Databases are key components of information systems. The development of the database must be coordinated with all other activities in the development lifecycle. Database development requires specialised skills and knowledge. Like IS development, database development requires a structured approach.

Database development requires a focus on the information needs of a business. Information Engineering (IE) is a popular, data-oriented methodology used to develop database systems. Data are modelled in the organisational context, not in the usage, processing or technology context. Business context changes slowly, leading to stable databases. Top-down planning is useful for considering integration of system components, understanding of the relationship between IS and business objectives, and understanding the impact of IS across the organisation.

IE Planning phase
- Goal is to align information technology and its usage with the overall strategic goals of the organisation.
- Alignment is essential to achieving maximum benefits from the investment in technology.
- Aims at an 'enterprise' view of the information needs of an organisation.
- Three steps in the phase.
Step 1 - identify strategic planning factors
- goals
- critical success factors (CSF)
- problem areas
  • see Hoffer, Prescott and McFadden, (2005), Table 2-2, p. 41
Identifying these factors enables
- the development of planning context
- the linkage of IS plans with strategic business plans
- setting of priorities for new IS requests

Step 2 - identify corporate planning objects
- organisational units
- organisational locations
- business functions
- entity types
- information systems
  • see Hoffer et al, (2005), Table 2-3, p. 42
 Defines business scope and where IS changes can occur

Step 3 – develop an Enterprise Model
- functional decomposition of each business function
- enterprise data model
- various planning matrices
  • see Hoffer et al, (2005), Figure 2-3, p. 44
Helps simplify problems, isolate attention
Identify business rules
Setting development priorities, scheduling activities

Planning matrices
- location-to-function
- unit-to-function
- information system-to-data entity
- supporting function-to-data entity
- information system-to-objective
Identifying orphans, missing entities, missing functions, unassigned functions, unassigned units, necessary systems, prioritisation of development

Not all database systems arise from a top-down planning approach
Bottom-up requests can cause a need for development
- operational level requests
- projects requested by IS users to perform job
- need for data management improvements
Still need an enterprise model of data
- data already exists? new data requirements? more than one database?
Enterprise Modelling
- Review enterprise modelling components identified during planning
- Analyse current IS, database and data processing
- Analyse general business functions and data needs
- Describe new information and data needs
- Determine which data already exists
- Justify need for new data and databases to support business

Enterprise Data Model
- High-level view of major ‘things’ of significance to the organisation
- Similar to entity-relationship modelling but not as detailed
- Business-oriented descriptions of elements
- Statements of business rules governing data validity

Enterprise Data Model
A possible Enterprise Data Model for Amazon.com

CUSTOMER -> SALE

BOOK

CD

Conceptual Data Modelling
- Identify scope of database requirements
- Analyse overall data requirements to support functionality
- Develop preliminary data model - entity-relationship (ER) modelling
- Compare conceptual ER model with enterprise data model
- Develop detailed conceptual data model - entities, relationships, attributes, and business rules
- Make conceptual model consistent with other IS models
- Populate repository with all conceptual DB specifications

Logical Database Design
- Transform conceptual model into logical data model
  - analyse in detail transactions, forms, displays and enquiries (DB view) needed to support functions
  - integrate database views and newly discovered requirements into conceptual model
  - identify data integrity and security requirements
  - transform reconciled data specifications into stable data structures - dependent on type of DBMS
- Start to specify logic for maintaining and querying database
- Populate repository

Physical Database Design and Definition
- Requires knowledge of specific DBMS used
- Define database to DBMS (often generated by repository)
- Decide on physical organisation of data - records, file organisation, indexes, clustering
- Design database processing programs necessary to generate information
- Enables secure and efficient handling of data processing needs
- Coordinated with design of other IS components - programs, hardware, operating systems, networks
Database Implementation
- Code, test and install database processing programs
- Complete database documentation and training materials
- Put procedures in place for ongoing support of DB and IS
- Install database
- Load and convert data from legacy systems
- Load any new data needed
- Put database into production

Database Maintenance
- Analyse database and database applications to ensure evolving information needs are met
- Tune database for optimum performance
- Fix errors in database and database applications
- Recover or rebuild database if corrupted or contaminated due to program or system malfunction or failure
- Typically the longest step in DB development - lasts throughout the life of the database and associated applications

Packaged Data Models
- Reuse of standard, but flexible, proven data models
- Can save time in modelling data requirements
- Comparatively low cost
- Can be customised and incorporated into other data models
- Developed by industry specialists and DBMS vendors
- Based on experience and expertise across industry sectors
- Two principal types of packaged data models
  - universal data models
  - industry-specific data models

Packaged Data Models
- Universal data models
  - core subject areas common to many businesses - customers, products, accounts, documents, projects
  - core functions common to businesses that follow similar patterns - purchasing, accounting, receiving, PM
- Provide templates for one or more of these areas
- Based on fact that although differing in detail, underlying data structures are similar

People Involved in Database Development
- Systems Analysts
  - analyse business situation
  - identify business needs to meet problems or opportunities
- Database Analysts
  - determine requirements for database
  - design database
- Users
  - provide assessment of information needs
  - monitor that system meets their requirements and needs
People Involved in Database Development

- Programmers
  - design and write programs to maintain and access data
- Data and Database Administrators
  - responsibility for existing and future databases
  - ensure consistency and integrity across databases
  - expert consulting and training
- Other technical experts
  - networks, operating systems, communications, testing, documentation

References
