



# Buyers' Guide to Database Server Effectiveness and Cost of Ownership

In recent years, there has been considerable focus on the total cost of ownership of IT. Much of this debate originated in the competition for supremacy between differing architectural models, such as traditional centralized computing models vs. decentralized workstation-based philosophies vs. network computers and thin clients.

However, while total cost of ownership is very important, organizations actually require high value for money, i.e. IT architectures, products and solutions that combine a competitive total cost of ownership with a comparably high level of effectiveness.

This combination of effectiveness and competitive total cost of ownership is becoming important for database servers since databases are underpinning increasingly mission critical applications with a high business impact such as data warehousing. Consequently, organizations need to:

- Analyze the effectiveness of individual database servers in user- and data-intensive environments
- Assess the overall cost of ownership of database products
- Evaluate measures of total cost of ownership which take into account intensity of database use

This study addresses these objectives. It compares the effectiveness and total cost of ownership for Microsoft SQL Server 6.5 and Oracle8 (Workgroup) both in a general purpose environment and in the more demanding data warehousing environment.

The overall conclusions of this study are:

### **Database Usage**

- Two-thirds are databases now support highly mission-critical applications
- Oracle8 (Workgroup) achieves a higher intensity of usage per named user than Microsoft SQL Server 6.5
- The number of users per database is expected to grow rapidly. The number of users accessing a typical Oracle8 (Workgroup) database is expected to grow at over 100% per annum over the next two years

### **Database Effectiveness in Support of Mission Critical Applications**

- Oracle8 (Workgroup) is perceived to be more effective than Microsoft SQL Server 6.5 in support of mission critical applications
- Oracle8 (Workgroup) is perceived to be more effective than Microsoft SQL Server 6.5 in support of data warehousing applications
- The level of upgrade activity required to overcome database reliability and performance issues within data warehousing applications is appreciably higher for databases utilizing Microsoft SQL Server 6.5 than those using Oracle8 (Workgroup)

### **Cost of Ownership: General Application Environment**

- Microsoft SQL Server 6.5 exhibits a lower product cost of ownership **per named user** than Oracle8 (Workgroup) in a general application environment
- Microsoft SQL Server 6.5 and Oracle8 (Workgroup) have similar costs of product ownership **per concurrent** user in a general application environment
- Microsoft SQL Server 6.5 and Oracle8 (Workgroup) have similar total costs of ownership **per named user** in a general application environment
- Oracle8 (Workgroup) has a lower total cost of ownership than Microsoft SQL Server 6.5 **per concurrent user** and **per database gigabyte** in a general application environment

**Cost of Ownership: Data Warehousing Applications**

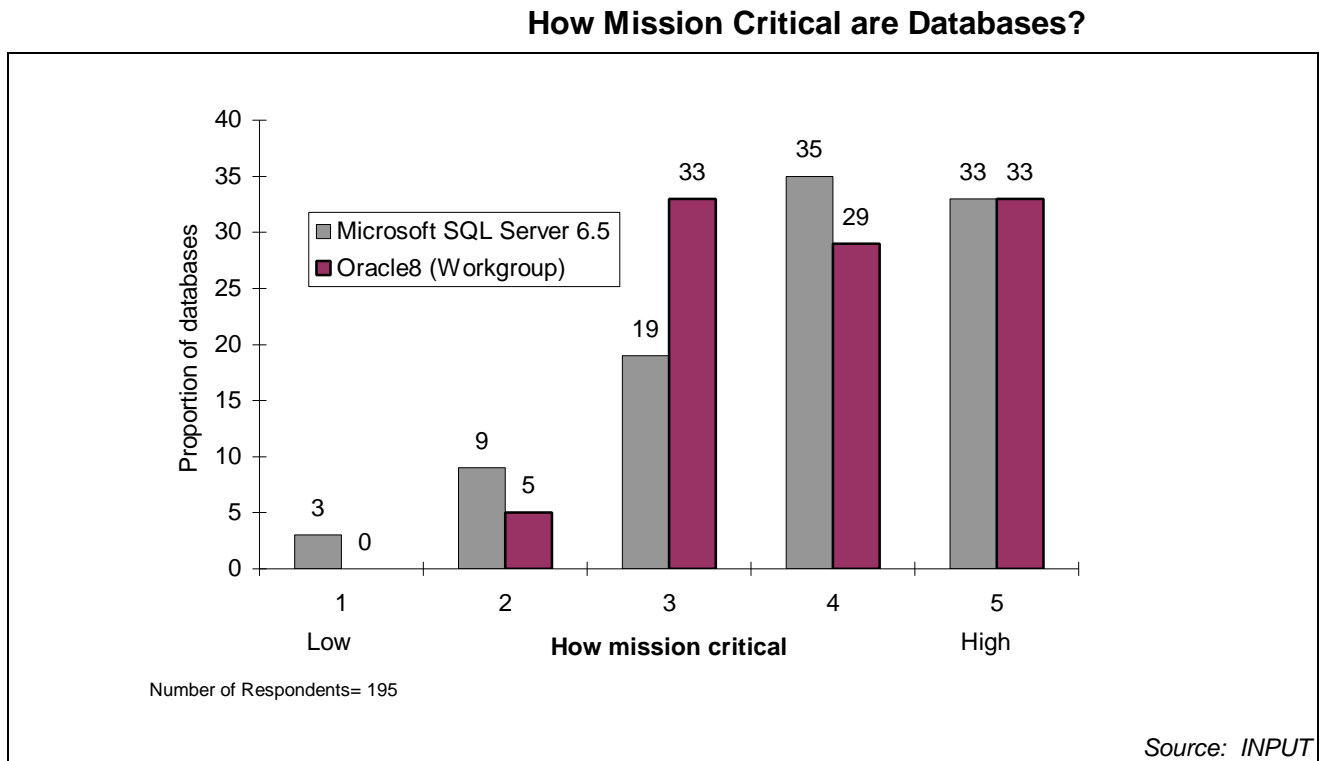
- Oracle8 (Workgroup) has a lower total cost of ownership **per named user** than Microsoft SQL Server 6.5 in support of data warehousing applications
- Oracle8 (Workgroup) has a lower total cost of **ownership per concurrent user** and **per database gigabyte** than Microsoft SQL Server 6.5 in support of data warehousing applications

**A**

**Databases Take On Increasingly Critical Roles**

Exhibit 1 shows the perceived level of criticality for a sample of databases utilizing Microsoft SQL Server 6.5 and Oracle8 (Workgroup).

Exhibit 1



Approximately two-thirds of databases are regarded as highly mission critical and only 5% of databases utilizing Oracle8 (Workgroup) are perceived to have a low level of criticality.

Exhibit 2 reinforces this perception of criticality by showing the profiles of perceived business impact of database downtime for databases utilizing Microsoft SQL Server 6.5 and Oracle8 (Workgroup) respectively.

Exhibit 2

**Business Impact of Downtime**

Business Impact	Proportion of databases (%)	
	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
An individual group will be inconvenienced	7	0
An individual group will be forced to stop working	3	0
A department or division will be inconvenienced	30	30
A department or division will be forced to stop working	15	20
The entire company will be inconvenienced	35	40
The entire company will be forced to stop working	10	10

Databases using these products are no longer implemented largely for the convenience of an individual group of users. Should a database fail then there is approximately a 50:50 chance that the entire company will be inconvenienced or even forced to stop working.

As a result the cost of downtime to businesses nowadays is considerable. In such circumstances, the performance, reliability and recovery facilities of database products are critical to the organization.

Exhibit 3 shows the profile of usage by application for each database server.

Exhibit 3

**Application Usage by Database Server**

Application	Proportion of applications (%)	
	Microsoft SQL Server 6.5 Users	Oracle8 (Workgroup) Users
Data warehousing	28	37
Customer relationship management	26	19
Accounting	20	12
OLTP	14	16
Supply chain management	7	7
ERP	6	9

The profiles of application usage are broadly similar across database server. However Oracle8 (Workgroup) tends to be more extensively used for more intensive applications such as data warehousing and OLTP than is Microsoft SQL Server 6.5.

Conversely there is greater emphasis on use of Microsoft SQL Server 6.5 for customer relationship management and accounting applications.



Exhibit 4 shows overall usage statistics for databases based on each database server.

Exhibit 4

**Usage Statistics by Database Server**

	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average number of named users	560	450
Average number of named users in two years	1100	2250
Growth rate (%)	40	120
Average number of concurrent users	155	170
Average size of database (Gigabytes)	45	120
Average expected lifetime of database (years)	6	7

Amongst those organizations surveyed, applications utilizing Microsoft SQL Server 6.5 have a higher average number of named users than applications utilizing Oracle8 (Workgroup). However, the Oracle8 (Workgroup) database servers achieve higher intensity of usage by supporting a higher ratio of concurrent users to named users. In addition, the average size of database supported is almost three times higher for Oracle8 (Workgroup). This suggests that a greater workload, overall and per named user, is typically being placed on those databases utilizing Oracle8 (Workgroup).

Furthermore, the number of named users supported by Oracle8 (Workgroup) is expected to grow much more rapidly (over 100% growth per annum) over the next two years than the number of named users supported by Microsoft SQL Server 6.5 installations. Accordingly applications utilizing Oracle8 (Workgroup) can be expected to overtake those utilizing Microsoft SQL Server 6.5 in terms of number of named users and consequently further increase their lead in terms of number of concurrent users supported.

**B**

**Oracle8 (Workgroup) is More Suited to Data Warehousing Environments**

In these circumstances, it is important that database software selected is suitable to support mission critical applications and has the scalability required to facilitate these high levels of planned growth.

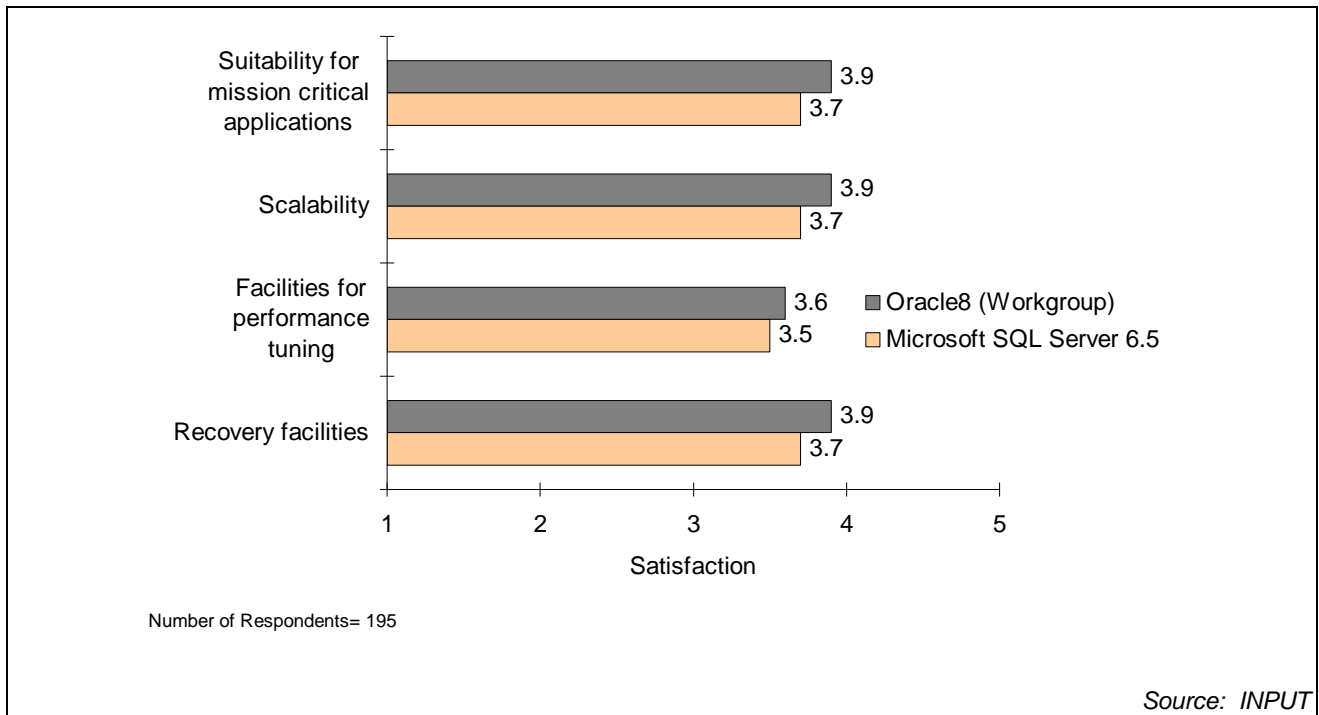
In particular, database software requires:

- A high level of reliability
- Recovery facilities to minimize downtime in mission critical environments
- Performance in increasingly demanding environments.

Exhibit 5 compares satisfaction with Microsoft SQL Server 6.5 and Oracle8 (Workgroup) in terms of a range of these characteristics across the complete application mix shown earlier.

Exhibit 5

**Satisfaction with Database Characteristics: Overall**

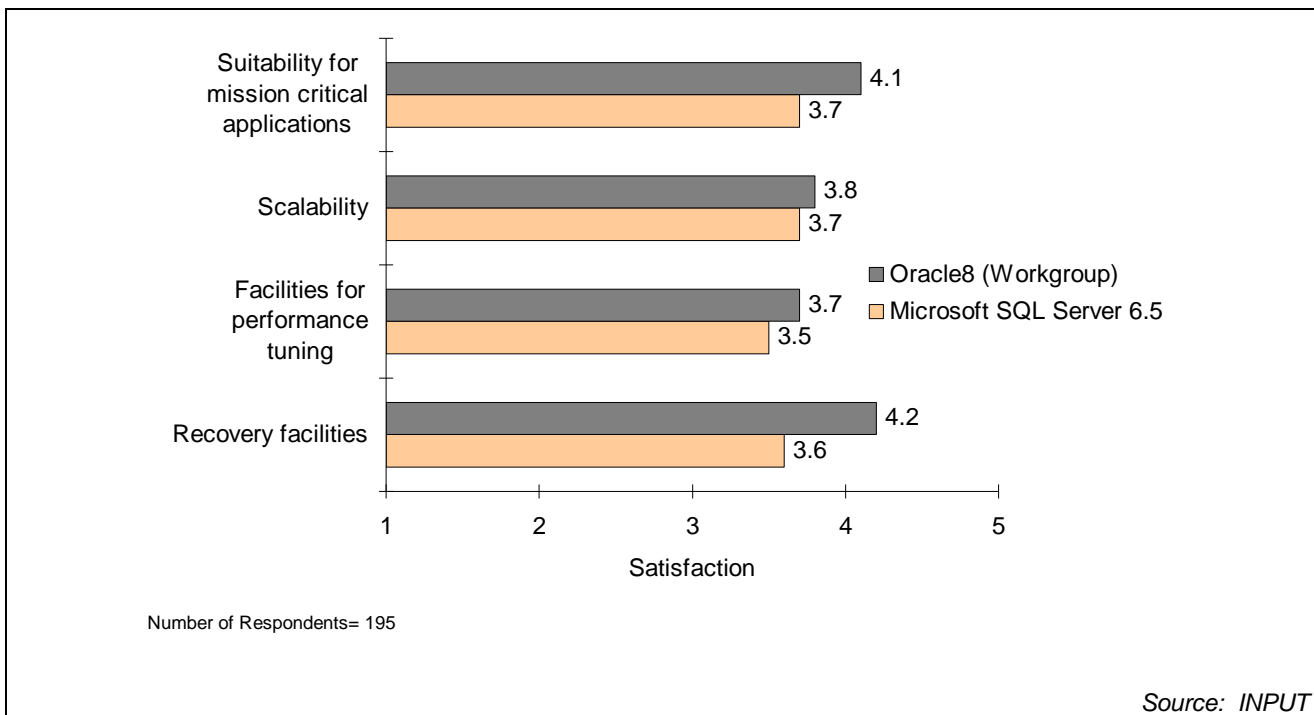


Oracle8 (Workgroup) exhibits a lead in effectiveness over Microsoft SQL Server 6.5 in terms of many of these characteristics within the general purpose computing environment represented by this mix of applications.

Exhibit 6 compares satisfaction with Microsoft SQL Server 6.5 and Oracle8 (Workgroup) in terms of the same characteristics within the more demanding data warehousing environment.

Exhibit 6

**Satisfaction with Database Characteristics: Data Warehousing Applications**



In the specific case of supporting data warehousing applications, Oracle8 (Workgroup) extends its lead in effectiveness over Microsoft SQL Server 6.5. This particularly applies to the ability of Oracle8 (Workgroup) to:

- Support mission critical applications
- Provide recovery facilities in this environment.

Another way of measuring the ability of database products to cope with the pressures of more-intensive environments is to compare the level of upgrades that they require in a data warehousing environment.



Exhibit 7 shows the proportion of databases that have received database server (software) upgrades by principal reason for the upgrade.

Exhibit 7

**Software Upgrades by Database Server: Data Warehousing Applications**

Primary reason for database software upgrade	Proportion of Microsoft SQL Server 6.5 databases upgraded	Proportion of Oracle8 (Workgroup) databases upgraded
Performance	63%	50%
Reliability	49%	25%
Scalability	33%	33%

The level of upgrade activity within data warehousing applications is appreciably higher for databases utilizing Microsoft SQL Server 6.5 than for those utilizing Oracle8 (Workgroup). In particular, databases utilizing Microsoft SQL Server 6.5 have typically received a higher proportion of software upgrades to overcome reliability and performance issues than databases utilizing Oracle8 (Workgroup).

Similarly, Exhibit 8 shows the proportion of databases that have received database hardware upgrades by principal reason for the upgrade.

Exhibit 8

**Hardware Upgrades by Database Server: Data Warehousing Applications**

Primary reason for hardware upgrade	Proportion of Microsoft SQL Server 6.5 databases upgraded	Proportion of Oracle8 (Workgroup) databases upgraded
Performance	71%	50%
Reliability	40%	33%
Scalability	41%	17%



The pattern is comparable with that shown previously. Databases utilizing Microsoft SQL Server 6.5 have typically received a higher level of hardware upgrades to overcome scalability, performance and reliability issues than databases utilizing Oracle8 (Workgroup).

## C

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### Total Cost of Ownership

This section compares the total cost of ownership for databases utilizing Microsoft SQL Server 6.5 and Oracle8 (Workgroup) in terms of their:

- Cost of ownership per named user
- Cost of ownership per concurrent user
- Cost of ownership per database gigabyte

To achieve both a general comparison of cost of ownership and a comparison relevant to more demanding applications, the cost of ownership comparisons between Microsoft SQL Server 6.5 and Oracle8 (Workgroup) are performed in each case:

- Across all applications
- For data warehousing applications only

**Cost of Ownership per Named User is Similar for Microsoft SQL Server 6.5 and Oracle8 (Workgroup)**

Exhibit 9 shows the average costs of ownership per named user per annum for each of the database servers across the generally applicable application profile shown earlier.

Exhibit 9

**Cost of Ownership per Named User**

Averages per named user	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average number of named users	560	450
Total annual cost per user (\$K)	4.0	3.4
Total annual cost per user less downtime (\$K)	2.9	2.9

The total costs of ownership per named user per annum are comparable for Microsoft SQL Server 6.5 and Oracle8 (Workgroup) particularly when the cost of downtime is excluded from the calculation.

Exhibit 10 shows the breakdown of these average costs of ownership per named user per annum for each of the database.

Exhibit 10

**Breakdown of Cost of Ownership per Named User**

Averages per named user (\$K)	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Product and maintenance (including upgrades)	0.5	0.7
Implementation (including training)	0.6	0.45
Operations and support	1.8	1.8
Down time	1.1	0.5

Microsoft SQL Server 6.5 exhibits a lower cost of *product ownership* per named user in a general application environment than Oracle8 (Workgroup). The overall levels of implementation and operations cost per

named user are broadly comparable, giving comparable overall costs of ownership before downtime is taken into account.

However in the more demanding data warehousing environment, Oracle8 (Workgroup) has the advantage in terms of cost of ownership per named user.

Exhibit 11 shows the average costs of ownership per named user per annum within data warehousing applications for each of the database servers.

Exhibit 11

**Cost of Ownership per Named User: Databases within Data Warehousing Applications**

Averages per named user	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average number of named users	715	385
Total annual cost per user (\$K)	4.7	3.3
Total annual cost per user less downtime (\$K)	3.1	2.5

In data warehousing environments, a difference in cost of ownership emerges between Microsoft SQL Server 6.5 and Oracle8 (Workgroup). Oracle8 (Workgroup) now shows a lower cost of ownership for data warehousing applications regardless of whether or not the costs of downtime are included in the calculation.

Exhibit 12 shows the breakdown of the costs of ownership per named user per annum for each of the database servers in support of data warehousing applications.

Exhibit 12

**Breakdown of Cost of Ownership per Named User: Data Warehousing Applications**

Averages per named user	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Product and maintenance (including upgrades)	0.5	0.9
Implementation (including training)	0.5	0.4
Operations and support	2.2	1.3
Down time	1.6	0.8

Although the product costs per named user remain lower for Microsoft SQL Server 6.5, the lower operations, support, upgrade costs and cost of downtime for Oracle8 (Workgroup) results in a lower overall cost of ownership per named user.

**Oracle8 (Workgroup) Exhibits Lower Cost of Ownership per Concurrent User**

Exhibit 13 shows the average costs of ownership per concurrent user per annum for each of the database servers across the application portfolio.

Exhibit 13

**Cost of Ownership per Concurrent User**

Averages per concurrent user	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average number of concurrent users	155	170
Total annual cost per user (\$K)	14.0	9.0
Total annual cost per user less downtime (\$K)	10.3	7.8

Since databases using Oracle8 (Workgroup) typically support a higher ratio of concurrent users to named users than Microsoft SQL Server 6.5, the cost of ownership per concurrent user per annum is considerably lower for Oracle8 (Workgroup) than for Microsoft SQL Server 6.5.

Exhibit 14 shows the breakdown of the average costs of ownership per concurrent user per annum for each of the database servers in a general-purpose environment.

Exhibit 14

**Breakdown of Cost of Ownership per Concurrent User**

	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Product and maintenance (including upgrades)	1.8	1.9
Implementation (including training)	2.0	1.2
Operations and support	6.5	4.7
Down time	3.7	1.3
Total less downtime	10.3	7.8
Total	14.0	9.0

Calculated per concurrent user, the gap in *product* cost of ownership between Microsoft SQL Server and Oracle8 (Workgroup) closes giving a similar cost of product ownership.

Calculated per concurrent user, Oracle8 (Workgroup) has a lower cost of ownership than does Microsoft SQL Server 6.5 across database implementation, operation and support, resulting in a lower overall cost of ownership per concurrent user.



As would be expected this cost of ownership advantage per concurrent user remains valid in a data warehousing environment. Exhibit 15 shows the average costs of ownership per concurrent user per annum for each of the database servers within data warehousing applications.

Exhibit 15

**Cost of Ownership per Concurrent User: Databases within Data Warehousing Applications**

Averages per concurrent user	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average number of concurrent users	225	215
Total annual cost per user less downtime(\$K)	10.0	4.4

Exhibit 16 shows the breakdown of the costs of ownership per concurrent user per annum for each of the database servers within data warehousing applications.

Exhibit 16

**Breakdown of Cost of Ownership per Concurrent User: Data Warehousing Applications**

Averages per concurrent user	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Product and maintenance (including upgrades)	1.5	1.5
Implementation (including training)	1.5	0.6
Operations and support	7.0	2.3
Down time	5.1	1.4

**Oracle8 (Workgroup) Exhibits Lower Cost of Ownership per Database Gigabyte**

Exhibit 17 shows the average costs of ownership per Gigabyte of database per annum for each of the database servers across the mix of applications.

Exhibit 17

**Cost of Ownership per Gigabyte of Database**

Averages per database Gigabyte	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average size of database (Gigabits)	45	120
Total annual cost per Gigabyte (\$K)	94	59
Total annual cost per Gigabyte (\$K) less downtime	74	57

The average size of databases utilizing Oracle8 (Workgroup) is higher than that for databases utilizing Microsoft SQL Server 6.5 and, on the basis of cost per Gigabyte, Oracle8 (Workgroup) shows the lowest overall total cost of ownership.



Exhibit 18 shows the breakdown of the average costs of ownership per database gigabyte per annum for each of the database servers in a general-purpose environment.

Exhibit 18

**Breakdown of Cost of Ownership per Database Gigabyte**

	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Product and maintenance (including upgrades)	19	13
Implementation (including training)	12	8
Operations and support	43	36
Down time	20	2
Total less downtime	74	57
Total	94	59

Exhibit 19 shows the average costs of ownership per Gigabyte of database per annum for each of the database servers within data warehousing applications.

Exhibit 19

**Cost of Ownership per Gigabyte of Database: Databases within Data Warehousing Applications**

Averages per database gigabyte	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Average size of database (Gigabytes)	65	190
Total per gigabyte (excluding downtime)	31	28

Exhibit 20 shows the detailed breakdown of the costs of ownership per Gigabyte of database per annum for each of the database servers.

Exhibit 20

**Cost of Ownership per Gigabyte of Database: Detailed Analysis**

Averages per database gigabyte	Microsoft SQL Server 6.5	Oracle8 (Workgroup)
Product and maintenance (including upgrades)	9.5	8.1
Implementation (including training)	5.7	5.7
Operations and support	16.3	13.8

**D****Methodology and Cost Factors**

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This section contains a description of the methodology used and also an analysis of some of the key cost factors within database cost of ownership. Organizations may find it useful to compare their internal costs against these cost factors.

**Methodology**

To ascertain the costs of ownership for each database server, 195 web interviews were carried out. Each interview referred to an individual database within an organization and collected measures of cost of ownership and effectiveness for that database.

Data collected within the total cost of ownership included:

**Product costs:** In addition to database product costs, these included all related product costs such as cost of underlying hardware and expenditure on database tools

**Database implementation costs** (costs, mainly manpower, associated with the initial database implementation both internal and external)

**Operations costs** (including all costs of IT personnel, user personnel and external expenditure incurred on server and network operations associated with the database, whether on central or local sites)

**Maintenance costs** (annual expenditure on maintenance for all hardware and software associated with the database)

**Support costs** (principally database administration costs, including the cost of personnel and external expenditure associated with performance monitoring and tuning for the database, and help-desk costs associated with the database)

**Training costs** (includes the cost of training both IT and user personnel associated with the database)

**Upgrade costs** (includes the cost of hardware upgrades, additional license fees, and any additional implementation and training costs resulting from the upgrades to this database)



Cost of downtime (includes the direct cost of downtime in terms of additional support cost and estimates of the indirect cost of downtime in terms of cost to the business).

Annual costs of ownership were calculated as shown in Exhibit 21.

Exhibit 21

**Calculation of Cost of Ownership**

Item	Calculation of annual cost of ownership
Software costs	Total software cost divided by expected life of database in years
Hardware costs	Total hardware cost divided by expected replacement cycle of hardware in years
Implementation costs	Total implementation cost divided by expected life of database in years
Training costs	Total training cost divided by expected life of database in years
Upgrade costs	Total upgrade cost to date divided by current age of database in years
Maintenance costs	Calculated as annual figures
Operations costs	Calculated as annual figures
Support costs	Calculated as annual figures
Downtime costs	Calculated as annual figures
Total annual cost of ownership	Calculated as sum of above components

Cost of ownership figures per named user, per concurrent user and per database gigabyte were then calculated on an annual basis by dividing the total annual cost of ownership calculated for each database by each database's number of named users, number of concurrent users, and size in Gigabytes.



Interviews were carried out across a broad range of industry sectors to give a representative mix of industries.

All databases included in the study were required to support a minimum of 50 named users. The average number of named users per database is 540. Exhibit 22 shows the profile of databases by number of named users.

Exhibit 22

**Profile of Databases by Number of Named Users**

Number of named users	Proportion of total (%)
50-100	36
101-200	21
201-500	23
501-1000	9
More than 1000	11
Total	100

The number of users concurrently using the database is less than the number of named users. The average number of concurrent users is 160. Exhibit 23 shows the profile of databases by number of concurrent users.

Exhibit 23

**Profile of Databases by Number of Concurrent Users**

Number of concurrent users	Proportion of total (%)
Less than 50	50
50-100	21
101-200	11
201-500	13
More than 500	5
Total	100

Exhibit 24 shows the profile of databases by size of database in Gigabytes. The average database size is 50 Gigabytes.

Exhibit 24

**Profile of Databases by Size of Database**

Size of database (Gigabytes)	Proportion of total (%)
Up to 1.0	12
1.01 to 2.0	14
2.01 to 5	19
5.01 to 10.0	18
10.01 to 50.0	24
50.01 to 100.0	4
More than 100	9
Total	100

On average, the year of implementation for the database surveyed was 1996. Exhibit 25 shows the profile of year of initial implementation for the databases covered in the survey.

Exhibit 25

**Profile by Year of Database Implementation**

Year	Proportion of total (%)
1994 or earlier	10
1995	10
1996	19
1997	37
1998	24
Total	100

The average expected lifetime of the databases in the survey was 6.4 years.

**Cost Factors**

This section provides an analysis of a number of key cost factors used in the total cost of ownership analysis. Organizations may wish to benchmark their own figures against those shown below.

Exhibit 26 shows the average replacement cycle for hardware platforms running database applications.

Exhibit 26

**Equipment Replacement Cycle**

Replacement Cycle	Average number of years
Equipment replacement cycle (years)	3.7

Exhibit 27 shows the typical number of days training received by IT and user personnel in support of database applications, together with the average training cost.

Exhibit 27

**Training Statistics**

Training item	Average
Number of days training per IT person	11
Number of days training per user	3
Average cost per man day training (\$)	550

As would be expected the average number of days per person incurred on technical training for IT personnel is considerably higher than the level of training per database user.

Exhibit 28 shows the average in-house cost of employment for database implementation, database administration, database operation and associated help-desk personnel.

Exhibit 28

**Manpower Costs**

Type of manpower	Cost per person (\$K)
Average cost of implementation manpower (\$K per person)	65
Average cost of employment per database administrator (\$K)	63
Average cost of employment per operator (\$K)	52
Average cost of employment per help-desk employee (\$K)	45

