

MAHARAJA COLLEGE'S GYMNASIUM EVALUATION AND SELECTION OF SYSTEMS

CONDUCTING EVALUATION

Once the three generic systems design **alternative were** finalised, Sarita asked Anoop Sarin to schedule a meeting of the project **team to review** them. **Because the final choice of a systems alternative** would have a major impact on the function of the gymnasium, **thus it was essential** project **team** be involved in the review. Sarita also **felt that by making a formal presentation**, she and Anil would be forced to consolidate the work completed to date.

After Sarita presented the findings, the three suggested alternatives were discussed **threadbare**. The **meeting was** long and often heated. A gist of the discussions is **presented as under**.

The stand-alone batch **alternative** automates the **current** manual system. Sarita and Anil **estimated** that at **best** it would provide a 20 percent **increase** in efficiency. Although they felt **this** increase would adequately solve the problems in the **gymnasium**, they **were** concerned that **this alternative revolved around** manual handling of ticket delivery **process** for a given **program**. Most **programs** require using three to four **ticket** salespeople simultaneously and only one centralized preprinted batch of tickets for program. **Either the** ticket sales staff would be bumping into each other or they would have to break up the tickets **into** smaller batches and allow each sales person to sell for only one section of the **gymnasium**. They would also have to share one **seating** chart or face **difficulties** in not duplicating **seats** offered to customers. However, the computer system portion of this **alternative** seemed extremely inexpensive to implement **and** administer. Costs of maintaining portions of the current **manual** system were yet to be determined. The important questions according to Sarita was, "Is this the best alternative when total costs are compared **to total benefits?**"

The project **team** felt **the** network-based alternative **provided** a means for each department to share **information**. A 50 to 60 percent improvement in efficiency is anticipated. This **coordination** and **efficiency improvement** would **allow** the Gymnasium to **operate** at near capacity.

The centralized alternative, although most attractive to all **concerned**, but MCG budget had been **traditionally** low, **the** team felt that requesting **the** funding for such an elaborate **system** might **not** find support in Management Committee. As a **systems** professional, **however**, Sarita was morally bound to **present** the centralized alternative because **benefits projected far exceeded** the costs, thus resulting in a **better** benefits-to-cost ratio **than the other two alternatives**.

By **the** end of the meeting the committee concluded that they **could** not reach a decision on the generic systems design alternatives until vendor **proposals were evaluated** and facts concerning the specifics on each **technology platform** were **gathered** and a **cost-effectiveness** analysis was **performed**.

Before developing the request for proposal (RFP), Sarita felt **that** one **enhancement should be** made. For **each** ticket **disbursement** by a given **sales agent**, a **summary statement** should be printed **that** would serve as a receipt for the transaction. This statement **would include** the number of tickets, **type of tickets**, type of payment, **amount of payment**, and so forth, and would **serve** as input to the accounting **system**. Then, if the customer needed further service, a **record** of the prior **service** could be obtained.

REQUEST FOR PROPOSAL

Sarita and Anil then sent out RFP (Request for Proposal) in the format given below:

Introduction

The MCG requests proposals for a Seating and Ticketing System (STS) to be provided on or before month dd, 19xx. This system should enhance current administrative and accounting support for the ticketing function of the gymnasium for all types of programs currently scheduled. These events are of three types: (1) Sporting programs for which open seating is required, (2) programs such as concerts for which designated categories of tickets and set-up are required, and (3) academic programs such as professional conferences that have specialised requirements for ticketing and seating. The system provided should enhance the ability of the gymnasium to maintain a mix of types and numbers of programs on a tight schedule, properly maintaining accounting and other requisite record keeping for the center on timely basis. The proposals should address the mandatory requirements in full. The MCG welcomes suggestions for enhancements and options within the spending guidelines.

Imperatives

The following issues must be addressed for the RFP to be considered:

Centrally accessible data : Ability to share data and printed reports among the activities of- fice, the ticket office, and the resources division.

Menu driven : User friendly, menu-based system for commonly used ~ b _____

Expandability and Upgradability: As the gymnasium expands, the system must be expan- dable to meet the increased need.

Desirable

Addressing the following items will improve the consideration for the proposed solution:

User report generation : Independence in production of reports necessary for each departmen- tal user of the system.

Online help: Access to information on software use from all workstations at all times.

PROPOSAL PREPARATION GUIDELINES

Vendors should prepare and deliver proposals to the MCG's Purchasing Division Office to meet the specific needs designated in the attachments on a before Month dd, 19xx.

Vendor Performance and Financial Condition

Proof of the vendor performance history, growth and financial strength is required. An audited financial statement is also required

A biographical sketch (resume) for all persons who will be involved in installation and support is required. Also, a list of the responsibilities and tasks assigned to each participant is required.

A list of customers (10-15) who have acquired the similar technology being proposed is required.

Systems Documentation

Samples of documentation for systems similar to the ones being proposed must be included. Complete review of the available online and offline documentation must be provided on re- quest by vendors who make the final short list.

Relevant policy **information** for hardware and software testing and **beta test** results should be described.

Legal and Business **Procedures**

Submit copies of your purchase and **service** and maintenance agreements, include **informa-**
tion on discounts, payment **schedules** and cancellation policies.

Generic Systems **Design Proposal** Report

A copy of the Generic Systems Design Proposal **Report** developed by the MCG **Gym-**
natorium is included. This document will provide information on user **requirements**, build-
ing blocks and the systems working environment for use **in** preparing proposals.

Data Processing Requirements

Provide **definition** of hardware and software set-up criteria. Include responses to the follow-
ing questions:

- * **Disk capacity?**
- * **Disk speed?**
- * **Disk access requirements?**

Note: It is proposed to **evaluate** computing **platform** proposals, using **benchmarks**.

Systems Requirements

Items that contribute to a **better** functioning of system and effect good systems **design** should
be **recommended** as needed, including:

- | | |
|-----------------------------------|------------------------------------|
| * Reliability measured
by MTBF | * Ease of use |
| * Modularity | * Maintainability measured by MTTR |
| * Compatibility | * Vendor support |
| * Installation schedule | |

Full Description of Building **Blocks** of Computing **Platform**

A full description of each **recommended** computing **platform** is required, including:

- | | |
|----------------------------|--|
| * Network topology | * Front-end and back-end processors |
| * Architecture | * Language processors |
| * Model number | * Security and control features |
| * Operating system | * Application program packages |
| * Primary storage capacity | * Peripherals |

Price and Financing Plans

Include full pricing, financing and acquisition methods.

Evaluation methodology

Simulations and benchmark **tests** may be scheduled during evaluation as required. Cus-
tomers will be contacted **about** their experiences with the proposed technology, its **perfor-**
mance and ease of use.

ASSIGNMENT ON MCG CASE (E)

Assume that you are the team consisting of Sarita and Anil that is conducting the evaluation and selection process. Write a comprehensive report on this analysis using 8 level screening process. The 8 Level Screening Process consists of following screens:

1. Desk Checking of Proposal Elements
2. Technical Performance Criterion Comparison
3. General Performance Criterion Comparison
4. Benchmark and Simulation Tests
5. Single Vendor Vs. Multiple Vendor
6. Price and Contract negotiations
7. Acquisition and Financing Methods
8. Cost Benefit Analysis

(Hint: You can send a fictitious RFP to selected vendors to get cost and technical data to perform this analysis).

SOLUTION TO ASSIGNMENT IN 'MCG CASE (E)
SYSTEMS EVALUATION AND SELECTION REPORT

Month dd, 19xx

To : All Division Heads
From : Sar Kakker, Chief Systems Analyst
Subject : Scheduling and Ticketing System (STS)
Copies : Mukul Gupta, Gymnatorium Director and Neera Tiwari, EDP Manager.

GENERAL EVALUATION STRATEGY

Vendors who submitted acceptable proposals were subjected to a seven-screen evaluation process to select the best vendors with the best technology platforms. The eighth evaluation screen subjected each systems design alternative with its technology platform to a cost-effectiveness analysis. The one with the best effectiveness-tocostratio should be selected for implementation.

Response from Requests for Proposals

The RFP and the Generic Systems Design Proposal Report were sent to 15 vendors. Three of the vendors were computer manufacturers, seven general computer systems vendors, and five were OEMs (Original Equipment Manufacturers) specializing in theater/program center ticketing and control systems.

One general computer systems vendor did not respond and another general computer systems vendor was eliminated in the general review of the proposal because of unclear substantive commitments. One computer manufacturer proposal was eliminated because it contained only hardware specifications without software. Twelve vendors remained after the general review and a seven-step screening process was started to consider the proposals of two computer manufacturers, five general computer system vendors and five OEMs. The following is a list of the vendors and the alternative to which they responded. Alternative 1 is the stand-alone batch generic systems design. Alternative 2 is the network-based generic systems design. Alternative 3 is the centralized generic systems design.

Vendors	Generic Systems Design Alternative
Computer Manufacturer	
VENDOR 1 — Wipro Systems	Alternative 3
VENDOR 2 — Digital Equipment	Alternative 3
General Computer Vendors	
VENDOR 3 — The computer Land	Alternative 1, 2
VENDOR 4 — Compurer Store	Alternative 1
VENDOR 5 — Computer Point	Alternative 1, 2
VENDOR 6 — Micro Land	Alternative 2
VENDOR 7 — Computer Joint	Alternative 1
Original Equipment Manufacturer	
VENDOR 8 — Central Information COs	Alternative 2, 3
VENDOR 9 — Program Data Processing	Alternative 2
VENDOR 10 — Tickets systems Unlimited	Alternative 3
VENDOR 11 — Online Reservations Pvt. Ltd.	Alternative 2
VENDOR 12 — The Schedulers Inc.	Alternative 3

The following criteria were used to screen vendors in the first evaluation.

- A. Vendor personnel
- B. Vendor customers
- C. Vendor documentation
- D. Vendor testing procedures and policies
- E. Vendor financial condition
- F. Vendor general, legal and business procedures

Based on this evaluation, Xs were placed in appropriate cells of the following grid when unacceptable:

	Vendor Number											
	1	2	3	4	5	6	7	8	9	10	11	12
A.	x	.	.	.	.	.	.
B.	.	.	x	.	.	.	.	.	.	.	.	.
C.	x	x	.	.	.	.	.
D.
E.	.	.	x	.	.	.	.	.	.	.	.	.
F.	x	.	.	.	.	.

Vendor 3 was eliminated based on phone calls made to this vendor's customers. They complained about training and installation support and unexpected costs that were incurred. Vendor 3 also presented an audited financial statement that had looks of creative accounting. Vendor 6 is a well-known vendor with a reputation for rapid turnover of personnel and was therefore eliminated. The documentation for vendor 6 was also unclear and difficult to follow. Vendor 7 was eliminated because the contract included a license agreement that called for a large yearly payment for a minimum of 10 years without the possibility of ownership. Vendor 7 was also eliminated for unclear and incomplete documentation. Vendor 10 did not provide evidence that testing procedures were conducted by a test group that was separate and independent from the development group.

Based on the outcome of this screening, vendors 1, 2, 4, 5, 8, 9, 11, and 12 remained in the running.

Evaluation Screen Two : Technical Performance Criteria Comparisons

This section contains:

- * Hardware technical performance criteria comparisons
- * Software technical performance criteria comparisons

Hardware Technical Performance Criteria	Vendors		Computing Platform for Standalone Batch System (Alternative I)
		4	5
Purchase Price		Rs. 150,000	Rs. 300,000
CPU		80386	80386
CPU Speed		33 Mhz	50 Mhz

Main Storage	1 Mbytes	1 Mbytes
Hard Disk Provided	240 Mbytes	300 Mbytes
Hard Disk Access Time	60 Mls	40 Mls
MTBF Rating	40,000 hours	30,000 hours
Display Provided	EGA colour	Monochrome
Display Resolution	640X400 PPI	1000x800 PPI
Display Graphics	Yes	Yes
Backup System	Floppies	Mag tape
Network Upgradable	Yes	Yes
Printer Provided	24-pin DMP	Laser
Expansion slots	8	7

Software			Computing Platform
Technical			for Standalone Batch
Performance			System (Alternative I)
Criteria	Vendors	4	5

Operating System	MS-DOS	MS-WINDOWS
Programming languages	COBOL	COBOL
Provided	C	SQL/RDB
Programming languages used	C	SQL/RDB
Source code provided	No	Yes
Main storage required	640K	512K
Disk storage required	20 Mbytes	30 Mbytes
Menu driven	Yes	Yes
Network upgradable	No	Yes
Access control	None	Passwords
Backup program	Yes	No
Structured Design	No	Yes
Integrated	Yes	Yes
Documentation quality	Fair	Good
Modules:		
Seating allocation	No	No
Reservation status	No	No
Reconcilecash	No	Yes
Billing process	Yes	Yes
Program management	Yes	Yes
Sales status	Yes	Yes

After reviewing the two proposals, vendor 5 was chosen as having the best proposal for alternative 1 because of the ability to upgrade to a LAN system. We then compared vendors 5, 8, 9 and 11 for alternative 2.

Hardware				Computing Platform
Technical				for Network-Based
Performance				System (Alternative 2)
Criteria/Vendors	5	8	9	11

Price	Rs. 540,000	Rs. 750,000	Rs. 800,000	Rs. 600,000
Workstations	Olivetti 1	IBM AS 1	IBM AS4	Microvax
CPU speed	18 Mhz	25 Mhz	25 Mhz	20 Mhz
Main storage	1MB	1MB	4MB	1MB
Network cards	Enable/LAN	Ethernet	Net II	G-Net
Hard disk	20 Mbytes	30 Mbytes	30 Mbytes	40 Mbytes
Harddisk speed	60 Mls	45 Mls	45 Mls	40 Mls
MTBF rating	40,000hours	30,000 hours	Unavailable	Unavailable
Display	CGA colour	VGA colour	Monochrome	EGA colour
Display resolution	320x200 PPI	640x200 PPI	640x200 PPI	720x400 PPI

Display graphics	Yes	Yes	No	Yes
LAN system	3-Com	IBM ring	IBM PC Net	Dec Net
Server	Olivetti III+	IBM AS1	IBM AS 4	Micro Vax
Server speed	25 Mhz	25 Mhz	25 Mhz	25 Mhz
Hard disk	80 Mbytes	80 Mbytes	240	240
Backup system	60 Mbytes	40 Mbytes	None	60 Mbytes
	Tape	Tape		Tape
Data transfer	10 Mbps	15 Mbps	12 Mbps	9 Mbps

Software Technical Performance Criteria/Vendors	5	8*	9	Computing Platform for Network-Based System (Alternative 2) 11
Price	Rs. 450,000	Rs. 420,000	Rs. 400,000	Rs. 360,000
LAN system	Novell	Banyan	PC-Net	DECNET
Programming language provided	SQL/DB	Pascal Cobol	SQL/DDDL C	SQL/FTP
Programming language used	SQL/DB	Pascal Cobol	SQL/DDDL C	SQL/FTP
Main memory required	500K	400K	640K	1 Mbyte
Main storage required	20 Mbytes	12 Mbytes	10 Mbytes	30 Mbytes
File locking	Yes	No	Yes	Yes
Passwords	Yes	Yes	Yes	Yes
Menu driven	Yes	Yes	Yes	Yes
report generators	Yes	No	No	Yes
Documentation	Excellent	Poor	Good	Fair
Service rates	Rs. 250/months	Rs. 300/Month	Rs. 400/month	Rs. 4000/Yr

* Eliminated vendor 8 because of poor Software documentation.

Hardware Technical Performance Criteria/Vendors	1	2	8	Computing Platform for Centralized System (Alternative 3) 12
Price	Rs. 900000	Rs. 1400000	Rs. 1000000	Rs. 1500000
CPU	Supreme 3020	DEC Vax II	IBM RC	IBM 9480
CPU speed	33	30 Mhz	50 Mhz	66 Mhz
Main storage	33 Mbytes	20 Mbytes	20 Mbytes	20 Mbytes
Hard disk	344 Mbytes	240 Mbytes	120 Mbytes	260 Mbytes
Hard disk speed	25 Mls	30 Mls	40 Mls	30 Mls
MTBF rating	100,000 hr	70,000 hr	40,000 hr	95,000 hr
Backup system	Mag Tape	Mag Tape	Mag Tape	Disk
Backup power	None	15 Minutes	30 Minutes	Auto Save
Input devices	Mouse	Lightpen	Touch screen	Mouse
Terminals	Wyze 50	DECUT 100	IBM 3164	TISL 200
Terminals	720x512 PPI	1000x480 PPI	860x600 PPI	640x480 PPI

Software Technical Performance Criteria/Vendors	1*	2	Computing Platform for Centralized System (Alternative 3) 8	12*
Price	Included	Included	Included	Included
Operating system	Pick	VMS 2.0	Unix system 5	MVS
Programming language provided	COBOL COBOL	FOCUS	C	C and FOCUS
Programming language used	COBOL	SQL/DA	ORACAL	SQL/DP
Main storage required	10 Mbytes	15 Mbytes	15 Mbytes	20 Mbytes
File locking	No	Yes	Yes	Yes
Menu driven	Yes	Yes	Yes	Yes
Passwords	Yes	Yes	No	Yes
Documentation	Fair	Good	Good	Excellent
Report generators	No	Yes	Yes	No
Online help	No	Yes	Yes	No
Monthly service	Rs. 1000	Rs. 1300	Rs. 1200	Rs. 1600

*Eliminated vendor 1 because it does not provide a 4GL Vendor 12 was eliminated because its proposal system did not contain online help.

Evaluation Screen Three : General Performance
Criteria Comparisons

Because vendor 5 was the only one remaining for alternative 1, it becomes the vendor of choice for alternative 1, Vendor 8 was eliminated from alternative 2 because the software documentation was poor. Vendor 1 was eliminated from alternative 3 because programming in a fourth generation language is preferred over COBOL. Vendor 12 was eliminated from alternative 3 because it was deemed inadequate without a report generator or online help. Whether screening for alternative 2 and alternative 3 is conducted based on the following general performance criteria:

- Compatibility: Flexible. Independent, Portable and Universal
- * Modularity : Segment. merged readily and modules changed easily.
 - * Maintainability : Changes in the program are made easily and low MTTR
 - * Reliability : Safe Shutdowns, high MTBF
 - * Life expectancy : Newer technology and support system over its life
 - * Installation schedule : Time to install
 - * Vendor support : Quality and cost of support when needed

NETWORK BASED SYSTEM (Alternative 2)							
General Performance Criteria	Weight	Vendor 5*		Vendor 9		Vendor 11*	
		Value	Score	Value	Score	Value	Score
Compatibility	20	7	140	5	100	8	160
Modularity	20	9	180	8	160	9	180
Maintainability	10	4	40	2	20	1	10
Realiability	10	8	80	9	90	10	100
Life expectancy	5	9	45	7	35	4	20
Installation schedule	5	10	50	8	40	5	25
Vendor Support	30	6	180	10	300	4	120
Total	100		715		745		615

* **Eliminated** : Although vendors 5 and 11 **received** higher marks form compatibility and modularity vendor 9 prevailed **because** of a very high mark for vendor support. Vendor 9 of-fered a five year **support contract included** in the price of the system. Vendor 9 **received favorable commants from customers concerning their level of support** and **users group has been formed**. Vendor 9 also provides **training** facilities with experienced personnel.

CENTRALIZED SYSTEM (Alternative 3)					
General Performance Criteria	Weight	Vendor 2		Vendor 8*	
		Value	Score	Value	Score
Compatibility	10	6	60	5	50
Modularity	10	9	90	8	80
Maintainability	5	1	5	2	10
Reliability	10	9	90	7	70
Life expectancy	20	9	180	7	140
Installaton Schedule	5	7	35	9	45
Vendor Support	40	8	320	6	240
Total	100		780		635

* Eliminated,: Although vendor 8 provided higher performing hardware, it was **felt** com-patibility, modularity, maintainability and vendor support were more important. For these reasons vendor 2 prevailed.

Evaluations Screen Four: Benchmark and Simulation Tests

The vendors left in the running up to this point are reasonably close **to each other** in **what** they are **offering** . **The** question now **becomes** which one actually **performs** the best under operating conditions.

At this point, vendor 5 supports **alternative 1**, vendor 9 supports **alternative 2**, and supports al-ternative 3.

Benchmark **tests** are based on :

- * Anticipated work load
 - * Compilers
 - * **Operating** system
- * Application and utility packages
 - * Input-bound and process bound speed

Applications	Vendor 8 Alternative 1	Vendor 9 Alternative 2	Vendor 2 Alternative 3
Ticket entry	NA	NA	80 sec
Backup of disk	30 min	10 min	45 sec
Print event listing	10 min	9 min	4 min
Process 20 events	2 min	1 min	20 sec
Query data base	NA	5 sec	3 sec
Process a ticket request	5 sec	4 sec	1 sec

Simulation tests considered were:–

- * **Turnaround** time
 - * Clock time
- * Systems capacity
 - * **Define** optimum equipment **configuration**

Note : Simulation tests could not be performed because of **the** unavailability of **appropriate** programs and personnel,

Vendor 2 **performed better** based on the benchmark **tests** over vendors 5 and 9, Similarly, **ve-**ndor **performed better than** vendor 5. **This** difference in **the performance** does not serve **to** eliminate any of the **three** at this **point** because of **the** price and configuration differences.

The evaluation **team** decided that dealing **with** a single vendor is advantageous. **A** single vendor involves fewer complexities and **better** support. Upgrades and changes are easier to **obtain**. It is also **difficult** to combine software packages from different vendors.

Evaluation Screen Six : Price and Contract **negotiations**

After negotiations with the remaining vendors, we determined the actual **selling** price. The terms of the bids are now in writing and the price and **financial** arrangements are specified in-detail. Delivery dates are mutually agreed upon and specified and acceptance criteria have been outlined. The specifics of all warranties have **been spelled** out and approved by legal counsel and purchasing & division:

Contract terms	Vendor 5 Alt 1	Vendor 9 Alt 2	Vendor 2 Alt 3
Selling Price	Rs. 300,000	Rs. 1,200,000	Rs. 1,400,000
Delivery date	DD/MM/YY	DD/MM/YY	DD/MM/YY
Financing available	Purchase or rent	Purchase or installment purchase	Operating lease of finance lease
Warranties	1 year	1 year	5 years
Service contract	Rs. 3000/ yr. Level 1	Rs. 12000/yr. Level 2	Rs. 15,000/ yr. Level 2
Acceptance criteria	Letter of approval within 30 days	Letter of approval within 90 days	Acceptance test

Evaluation Screen Seven: **Acquisiton** and Financing Methods

Before determining costs versus benefits of the three **altamative**, it is necessary to determine the best acquisition and financing method.

Based on our analysis, it is best to purchase the technology block for alternative 1, **to** use the installment purchase method for the **technology** platform for alternative 2, and lease using the operating method for the technology block for **alternative 3**. **A** summary of the financial details are as follows:

Contract terms	Vendor 5 Alternative 1	Vendor 9 Alternative 2	Vendor 2 Alternative 3
Financing method	Purchase	Installent purchase	Operating lease
Cost	Rs. 100,000	Rs. 17450/month	Rs. 20,000 / month
Term	NA	7 years	NA
Depreciation	Rs. 20,000 for 5 years	Rs. 90,000 for 5 years	Na
Salvage value	Zero	Zero	NA
Residual	NA	NA	Rs. 500,000

Evaluation Screen Eight : Cost– effectiveness Analysis
of General Systems Design Alternatives

We use the present value (PV) of cash flows method to determine which **alternative** over a period of ten **years** will provide the best financial benefit to the **gymnatorium**. **Ow** analysis is based on the following costs and benefits:

Benefits

1. Tangible
- a. Labour savings form more efficient scheduling and coordination

b. Revenue from additional program **bookings**

c. Cost savings from improved scheduling

d. Efficient and controlled ticket handling

e. Increased revenue from the ability to sell tickets in central market (for Alternative 3 only)

2. Intangible

- a. Customer goodwill from efficient and controlled ticket handling.

Cost

1. Systems implementation costs
2. Computing platform costs
 - a. Cost to acquire the initial system with finance charges
 - b. Cost of additional programming and hardware if required
3. Cost to operate the computer facility
 - a. Power requirements
 - b. Air conditioning
 - c. Furniture and fixtures
 - d. Supplies
 - e. Staffing
 - f. Maintenance contract fees
 - g. Insurance

STAND-ALONE BATCH ALTERNATIVE 1										
Years	1	2	3	4	5	6	7	8	9	10
Labour saving	30,000	40,000	40,000	50,000	50,000	60,000	80,000	90,000	10,000	1,20,000
Revenue	4,00,000	6,00,000	8,00,000	8,00,000	8,00,000	8,00,000	8,00,000	8,00,000	8,00,000	10,00,000
Cost savings	60,000	60,000	50,000	40,000	40,000	30,000	30,000	30,000	20,000	20,000
Ticketing	0	0	10,000	10,000	10,000	15,000	15,000	20,000	20,000	20,000
Benefits	4,90,000	7,00,000	9,00,000	9,00,000	9,00,000	9,15,000	9,25,000	9,40,000	9,40,000	9,60,000
Hardware	3,00,000	0	0	0	0	0	0	0	0	0
Programming	35,000	0	0	0	50,000	0	0	0	50,000	0
Maintenance	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Operations	1,00,000	1,50,000	1,50,000	1,60,000	1,30,000	1,80,000	2,00,000	2,50,000	2,50,000	2,50,000
Costs	4,38,000	1,53,000	1,53,000	1,63,000	2,33,000	1,33,000	2,03,000	2,03,000	3,03,000	2,53,000
Net cash	52,000	5,47,000	7,47,000	7,37,000	6,67,000	7,32,000	7,22,000	7,37,000	6,37,000	9,07,000
Factor @ 20%	.883	.696	.578	.482	.402	.335	.279	.233	.186	.162
PV	43,316	3,80,712	4,31,766	3,55,234	12,68,134	2,45,220	2,01,438	1,171,721	1,18,482	1,46,934
TOTAL PV	23,62,957									

TOTAL BENEFIT '72,60,000

RATIO 3

NETWORK-BASED ALTERNATIVE-2										
	1	2	3	4	5	6	7	8	9	10
a. Labour savings	40,000	50,000	70,000	3,80,000	1,00,000	1,14,000	1,20,000	1,40,000	1,40,000	1,50,000
b. Revenue	1,10,000	1,10,000	1,15,000	1,20,000	1,20,000	1,30,000	1,30,000	1,30,000	1,30,000	1,30,000
c. Cost Savings	60,000	60,000	80,000	80,000	1,00,000	1,00,000	1,50,000	1,50,000	1,30,000	2,00,000
d. Ticketing	40,000	40,000	50,000	50,000	60,000	60,000	60,000	60,000	60,000	60,000
e. Benefits (A+B+C)	2,50,000	2,60,000	3,15,000	3,30,000	3,30,000	4,00,000	4,60,000	4,80,000	5,10,000	5,30,000
f. Hardware Installments	17,143	17,143	17,143	17,143	17,143	17,143	17,143	0	0	0
g. Programming	10,000	10,000	10,000	10,000	50,000	10,000	10,000	10,000	50,000	10,000
h. Maintenance	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
i. Operations	1,50,000	1,50,000	1,60,000	1,80,000	2,00,000	2,00,000	2,00,000	2,00,000	2,10,000	2,10,000
j. Cost (F+G+H+I)	1,89,143	1,89,143	1,99,143	1,99,143	2,19,143	2,19,143	2,39,143	2,22,000	2,82,000	2,42,000
k. Net Cash	60,857	76,857	1,15,857	1,30,857	1,20,857	1,80,857	2,20,857	2,58,000	2,28,000	2,88,000
Factor @ 20%	0.833	0.696	0.579	0.482	0.402	0.335	0.279	0.233	0.196	0.162
PV	50,694	49,316	67,081	63,073	48,584	60,587	61,619	60,114	44,688	46,656
Total PV	5,52,412									
Total Benefits	39,15,000									
Ratio	7.1									

NETWORK-BASED ALTERNATIVE 3										
	1	2	3	4	5	6	7	8	9	10
a. Labor savings	50,000	70,000	80,000	90,000	1,10,000	1,30,000	1,30,000	1,30,000	1,30,000	1,30,000
b. Revenue	1,20,000	1,20,000	1,60,000	1,60,000	1,50,000	1,50,000	1,60,000	1,60,000	1,80,000	1,80,000
c. Cost Savings	30,000	1,20,000	1,50,000	1,80,000	1,30,000	1,30,000	1,30,000	1,80,000	1,80,000	1,80,000
d. Ticketing (A+B+C)	60,000	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000	1,20,000	1,20,000	1,20,000
e. Contract Mkt Ticketing	26,000	26,000	28,000	28,000	30,000	32,000	32,000	32,000	36,000	36,000
f. Benefits (A+B+C+D+E)	3,36,000	4,36,000	5,18,000	5,58,000	5,70,000	5,90,000	6,02,000	6,22,000	6,46,000	6,46,000
g. Hardware lease	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
h. Programming	10,000	30,000	30,000	30,000	15,000	30,000	30,000	30,000	20,000	30,000
i. Maintenance	1,55,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
j. Operations	2,00,000	2,00,000	2,50,000	2,50,000	2,50,000	2,80,000	2,80,000	3,00,000	3,00,000	3,00,000
k. Costs (G+H+I+J)	2,45,000	2,65,000	3,15,000	3,00,000	3,00,000	3,00,000	3,45,000	3,65,000	3,55,000	3,65,000
l. Net cash	91,000	1,71,000	2,03,000	2,43,000	2,70,000	2,55,000	2,57,000	2,27,000	2,91,000	22,81,000
Factor @20%	0.833	0.696	0.579	0.482	0.402	0.335	0.279	0.233	0.196	0.162
PV	75,803	1,19,016	1,17,126	1,17,126	1,08,546	85,425	71,703	59,881	54,126	45,522
Total PV	7,94,803									
Total Benefits	55,24,000									
Ratio	7.0									

