the above categories, but this study will only report on the last two. Since the Levy (1988) case study of the University of Arizona, there has been very little literature relating to the pace of acquisition of information technology at institutions of higher education. For this reason, Levy conducted a case study after consulting with experts in the field and with senior case researchers. Their recommendation was to conduct an in-depth study of the institution using the case methodology. This study replicates and extends that study and thereby adds to the body of knowledge on the nature of information technology acquisition at universities.

Levy (1988) used a single-case design for the study at the University of Arizona. Single cases may be used to confirm or challenge a theory, or to represent a unique or extreme case (Yin, 1994). Single-case studies are also ideal for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. These studies can be holistic or embedded, the latter occurring when the same case study involves more than one unit of analysis. Multiple-case studies follow a replication logic. This is not to be confused with sampling logic, where a selection is made out of a population, for inclusion in the study. This type of sample selection is improper in a case study. Each individual case study consists of a "whole" study, in which facts are gathered from various sources and conclusions drawn on those facts.

As in all research, consideration must be given to construct validity, internal validity, external validity, and reliability (Yin, 1989). Levy (1988) established construct validity using the single-case exploratory design, and internal validity using the single-case explanatory design. Yin (1994) suggested using multiple sources of evidence as the way to ensure construct validity. The current study used multiple sources of evidence ; survey instruments, interviews, and documents. The specification of the unit of analysis also provides the internal validity as the theories are developed and data collection and analysis test those theories. External validity is more difficult to attain in a single-case study. Yin (1994) provided the assertion that external validity could be achieved from theoretical relationships, and from these generalizations could be made. It is the development of a formal case study protocol that provides the reliability that is required of all research.

The design of this case study closely follows that of the Levy study. The methodology selected by Levy (1988) was based on the seminal work by Yin (1984) and confirmed by Feagin et al. (1991). The Levy single-case study methodology was used in the current study and is described below. Danziger (1985) has established the "context of use" as a mitigating factor in the study of computing in organizations. The "pattern matching" (Yin, 1984) of acquisition and use established in other environments may be shown to be applicable in higher education. Yin (1994) listed six sources of evidence for data collection in the case study protocol:

1. Documentation,
2. Archival Records,
3. Interviews,
4. Direct Observation,
5. Participant Observation, and
6. Physical Artifacts.

Not all need be used in every case study (Yin, 1994). In this study, the last three types of sources are not relevant, since they are related to direct sociological investigation, and are not used.

For this case study, the researcher replicated Levy's (1988) study, but also added to the field by examining aspects of client/server computing, the Internet, and the WWW. It is based on a modification of the methodology devised by Yin (1984).

The questionnaires developed by Levy (1988) were modified for use at Fairfield University. The modifications were approved by Levy. The modified instruments reflect both the current case

organization and the technology environment under study. The modified instruments were tested on a group of individuals from the administration and from the faculty at Fairfield University, the case organization. The results from the test group indicated that changes to the instruments would be beneficial, and these changes were made. The remodified instruments were reviewed by Levy. King and Kraemer (1985) provided the logical categories for context of use in computing environments and were adapted by Levy in the 1988 study:

1. Technological Development,
2. Structural Arrangements,
3. Socio-Technical Interface,
4. Political/Economic Environment, and
5. Benefits/Problems.

Specific questionnaire items cover these areas. These categories were also employed in the analysis.

The primary data gathering was accomplished using the "Administrator Assessment of Computing" and the "Faculty Assessment of Computing" questionnaires developed for the Levy study, appropriately modified to reflect recent developments and concerns specific to Fairfield University. The purpose of the modifications to the instruments was to gather data on the client/server aspects of the computing environment, as well as the use of the Internet and the World Wide Web.

The questionnaires were distributed through the office of the Academic Vice President (AVP) to all full-time faculty and academic administrators, and specific others recommended by the deans and the AVP. This data gathering activity was co-sponsored by the Education Technology committee. The completed questionnaires were returned to the office of the Academic Vice President.

A reminder notice was sent to all faculty and administrators one week after the original contact, so as to encourage participation. This action increased the response rate. The Educational Technology Committee made phone calls to colleagues to encourage participation.

Levy (1988) used open-ended interviews as recommended by Yin (1984) to expand the depth of data gathering, and to increase the number of sources of information. In this study the researcher used the same interview questions and protocol that were used in the Levy study. As in the Levy study, the survey was enhanced by interviews of key individuals so as to acquire information that might not have become available through the questionnaire. The interviews were conducted according to the interviewee's schedule and availability, as suggested by Feagin et al. (1991). Interviews were conducted with individuals whose responsibility included some aspect of information technology. The interview protocol used by Levy was free form and followed the recommendations of Yin (1984). It was ideal for the case organization under study. The researcher is well qualified to conduct this form of inquiry.

Results

The reporting aspect of a case study is perhaps most important from the user perspective. It is the contact point between the user and the researcher. A well designed research project that is not well explained to the reader, will cause the research report to fall into disuse. In this section, the researcher must refrain from technical jargon and resort to clear explanations. Those explanations are necessary to help the user understand the implications of the findings.

The results reported here are presented not exclusively as statistical results, but with accompanying explanations of the meaning of those test results. In that way both the technical requirements and the informational needs are met. The results are excerpted in this report so as to be concise and manageable. The author will provide the complete report to those interested in the details.

Responses to the Surveys

The two surveys, the "Faculty Assessment of Computing" and the "Administrator Assessment of Computing" were distributed to full-time faculty and educational administrators respectively. The surveys were distributed under the joint sponsorship of the Academic Vice President's office and the Educational Technology Committee with a covering note from the former, encouraging participation The members of the Educational Technology Committee also called their colleagues to encourage broad participation in the process.

Table 1
Survey Response Characteristics

Survey Type	# Distributed	# Respondents	% Response
Faculty	191	88	46
Administrators	22	14	64

It is clear from the data above that the response rate was sufficient to conduct the planned statistical tests. Moreover, as the report will indicate, the response was representative of the faculty and the administrators and was considered adequate for this study.

Note: For all the following tables, the responses for "Strongly Agree" and "Agree," and the responses for "Strongly Disagree" and "Disagree" were aggregated into "Agree" and Disagree" respectively using the SPSSx "Recode" option. This conforms to the data aggregation carried out by Levy (1988) in his study of the University of Arizona. In the following tables, **A** represents the **percentage** of responses in the "**Agree**" category and **D** represents the **percentage** of responses in the "**Disagree**" category. The difference between the reported percentages is the percentage of "**Neutral**" responses. When there is a significant percentage of "neutral" responses, that fact will be brought to the reader's attention. **Missing responses** are coded as "9" and are not part of any calculations.

The data in Table 2 could be useful to planners since it indicates that the respondents expect that their usage of information technology is likely to increase.

Table 2
Projected Faculty Computing Use
N=88

Item	Question	%Increase	%Decrease	%Same
3	Number of Applications	93	0	7
4	Amount of Time Spent	86	1	13
6	Data Communications	87	1	12

(Note: In this all following tables, "Item" refers to items in the Survey Instruments)

In items 7-11 reported in Table 3 the respondents were asked to indicate whether particular computer uses were of interest "currently," "could use now" (meaning they could have used the resource now if they had it), or "would enhance future work". The data in the table reflect the recoding that was used so that only "1" responses were retained and all other responses were treated as "No."

Table 3
Current and Future Computing Uses or Needs (Faculty)
N=88

Item	Question	%Current Use	%Could Use Now	%Future Enhance
7	Internet Resources	72	10	17
8	World Wide Web	59	18	24
9	Networked Class PC	11	25	35
10	AI	2	6	19
11	Complex Graphics	22	22	30

(%Future Enhance = Would enhance future work)

Most of the items in Table 4 show that the respondents expect that the importance of databases and other information technology items to increase in importance over the next five years.

Table 4
Important in Next 5 Years (Faculty)
N=88

		Cross Tabulations									
		All		A & S		Business		Nursing		GSEAP	
Item	Question	A	D	A	D	A	D	A	D	A	D
39	Dept support for net PC	51	28	**44**	**34**	**64**	**7**	**40**	**20**	**100**	**0**
63	More LANs	70	4	**70**	**4**	**71**	**7**	**75**	**0**	**80**	**0**
64	Search library holdings	95	5	**92**	**0**	**100**	**0**	**100**	**0**	**100**	**0**
65	Database Search	98	0	**96**	**0**	**100**	**0**	**100**	**0**	**100**	**0**
66	Off campus computing	82	2	**79**	**4**	**100**	**0**	**80**	**0**	**100**	**0**
67	Email	85	1	**88**	**2**	**57**	**0**	**100**	**0**	**100**	**0**
68	Students PC	78	4	**75**	**4**	**79**	**7**	**100**	**0**	**67**	**0**
69	Off campus email	82	2	**83**	**2**	**64**	**7**	**14**	**50**	**100**	**0**
70	Laser printing	95	2	**92**	**4**	**100**	**0**	**100**	**0**	**100**	**0**
71	Test scanning	45	13	**39**	**14**	**50**	**14**	**100**	**0**	**83**	**0**
72	Upgraded PC	93	5	**90**	**6**	**93**	**7**	**100**	**0**	**100**	**0**
73	Video conference	57	8	**54**	**12**	**50**	**7**	**100**	**0**	**67**	**0**
74	OCR	75	4	**67**	**6**	**93**	**0**	**100**	**0**	**100**	**0**
75	Voice recognition	33	12	**34**	**16**	**21**	**7**	**50**	**0**	**50**	**0**
76	Database browsing	83	1	**83**	**0**	**19**	**0**	**75**	**0**	**100**	**0**
77	Video capture	59	7	**54**	**8**	**50**	**14**	**75**	**0**	**83**	**0**
78	Access to WWW	95	5	**94**	**0**	**93**	**0**	**100**	**0**	**100**	**0**
79	Class access networked CD	77	24	**71**	**0**	**86**	**0**	**100**	**0**	**83**	**0**

80	Class material on WWW	74	2	**71**	**4**	**62**	**0**	**100**	**0**	**67**	**0**

(A = % Agree; D = % Disagree; Neutral = A - D; A&S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

***Note**: The number of responses in School of Nursing and GSEAP was small and the percentages in the cross tabulations above could be misleading. In this table and all following tables, the cross tabulations appear in bold.

Context of Computing Use

King and Kraemer (1985) developed the logical categories within which computer use could be examined. Those categories were adapted by Levy (1988) for his study. The survey items in the questionnaires used by Levy and in this study also fell into those categories as follows:

In the Faculty Survey the items that fell into each category were:

Technological Development, items 39, 63-80, 82-102, 107-116
Structural Arrangements, items 16-17, 38
Socio-Technical Interface, items 18, 51-62, 117, 120
Political/Economic Environment, items 19, 40, 42-50, 104-105, 118-119
Benefits/Problems, items 25-37, 106

In the Administrative Survey the items that fell into each category were:

Technological Development, items 40, 64-81, 83-103
Structural Arrangements, items 16-17, 39
Socio-Technical Interface, items 18, 52-63
Political/Economic Environment, items 19, 41, 43-51, 105-108
Benefits/Problems, items 26-38

Table 5 summarizes the responses to the items relating to the areas where the institution should place high priority, and those that relate to instructional computing. The respondents felt that servers and disk storage would be important, as would network-based materials. The responses also showed that there was significant importance attached to instructional computing, and access to the WWW.

Table 5
High Priority Should Be Placed On (Faculty)
N=88

		Cross Tabulations

		All		A & S		Business		Nursing		GSEAP	
Item	**Description**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**
82	Up-to-date Labs	87	2	**85**	**2**	**100**	**0**	**80**	**20**	**83**	**0**
83	More Mainframe	34	15	**35**	**12**	**21**	**21**	**40**	**20**	**50**	**0**
84	More Server Disk	68	1	**65**	**2**	**64**	**0**	**60**	**0**	**83**	**0**
85	More Powerful Server	77	0	**79**	**0**	**71**	**0**	**80**	**0**	**67**	**0**
86	Instructional PC Room	77	2	**81**	**2**	**86**	**0**	**60**	**20**	**67**	**0**
87	Multimedia Classroom	82	1	**83**	**2**	**93**	**0**	**80**	**0**	**67**	**0**
88	More Laser Printing	72	2	**70**	**2**	**71**	**0**	**80**	**20**	**100**	**0**
89	More Documentation	68	0	**64**	**0**	**57**	**0**	**100**	**0**	**83**	**0**
90	More Training	79	1	**77**	**0**	**79**	**7**	**100**	**0**	**100**	**0**
91	More Instruct Consulting	83	2	**83**	**0**	**71**	**14**	**100**	**0**	**83**	**0**
92	More Research Consulting	81	1	**79**	**0**	**79**	**7**	**100**	**0**	**67**	**0**
93	More Communications	51	2	**49**	**2**	**46**	**0**	**60**	**20**	**50**	**0**
94	Programming for University Supported System	48	1	**53**	**0**	**31**	**8**	**50**	**0**	**60**	**0**
95	Programming for Non-Supported Sys	32	7	**25**	**4**	**31**	**15**	**50**	**0**	**40**	**20**
96	Dept System Maintenance	88	1	**88**	**2**	**79**	**0**	**80**	**0**	**100**	**0**
97	Dept Software Maintenance	89	0	**90**	**0**	**86**	**0**	**80**	**0**	**100**	**0**
98	More Net Class	79	1	**75**	**2**	**92**	**0**	**100**	**0**	**67**	**0**
99	More WWW Sup	76	1	**71**	**1**	**79**	**7**	**100**	**0**	**67**	**0**
100	More Instructional Software	86	0	**81**	**0**	**85**	**0**	**100**	**0**	**100**	**0**
101	Transfer Files	66	2	**64**	**4**	**50**	**0**	**80**	**0**	**83**	**0**
102	Store Class Mat on WWW	78	1	**75**	**2**	**69**	**0**	**80**	**0**	**100**	**0**

(A = % Agree; D = % Disagree; Neutral = A - D; A & S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

Instructional uses of computing are assisted by:

		Cross Tabulations									
		All		A & S		Business		Nursing		GSEAP	
Item	Description	A	D	A	D	A	D	A	D	A	D
107	Sufficient Software	76	13	**72**	**20**	**79**	**0**	**80**	**20**	**83**	**0**
108	Sufficient Workstations	67	19	**60**	**24**	**77**	**8**	**80**	**20**	**67**	**17**
109	Sufficient Training	70	19	**65**	**24**	**86**	**7**	**60**	**20**	**67**	**33**
110	Suff Development Incentives	53	18	**55**	**22**	**50**	**7**	**60**	**40**	**17**	**17**
111	Affordable Software	72	11	**68**	**16**	**79**	**7**	**75**	**0**	**67**	**0**
112	Suff Data Communications	63	12	**52**	**18**	**86**	**0**	**75**	**0**	**67**	**17**
113	Current PC Equipment	68	20	**66**	**24**	**93**	**0**	**80**	**20**	**33**	**17**
114	Access to WWW	80	7	**76**	**10**	**93**	**0**	**80**	**0**	**67**	**17**
115	Access to Instructional Labs	71	5	**67**	**6**	**77**	**8**	**80**	**0**	**50**	**0**
116	Access to Student Labs	70	6	**69**	**6**	**64**	**14**	**100**	**0**	**33**	**0**

(A = % Agree; D = % Disagree; Neutral = A - D; A&S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

Structural Arrangements

Item 38 concerned faculty dissatisfaction with the level of computing decisions as presented in Table 6. Computing policy in general was not well regarded by the respondents.

Table 6
University Policies (Faculty)
N=88

		Cross Tabulations

		All		A & S		Business		Nursing		GSEAP	
Item	**Description**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**
16	Univ has effective guidelines	12	63	**11**	**68**	**7**	**43**	**20**	**80**	**33**	**33**
17	Univ allocates resources equitably	19	55	**19**	**61**	**0**	**36**	**0**	**80**	**50**	**17**
38	Satisfied with computing decisions	7	68	**11**	**66**	**0**	**71**	**0**	**67**	**0**	**50**

(A = % Agree; D = % Disagree; Neutral = A - D; A&S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

Socio-Technical Interface

Table 7
Socio-Technical Interface (Faculty)
N=88

		Cross Tabulations									
		All		A & S		Business		Nursing		GSEAP	
Item	**Description**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**
18	Hands-On Workshop	87	8	**85**	**8**	**93**	**7**	**100**	**0**	**83**	**17**
51	Frequently Upgraded PC	52	36	**52**	**40**	**54**	**31**	**20**	**20**	**83**	**17**
52	Sufficient Data Communications	48	31	**38**	**36**	**54**	**23**	**60**	**40**	**80**	**20**
53	Appropriate Computing Resources	43	42	**40**	**42**	**36**	**50**	**40**	**40**	**67**	**17**
54	Appropriate Software	57	25	**50**	**29**	**71**	**21**	**60**	**20**	**67**	**17**
55	Good Documentation	33	43	**33**	**41**	**17**	**67**	**40**	**20**	**50**	**33**
56	Sufficient Training	35	36	**33**	**33**	**29**	**50**	**20**	**40**	**50**	**33**
57	Sufficient Consulting	33	40	**28**	**43**	**21**	**50**	**20**	**40**	**67**	**17**
58	Sufficient Support Staff	34	46	**31**	**49**	**29**	**50**	**0**	**60**	**67**	**33**
59	Effective Support Staff	37	46	**33**	**47**	**23**	**54**	**60**	**20**	**67**	**33**

60	Office Access to WWW	80	11	**80**	**14**	**71**	**7**	**80**	**0**	**83**	**17**
61	Class Access to WWW	19	52	**21**	**58**	**15**	**39**	**0**	**60**	**33**	**17**
62	Home Access to WWW	38	44	**34**	**48**	**39**	**54**	**40**	**20**	**50**	**17**
117	Would Use Instructional Help	79	5	**75**	**4**	**69**	**15**	**100**	**0**	**83**	**0**
120	Would Use Research Help	71	6	**71**	**8**	**54**	**8**	**100**	**0**	**80**	**0**

(A = % Agree; D = % Disagree; Neutral = A - D; A&S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

Table 7 shows a faculty willing to learn about the technology by taking appropriate classes (87 %). Items 55-59 indicate the dissatisfaction of the respondents with the current status of documentation, training, and support. Current classroom access to the WWW was not considered acceptable.

Political/Economic Environment

Table 8
Sources for Funding (Faculty)
N=88

		Cross Tabulations									
		All		**A & S**		**Business**		**Nursing**		**GSEAP**	
Item	**Description**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**	**A**	**D**
19	All Student Access Computers	97	1	**96**	**2**	**100**	**0**	**100**	**0**	**83**	**0**
40	Frequently Approached By Vend	14	73	**15**	**77**	**7**	**79**	**0**	**50**	**17**	**50**
42	From Faculty Positions	3	90	**0**	**92**	**0**	**85**	**0**	**100**	**0**	**100**
43	From Support Positions	29	56	**32**	**55**	**23**	**46**	**67**	**33**	**25**	**50**
44	From Other Equipment	36	44	**29**	**44**	**54**	**31**	**75**	**25**	**50**	**50**
45	From Professional Travel	11	72	**6**	**71**	**23**	**62**	**0**	**100**	**0**	**100**
46	From Plant Maintenance	26	53	**23**	**51**	**31**	**54**	**25**	**50**	**75**	**25**

47	From New Programs	43	42	**47**	**35**	**39**	**54**	**33**	**67**	**50**	**50**
48	From Salary Increase	5	76	**2**	**73**	**15**	**69**	**0**	**100**	**0**	**100**
49	From Current Instruction Programs	27	60	**28**	**55**	**23**	**69**	**33**	**33**	**50**	**50**
50	Current Support Programs	23	65	**37**	**49**	**15**	**46**	**60**	**20**	**60**	**20**
104	Suff Support Dept Instr Computing	13	64	**23**	**69**	**31**	**46**	**0**	**100**	**0**	**67**
105	Suff Support Univ Instr Computing	12	65	**17**	**67**	**0**	**46**	**0**	**100**	**0**	**50**
118	Suff Support Dept Resch Computing	23	55	**19**	**64**	**21**	**43**	**20**	**60**	**33**	**50**
119	Suff Support Univ Resch Computing	15	59	**15**	**64**	**14**	**50**	**0**	**75**	**17**	**67**

(A = % Agree; D = % Disagree; Neutral = A - D; A&S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

The faculty felt overwhelmingly that all students should have access to computing (97 percent). The faculty rejected most of the listed choices of potential reallocation of funds, to finance the acquisition of information technology as can readily be observed in the results above. An equal percentage of respondents agreed to reduce new programs as opposed that reduction. Their needs were not affected by vendor presentations since only 14 % of the respondents were approached by vendors.

Benefits/Problems

The use of information technology has had a continuous growth in all spheres, not just in higher education. Fairfield University is no exception to the quandary of continually rising information technology costs, since the benefits of information technology contribute to the expanding demand for it. The survey instruments were designed to gather data on the perception that outsiders might have of the university as a result of its information technology resources. Item 25 in the Faculty Survey and Item 26 in the Administrator Survey asked if the use of computing directly increased the scope of the work of the respondent. Other items asked whether the respondent felt that computing resources would be attractive to outsiders. Table 9 summarizes the responses to these items.

Table 9
Contribution of Information Technology to the Following (Faculty)
N=88

		Cross Tabulations									
		All		A & S		Business		Nursing		GSEAP	
Item	Description	A	D	A	D	A	D	A	D	A	D
25	Scope of work incr by computing	97	1	**96**	**2**	**100**	**0**	**100**	**0**	**100**	**0**
26	Attracts Undergraduates	51	32	**45**	**35**	**43**	**43**	**80**	**20**	**80**	**0**
27	Attracts grad students	23	38	**19**	**33**	**14**	**64**	**40**	**40**	**17**	**33**
28	Attracts faculty	45	33	**42**	**34**	**43**	**43**	**40**	**40**	**50**	**17**
29	Attracts sponsored research	36	38	**38**	**38**	**29**	**36**	**20**	**80**	**25**	**25**
30	Attracts alumni support	29	28	**33**	**27**	**21**	**43**	**20**	**40**	**25**	**0**
31	Attracts corporate support	41	25	**43**	**23**	**36**	**36**	**20**	**60**	**25**	**0**
32	Attracts joint vent	32	28	**30**	**28**	**14**	**36**	**40**	**60**	**40**	**0**
33	Able to discuss needs	40	32	**44**	**33**	**0**	**43**	**100**	**0**	**50**	**25**
34	Satisfied with applications	21	53	**23**	**49**	**14**	**71**	**0**	**100**	**25**	**25**
35	Satisf with system response time	17	68	**20**	**65**	**14**	**57**	**0**	**100**	**0**	**75**
36	Satisfied with access to data	39	26	**26**	**37**	**57**	**0**	**100**	**0**	**75**	**0**
37	Satisfied data sets	7	28	**8**	**33**	**0**	**29**	**0**	**0**	**25**	**0**
106	in 5 yr computing improve instruction	99	0	**98**	**0**	**100**	**0**	**100**	**0**	**100**	**0**

(A = % Agree; D = % Disagree; Neutral = A - D; A&S = Arts & Sciences; %Business = School of Business; %Nursing = School of Nursing; GSEAP = Graduate School Of Education & Allied Professions)

Factor Analysis of Fairfield University Data by King and Kraemer (1985) categories: Faculty

A factor analysis was run on the Fairfield University data for each of the five King and Kraemer (1985) groupings of variables that were adapted for use in a study of the University of Arizona by Levy (1988). The following discussion will establish that a factor analysis may not be possible when the number of cases with data is insufficient for the procedure. The factor analysis procedure requires the same number of cases in every item included in the procedure. The researcher used the option in SPSSx to replace missing scores with the mean, so as to present an identical number of scores to the statistical procedure. There were 88 Faculty respondents and 22 Administrator respondents. The latter group may not provide a sufficient number of cases for a successful factor rotation. In both cases, as the overall responses are broken down according to the King and Kraemer groupings, there will be some groups that do not have a sufficient number of cases for a successful factor analysis, as the results will show. The King and Kraemer groupings adapted by Levy (1988, p. 60) are:

1. Technological development
2. Structural arrangements
3. Socio-technical interface
4. Political economic environment, and
5. Benefits/problems.

SPSSx for Windows version 7.1 was used to develop the Factor Analysis and extract the factors from the previously developed groupings described above. The researcher set the convergence factor at 75, and replaced missing scores with the mean, both selected from the screen menu options. In addition, a varimax rotation was selected from that menu so that the factors would be clearly identified.

Factor analysis of technological development

The 52 items in this group were included in the factor analysis. The results showed a convergence after 42 iterations. Although the procedure identified 15 factors, the Final Statistics of the SPSSx report showed that 47 % of the variation was explained by the first five factors. Hence this report will only report on those five factors, named by this researcher for the nature of the items that they represent: "Instructional support," "Internet/WWW," "Communications," "Online searching," and "Programming support." The individual items which had high factor loadings on each factor are as follows:

Instructional support:

Table 10
Instructional Support
N = 88

Item	Factor Loading

Sufficient amount of quality software/courseware	.8817
Sufficient number of available multimedia workstations	.8812
Sufficient training and development for faculty	.8342
Sufficient incentives for software development for faculty	.8012
Software at affordable prices for use on PC network	.7708
Sufficient data communications	.7453
Current PC equipment	.6765

<H3.*Internet/WWW:*

Table 11
Internet/WWW
N = 88

Item	**Factor Loading**
Access to the Internet and WWW	.7998
Ability to create class material for use on WWW	.6205
Support for WWW multimedia course development	.6118
Ability to store and scan materials for the WWW for instructional use	.5649
More instructional consulting support	.5571
More research consulting support	.5402

<H3.*Communications:*

Table 12
Communications
N = 88

Item	Factor Loading
Video capture/playback capability	.7953
More communications (data/voice)	.7030
Voice recognition	.7025
Large file transfer with sound, images, etc.	.5608

<H3.*Online Searching:*

Table 13
Online Searching
N = 88

Item	Factor Loading
Online search of library holdings from the office	.8279
Online search of national databases from the office	.8212

Table 14
Programming Support
N = 88

<H3.*Programming Support:*

Item	Factor Loading
Programming for university supported programs	.8193
Programming for non-university programs	.8122

Future researchers could use the above groupings to determine whether they are more effective and descriptive than the King and Kraemer (1985) groupings. In each grouping above, the factor loadings were .6 and higher, while loading very low on other factors. This indicates the independence of the factors from each other.

Factor analysis of structural arrangements

The three items in this group produced only one factor and hence could not be rotated. However, this is a confirmation that the three items do in fact form a cohesive group. The items in this factor are:

Table 15
Structural Arrangements
N = 88

Item	Factor Loading
University policy has provided effective guidelines for computing use in the university	.7886
The university's central administration has been equitable in allocating available resources for computing	.7117
Satisfied with our level of computing decisions	.7821

Factor analysis of socio-technical interface

The factor analysis identified five factors out of the original 15 in this group, but 60 percent of variance was explained by three: "Training and support," "Computing and communications," and "Computing support."

<H3.*Training and support:*

Table 16
Training and Support
N = 88

Item	Factor Loading
Good documentation	.6196
Sufficient training	.7321
Sufficient consulting	.8186

Sufficient support staffing	.8949
Effective support staffing	.8307

Computing and Communications:

Table 17
Computing and Communications
N = 88

Item	Factor Loading
Frequently upgraded personal computer	.8337
Sufficient data communications capabilities	.8648
Appropriate computing resources	.7045
Appropriate software	.7423

Computing Support:

Table 18
Computing Support
N = 88

Item	Factor Loading
Hands-on workshop for faculty	.6659
I would use the services of an Instructional Computing group to help faculty use computing for instruction	.8171
I would use the services of an Research Computing group to help researchers use computing in their research	.8498

Factor analysis of political economic environment

From the 15 items in this group, the factor analysis identified six factors but 55 percent of variance was explained by four: "Instructional and research support," "Travel salary reduction," "Equipment and support reduction," and "Program reduction."

Instructional and research support

Table 19
Instructional and Research Support
N = 88

Item	Factor Loading
There is sufficient support for instructional computing in my department	.6015
There is sufficient support for instructional computing in my university	.6264
There is sufficient support for research computing in my department	.8494
There is sufficient support for research computing in my university	.8543

Travel and Salary Reduction:

Table 20
Travel and Salary Reduction
N = 88

Item	Factor Loading
Professional travel and conferences	.8910
Promotions and salary increases	.8517

Equipment and support reduction:

Table 21
Equipment and Support Reduction
N = 88

Item	Factor Loading
Support positions	.7296
Other equipment and supplies	.7828
Plant and equipment maintenance	.7175

Program Reduction:

Table 22
Program Reduction
N = 88

Item	Factor Loading
New programs	.7080
Current instructional programs	.5975
All students should have access to computing	.6392

Factor Analysis of Benefits / Problems

The results of the factor analysis extracted two factors from the group of 14 items, which explained 53 % of the variance. The two factors were: "Computing resources attracts," and "Mainframe resources."

Computing resources attracts:

Table 23
Computing Resources Attracts
N = 88

Item	Factor Loading
Attracting undergraduates	.6845

Attracting graduate students	.7926
Attracting faculty	.8632
Attracting sponsored research	.8747
Attracting alumni support	.8309
Attracting corporate donations/grants	.8519
Forming joint ventures with private sector	.8407

<H3.*Mainframe Resources:*

Table 24
Mainframe Resources
N = 88

Item	**Factor Loading**
Satisfied with available applications	.7923
Satisfied with system response time	.6928
Satisfied with access to data for which I have clearance	.6508
Satisfied with institutional data sets available for analysis	.7390

Conclusions

Some of the conclusions from the data analysis, interviews, and literature are:

1. Institutional planning for information technology is inadequate.
2. Reduction in the work force through improved productivity could redress concern over the cost of information technology.
3. A shorter planning cycle is needed for information technology.
4. Allocation of resources is not equitable among users.
5. Users are dissatisfied with their ability to influence computing decisions.
6. Faculty and administrators did not accept any potential sources of funding for information technology
7. Faculty and administrators felt that computing enhanced the scope of their work.

8. Faculty and administrators have differing views on the level of computing resources at the institution.
9. The expenditures and procedures for implementation of client/server computing were not carried out in a systematic and documented manner.
10. The equipment acquisition procedures are not responsive to user needs either in terms of pricing or timeliness.
11. Equipment maintenance service is inadequate.
12. Equipment maintenance responsibilities assigned to agencies are not clear to users.
13. There is a low level of user confidence in network integrity.
14. The faculty expect to use networked PC's in the classrooms.
15. User productivity is lowered due to resource allocation problems, and other technology issues.
16. There will be a significant increase in the use of the Internet and WWW by faculty over the next five years.
17. The requirements of Internet, and WWW need to be met by a well-designed client/server environment.
18. The shift to client/server computing will result in higher financial burdens.
19. There is no formal procedure to configure the servers using capacity planning procedures.
20. Multimedia classrooms for instruction and support will be needed in the near future.

Implications

1. In a client/server computing environment formal capacity planning procedures need to be instituted, to ensure properly configured servers and adequately equipped client systems.
2. As the pace of technology advance accelerates, desktop systems are likely to become more capable than the server. This could present problems in the delivery of service and result in bottlenecks. The client/server environment must be continually monitored for efficiency.
3. A budget item must be included for information technology so that the expenditure for acquisition is part of the institutional planning process.
4. The information technology planning cycle should be shortened so that the institution is in a position to respond to the rapid pace of technology change.

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