Chapter 4
Implementing GIS

Implementing GIS

- Establishment Phase

    - hardware/software
    - trained manpower
    - pilot study

- Application Development Phase

    - Database Standards
    - Database Development
    - GIS Applications

GIS Development Phase

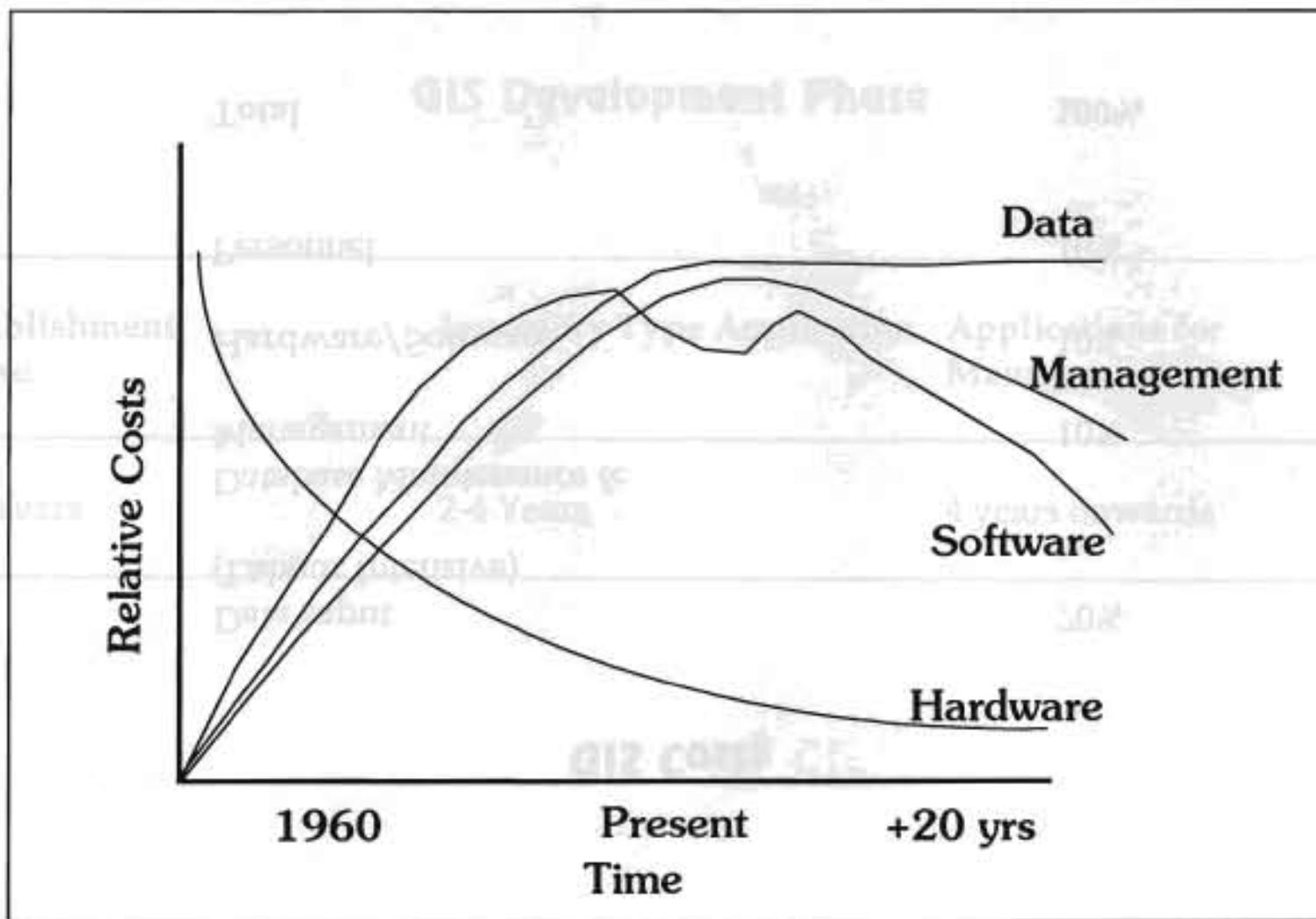| Establishment Phase	Inventory Type Application	Applications for Management
1-2 Years	2-4 Years	4 years onwards

GIS Costs

Data Input (Labour Intensive)	70%
Database Maintenance & Management	10%
Hardware/Software	10%
Personnel	10%
Total	**100%**

Costs of GIS

Organisational Aspects of GIS


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                    ┌──────────────────┐
                    │   Management     │
                    └──────────────────┘

┌──────────────────┐                      ┌──────────────────┐
│ Information and  │                      │ Aims and Queries from │
│   Management     │                      │   Management     │
└──────────────────┘                      └──────────────────┘

              ┌────────────────────┐
              │    Geographical    │
              │    Information     │
              │      Systems       │
              └────────────────────┘

                 ┌──────────────────┐
                 │  Data Gathering  │
                 └──────────────────┘
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GIS Technology

Requirements

- Highly Reliable Data Storage

- Flexibility: growth and expansion

- Communication, Networking, Interoperability

- Optimisation for Data Management
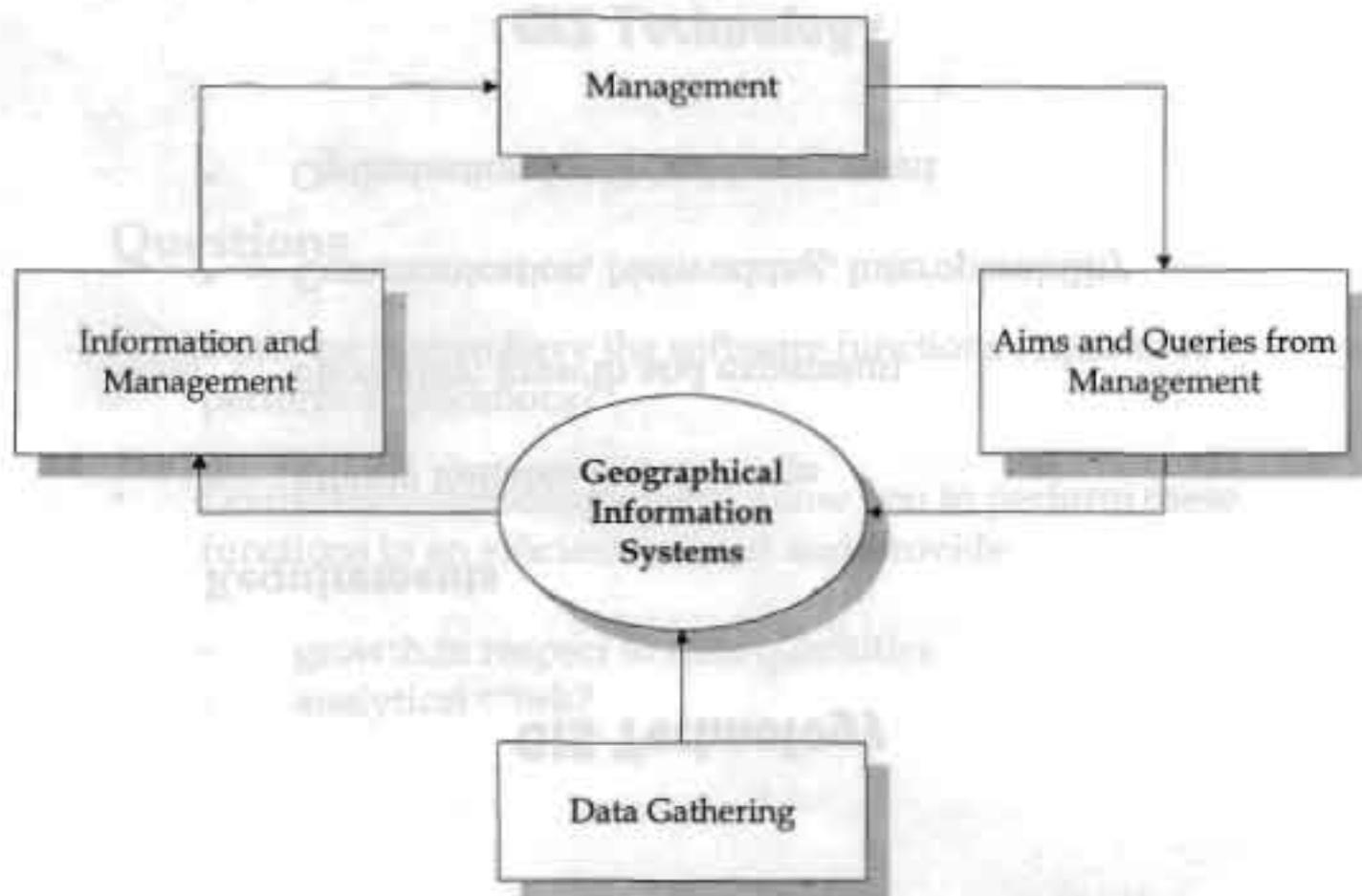
GIS Technology

Questions

- Does the system have the software functions required to perform applications?

- Do the hardware components allow you to perform these functions in an efficient manner and provide:

    - growth in respect to data quantities
    - analytical work?

GIS Technology Trend

- Corporate GIS
- Desktop GIS

- Data Transparency
- User Transparency

GIS Technology Trends

- Computer Technology

    - Distributed Computing

        Client-Server Architecture
        Multitasking Capability

    - High Quality Graphics

        3-D or Topographic modelling

    - Network Environment

        Network Transparency

    - Graphical User Interface

        User-friendly Software
        Usability Engineering

GIS Technology Trends

- Database Management Technology

    - Relational Database Management System (RDBMS)
    - Object Oriented Database Technology

- Spatial Modelling

    - Powerful Software Tools
    - Spatial Database Management
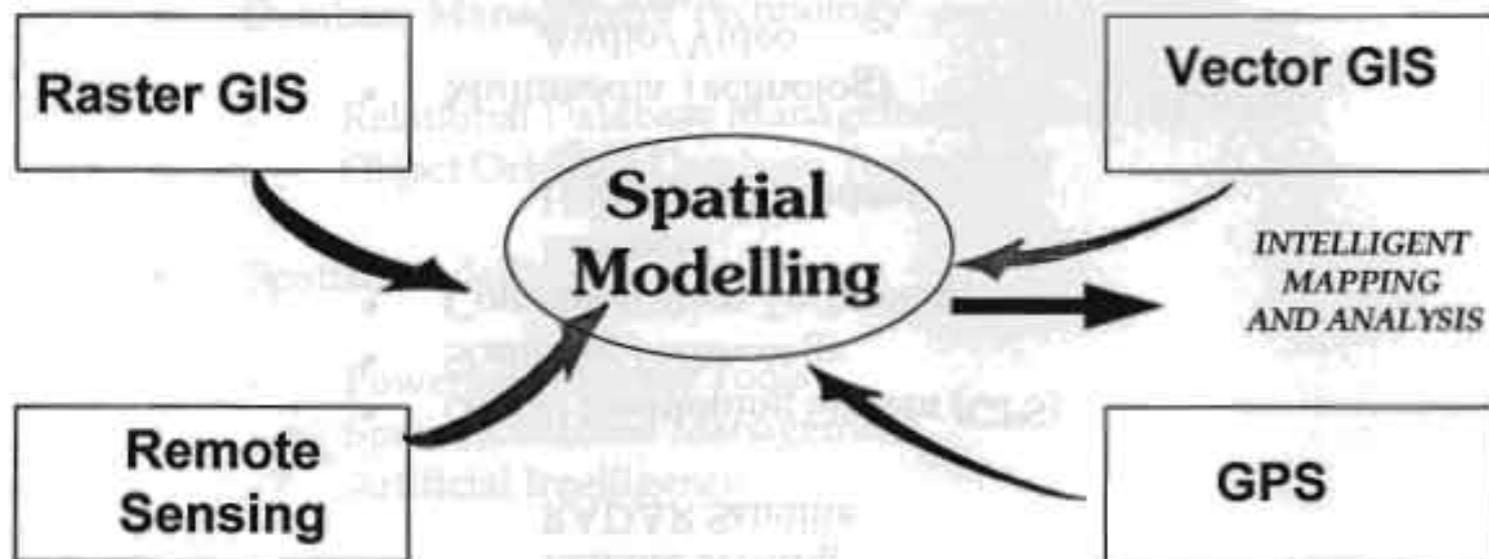   - Artificial Intelligence

        Neural Networks
        Expert Systems

GIS Technology Trends

- Satellite Technology
  - Remote Sensing
  - RADAR Satellite

- Global Positioning System (GPS)
- Scanning Technology
- Communication Technology
  - Internet
  - High Speed Modem

- Multimedia Technology
  - Audio/Video
  - CD-ROM

- Printing Technology
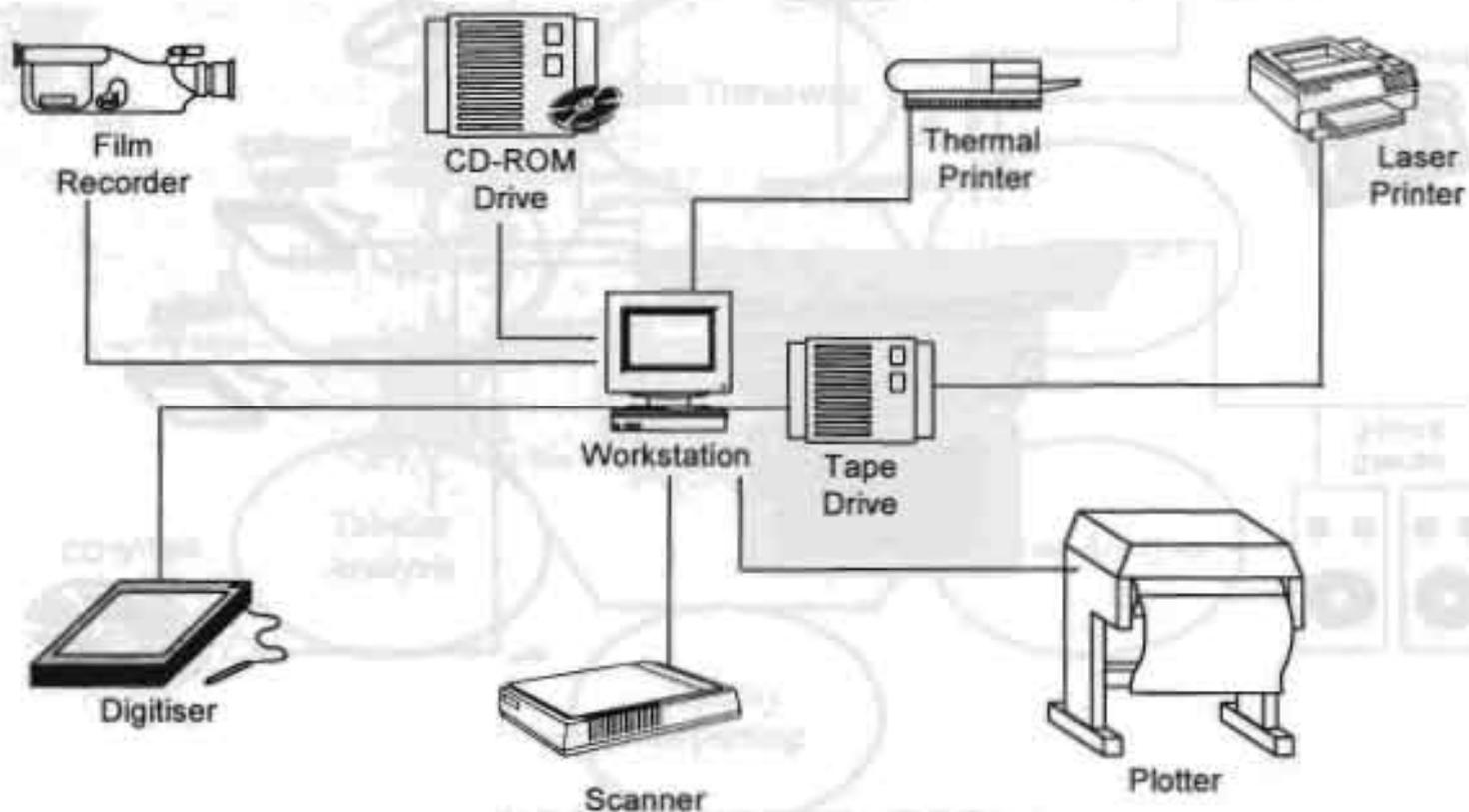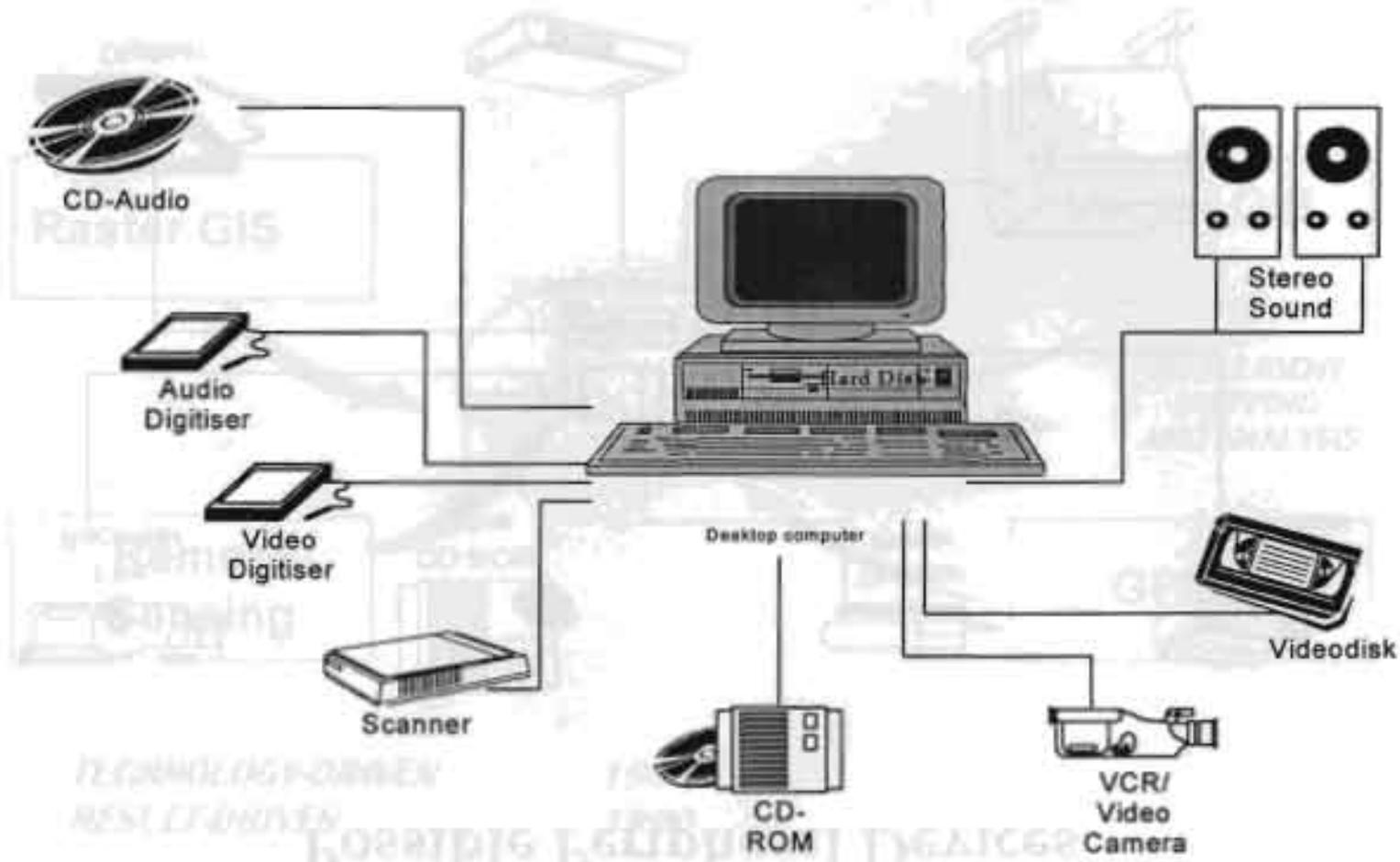 - True Colour Printing Capability

Integration of GIS Technology

Raster GIS

Vector GIS

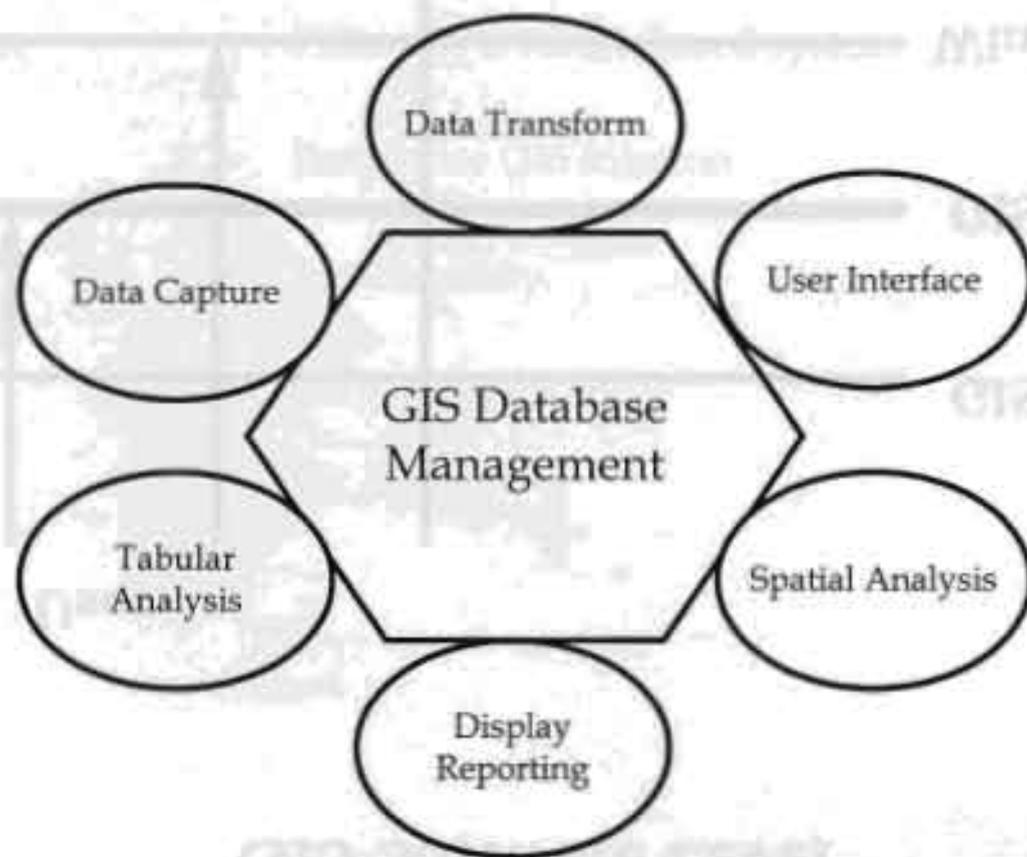**Spatial Modelling**

INTELLIGENT MAPPING AND ANALYSIS

Remote Sensing

GPS

TECHNOLOGY-DRIVEN   *1980*
RESULT-DRIVEN   *1990*

Possible Peripheral Devices

Film Recorder

CD-ROM Drive

Thermal Printer

Laser Printer

Workstation

Tape Drive

Digitiser

Scanner

Plotter

Multimedia GIS

CD-Audio

Audio Digitiser

Video Digitiser

Scanner

Desktop computer

CD-ROM

VCR/ Video Camera

Videodisk

Stereo Sound

Software for GIS

- Data Transform
- Data Capture
- User Interface
- GIS Database Management
- Tabular Analysis
- Spatial Analysis
- Display Reporting

GIS Software Level

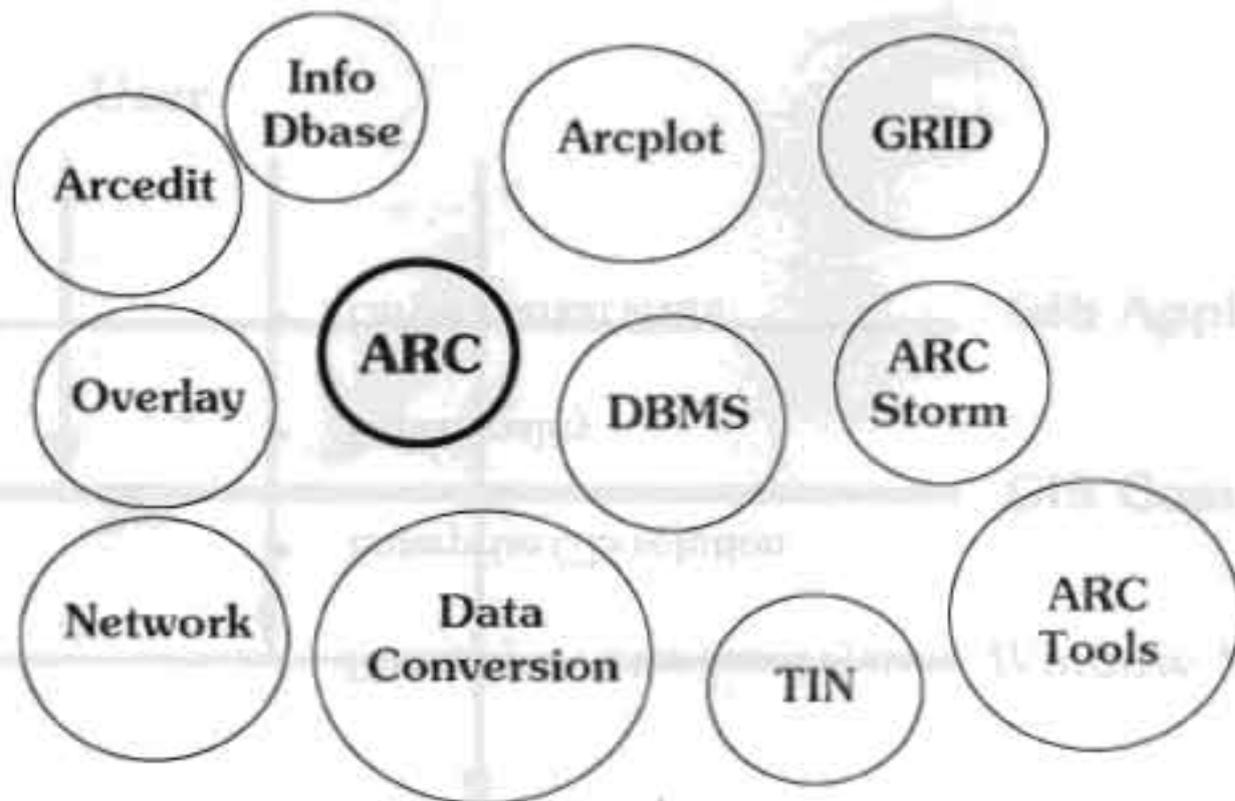

User

GIS Applications

GIS Commands

Window Manager

Operating System
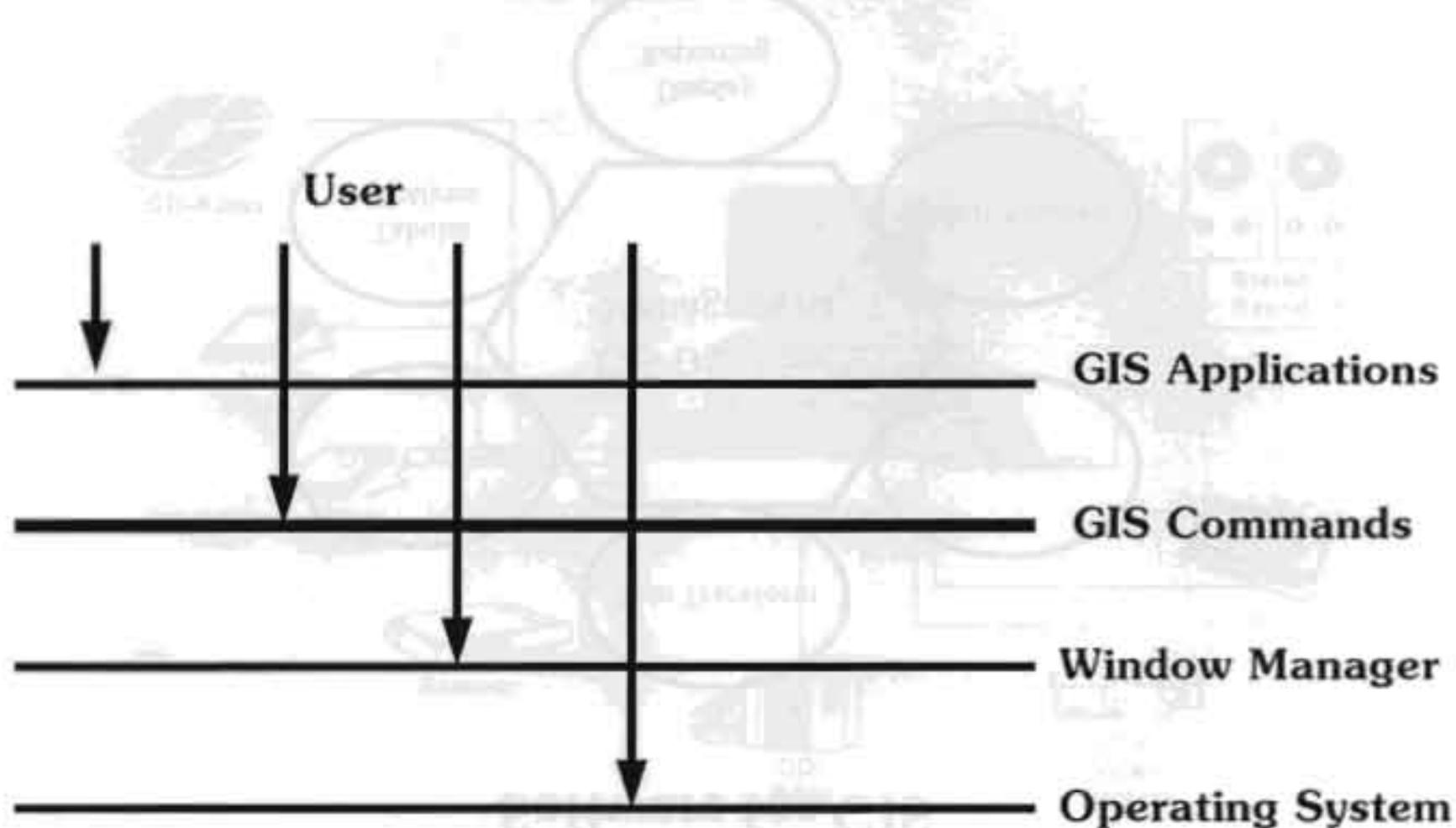
Arc/Info

- Primarily a vector-based system

- Enterprise GIS solution

- Functionality

- Larget market share

Arc/Info Modules

ArcView

- Display and Query GIS Database

- Windows'- based software

- Presentation

- Graphical User Interface

- Options for Raster data

GIS Trends In The Commercial Sector

Project-oriented GIS uses ➡ Database-oriented GIS uses

Mainframe-based GIS ➡ Mini-Computer-based GIS

Minicomputer-based GIS ➡ Workstation/
Personal Computer-based GIS

Small area databases ➡ Global databases

Isolated users ➡ Networked users.

National GIS Considerations

- Steering Committee

  - A Policy Board
  - Local User Representation
  - University Representation

- Coordinating Agency

  - Training
  - Database Standards and Development
  - Data Distribution and Archiving
  - Technical Advice and Hardware/Software

...Contd.

- Success Stories and Pilot Studies
  - Successful GIS Strategies
  - Local-level Pilot Study
  - Regional-level Pilot Study
  - National-level Pilot Study

- Implementation Strategy and Growth Plan

- Annual Programme of Information Sharing and Programme Assessment

Policy Formation Consideration

- Result Driven Vs. Technology Driven

- Education/Training

- Institutional Framework/Initiative

- Standardisation

- Data Standards

A successful GIS implementation demands a paradigm
shift at the Policy and Institutional level

GIS System Development Phase

- Awareness

- Development of System Requirements

- System Evaluation

- Implementation Plan

Database Issues

- Data Standards

- Data Sensitivity

- Data Quality

- Data Dissemination Procedures

- Database Management and Update

GIS Challenges

- Data Capture
- Data Modelling
- Accuracy
- Volume
- Analysis
- User Interfaces
- Costs and Benefits
- Impact on Organisations
- Education and Training

Implementation Alternatives

Considerations	User Creates System	Buy Some Software	Buy Complete Software Package	Buy complete Software and Hardware Packages	Purchase GIS Services
Dependence on supplier	Very low	Low	High	Very High	Nearly Complete
Time until system functions	Long	Long to Moderate	Short	Very Short	Not a problem
Initial cost	Low	Moderate	Moderate	High	High
Labour costs paid by user	High	Lower	Moderate	Moderate	Very low
Risk and uncertainty	High	Lower	Low	Low	Low
Customising	Complete	Complete	Moderate	Moderate	Varies
Technical skill required of user	Extremely High	High	Moderate	Moderate	Quite Low
Use of existing resources	High	High	Moderate	Low	Very Low

Source: *Adapted from Dangermond and Smith 1980*

Elements of GIS Project Success and Failures

Characteristics of GIS Projects		
Activity	Success	Failure
Planning	Rigorous	'Run and gun' style
Requirements	Focussed	Diffused
Appraisal of effort	Realistic	Unrealistic
Staffing	Dedicated, motivated, high continuity	High turnover
Funding	Adequate	Inadequate, conjectural
Time estimates	Thoughtful	Rushed or prolonged
Expectation	Balanced	Exaggerated

Source: *Antenucci, Brown, Croswell, and Kevany (1991). Copyright 1991 by Chapman & Hall, reprinted by permission*

Implementing a GIS

	Low	High
High	Probability of Type II and Type III errors High acceptance, misuse	High probability of implementation success
Low	High probability of implementation failure	Probability of Type I and Type IV errors Low acceptance, low use

Effectiveness of Tactics (vertical axis)

Effectiveness of Strategy (horizontal axis)

Strategy/tactics effectiveness matrix. From Schultz, Sleving, and Pinto (1987). Copyright 1987 by Randy L. Schultz, Dennis P. Slevin, and Jeffrey K. Pinto. Reprinted by permission.