FACTFILE:
GCE DIGITAL TECHNOLOGY

AS1: APPROACHES TO SYSTEMS DEVELOPMENT 1

System Development and Analysis

Learning Outcomes

Students should be able to:
- Explain the impact of the 'software crisis'
- Explain the need for software systems which meet the needs of organisations and/or individuals
- Explain the main factors affecting system development: the user needs, time and cost
- Understand that a computer system consists of a user interface, processes and data
- Describe the roles of the following during system development: the systems analyst, the project manager and the programmer
- Describe the purpose of analysis
- Evaluate different fact finding techniques: interviews, questionnaires, observation and document sampling
- Distinguish between functional and non-functional user requirements
- Explain the purpose of a data flow diagram (DFD)
- Produce context and level one DFDs for simple scenarios

Content of Approaches to System Development 1 Fact File

Students should be able to:
- Reasons for System development
- The role of personnel during system development
- Analysis
- Data Flow Diagrams

Reasons for Systems Development

The impact of the "Software crisis"
The software crisis was created when the hardware developments, such as the speed of RAM and processing power, were growing at a much faster pace than software developments. As computer technology became more sophisticated, organisations were demanding more complex problems to be solved. Programmers struggled to keep pace with developments which led to the software crisis. The software crisis was evident as projects ran over budget, were delivered late (if at all) and the software was very inefficient. In addition, software developed was of allow quality and did not meet the user's needs. Projects were difficult to manage and the codes were difficult to maintain with little or no documentation being produced.

The software crisis did not only affect the development of new software but also impacted upon the maintenance of older established software that needed to be adapted to new user requirements.

Maintaining older systems is difficult. Programmers spend large amounts of time on keeping older software functional to allow an organisation to continue operating. Organisations that have spent a lot of money developing software in the past are reluctant to replace this older software with new software. Apart from the expense in developing new software there is also the time required to test new software before it becomes fully operational.
A famous example of software maintenance posing such a problem was at the turn of the millennium

when the date on computer systems would change from 1999 to 2000. Experts worried that the 00 date would cause serious world-wide computer crashes.

The need for software systems

Organisations and individuals demand software to solve problems. In most cases software is bought as generic packages and tailored to meets the user needs such as Microsoft Office 365. We sometimes refer to these as productivity tools such as individual using Word processing software to produce personal letters. In some cases an organisation may purchase an application software package which focuses on a given task such as payroll. In this application the inputs, processes and outputs are the same for all organisations. Rather than each organisation developing their own software it would save on development time and costs to purchase a payroll software package "off-the-shelf". Each business would only pay a fraction of the development costs. If the business functions are very specialised such as manufacturing robot arms the software may have to be tailor made which involves using an ICT development team to create a specialised software package. This will be more expensive as the organisation will have to meet the full development costs and there will also be time required to fully develop and test the custom made software.

Main factors that affect system development

A new system has to be developed due to a number of reasons. The current system may no longer be suitable for its purpose as the requirements of the business may have changed or the business may have expanded. The current system may also be too inflexible or expensive to maintain. The technical support for the old system may no longer be available or it could be available but very expensive. Technological developments could also make the current system outdated or redundant. Advances in hardware and operating systems may also necessitate a new system, as they may not support the old system.

Computer Systems

A computer consists of a user interface which allows data to be entered that requires processing and outputs the results after processing. The user interface allows the user to interact with the computer and the software. A process is an activity carried out as part of a computer system. A process typically will take data in the form of raw facts and figures and produce information typically in the form of reports.

The role of personnel during system development

Systems Analyst

The systems analyst will analyse the data processing requirements of the organisation and document the findings. As part of this they will conduct a feasibility study to help ascertain whether the system should be computerised and which solution is most suitable. They will be responsible for drawing up the systems specification; criteria against which system testing should be evaluated leading to implementation of the system. If a fault is found during system testing which reflects a fault in the system design then the Analyst will be responsible for correcting the fault.

Programmer

This is the person who is responsible for writing the source code using a programming language such as Visual Basic. The program will be written from the module specifications. When the program is produced the programmer will also develop a test plan and test the program. At this stage if there are any bugs in the program, then they will also debug the program. To allow the program to be further developed the programmer will also produce technical documentation which will be used during the maintenance stage.

Project Manager

The Project manager will have a number of roles in system development. These roles can be categorised as:
- To oversee the development of the new system
- To schedule the project
- To manage the budget
- To allocate resources (Resource includes human, hardware and software)
- To monitor progress
- To identify and respond to risk or bottlenecks
- To report back to clients as the project progresses

Analysis

Purpose of Analysis

The main purpose of analysis is to investigate a problem(s) with an information system. The solution to the problem can be either improvements within the existing system or creation a new information system. The systems analyst(s) who will be investigating the current system may have little or no knowledge of how the existing organisation works.

The systems analyst will have to investigate the present system to establish user requirements. In order to do this the analyst needs to understand the purpose of the business or organisation and its existing system in terms of inputs, processing and outputs. This will also include any constraints to be placed on the new system such as timescale, cost, existing hardware and software and staff capability.

Fact Finding Techniques

In order to carry out a full investigation a method(s) of fact finding is employed. There are a number of methods of Fact Finding available including:

- Interviews
- Questionnaires
- Observation
- Document Sampling

Interviews

This involves the users answering questions from the system analyst on a one-to-one basis or in small groups. User can express their opinions in a detailed way .The interview may be structured or unstructured allowing questions to be followed up as more facts may come to light from the user answers. Compared to other methods interviewing is time consuming and users may also suggest Time consuming for analyst to gather facts Suggest answers the analyst may want to hear and not the actual truth.

Questionnaires

This involves a representative group of users who complete a set of questions the questions may be open or closed and are aimed at identifying detail on the current processes and data. Compared to interviews they are more efficient in terms of time to be completed. The down side is the inflexible opportunities to respond as answers tend to be multiple choice. Also there tends to be a low return rate from staff, particularly if done by post or e-mail.

Observation

This involves the systems analyst shadowing users carrying out a particular process. It allows the Analyst to see at "first hand" what the user's role entails. By doing this the Analyst can get a "feel" of user competence and abilities in doing a particular task. It also allows the analyst can get a better idea of time required to do a task, constraints and strengthens of current system. The drawback in observation is that users may respond differently if they are being observed.

Document Sampling

This involves the Analyst inspecting sample documentation such as orders, invoices and reports to help identify the current system's inputs and outputs. It will also allow the Analyst to get an idea of the volume of data stored seeing how data is collected and stored. It can be time consuming if there is a large volume of files

Functional and Non-Functional Requirements

The functional requirements of a system will specify the activities that a system must be able to perform or provide for users. Typical functional requirements will describe functions such as how data is to be entered into the system, descriptions of outputs such as queries and reports and descriptions of operations performed by each screen. While functional requirements describe what the system should do, non-functional requirements describe how the system works

Non-functional requirements focus on specifying criteria that will judge the operation of a system as opposed to the activities to be carried out such the time (response time) it will take updating a stock database. Other non-functional requirements will include criteria for usability, security and access to the system, storage capacity, and maintainability. If we consider security and access to the system the non-functional requirements will specify frequency of backup of data, recovery procedures, contingency planning and access restrictions. Access restrictions will specify what data needs protected and what data should be restricted to a particular user role and level of access such as "read only". All new computer systems are subject to legislation such as the Data Protection Act.

Data Flow Diagrams

Data flow diagram (DFD) shows how data moves through a system and what data is stored.

It does not specify what type of data storage medium is used or how the data is stored.

The following table shows the symbols used when constructing a DFD.

Symbol	Description
Data Source	A Data Source can represent an external entity or a human. It is where data comes from and/or goes to.
Duplicated Data Source	If a data source appears more than once on a DFD this symbol can be used to help the presentation.
Process	A process is an activity or function where data is manipulated. A process can also be decomposed to show a more in depth level of detail. Apart from name the process it can also contain a number to show the order of processes.
Data Store	A data store represents the storage of the data required after it has been processed. Produced by the process.
Data Flow	An arrowed line is used to show the path that the data takes through the system. A brief description of the data flow should be added to the arrowed line.
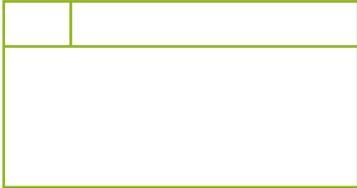
Context Diagram

A context diagram is known as a "Level 0" data flow diagram. It sees the system as one main process, identifying the main data source and the main data flows into and out of this process. It does not consider data stores at this stage.

Level 1 DFD

A level 1 diagram will break down the process into a number of sub processes showing how the data flows between these. Also at this stage data stores are shown and an indication of what data is stored.
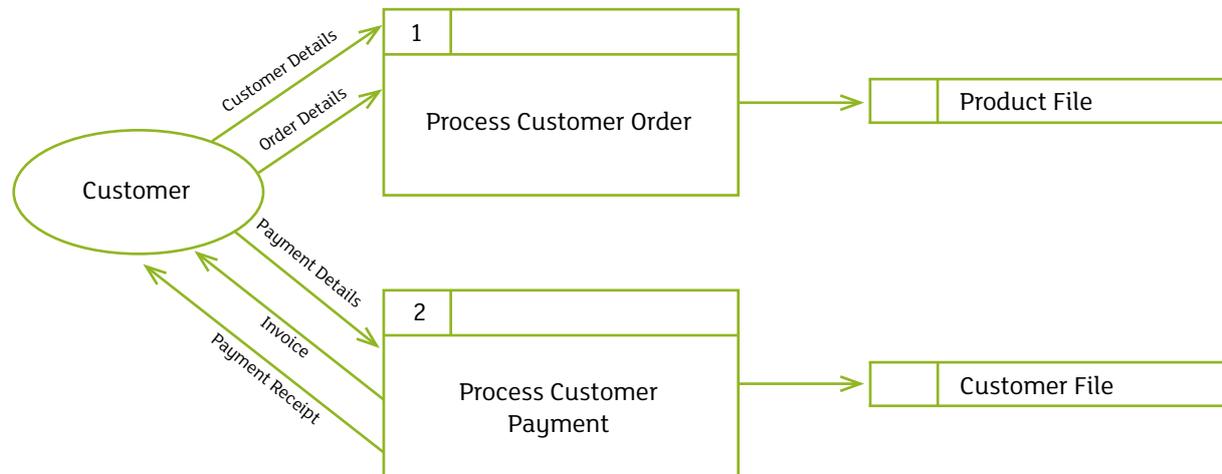
? Questions

1 What impact will the "software crisis" have on future employment within our economy.

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2 Identify three main responsibilities attached to the following roles:
(a) A Programmer
(b) A Project manager
(c) A Systems Analyst

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3 Identify one advantage and one disadvantage of using interviewing over questionnaires in fact finding.

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4 Distinguish between functional and non-functional user requirements in a stock control system.

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5 Outline the difference between a Context DFD and a level 1 DFD.

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Bibliography
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