Implementing Information Systems: A System Development Overview

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Today, HIM professionals are working more closely with information systems staff to develop and/or select computerized systems for the healthcare organization. This is because HIM professionals possess the critical knowledge of the users' needs, necessary inputs into the system, and needed outputs from the system -- knowledge necessary for developing information systems that meet the organization's needs. As HIM professionals take on crucial roles in the development and implementation of information systems, it becomes important for them to understand the process of systems analysis, design, and implementation.

Following is an overview of the systems analysis, design, and implementation process to help you get started on the right path. It is important to note that this process can vary greatly and many different methods are available. This overview is meant to serve as a general guide to the systems analysis, design, and implementation process.

One popular model of systems development is the systems development life cycle (SDLC). The SDLC, an engineering model that is used as a plan for developing information systems in business organizations, consists of three stages: analysis, design, and implementation. These three stages encompass nine activities:

Analysis

- systems planning
- feasibility study
- requirements determination

Design

- conceptual design
- physical design, prototyping, construction and testing, or purchase and testing

Implementation

- conversion
- training
- implementation
- evolution for enhancement and maintenance

Analysis

During the analysis stage, existing systems are studied and problems or opportunities are identified. System requirements are identified and developed, and alternative systems are provided as possible solutions.

Systems planning involves identifying the purpose and the features of the system. It entails looking at the departmental and organizational mission and goals and defining an information architecture (or plan) for selecting the appropriate information technology and information system(s) that will best support those goals. Within the systems planning activity, business areas and applications that support business functions should be evaluated and prioritized. The systems planning stage ensures that the development of the information system meets requirements, stays within budget, and is completed on time. Various project management tools (such as PERT diagrams, task diagrams, or GANTT charts) can be utilized to lay out the resource usage

and time required for individual activities and to identify the project completion date. Project management tools are also used to reallocate resources as necessary and track project progress. This stage is crucial to avoid potential problems such as lack of time to meet project deadlines, or loss of credibility with users due to these missed deadlines.

The *feasibility study* is the process by which the feasibility of an information system is measured. In other words, it measures how beneficial the development or enhancement of an information system will be to the organization. There are three parts to the feasibility study: operational, technical, and economic.

- *operational feasibility* -- the measure of how well a particular information system will work in a given environment
- *technical feasibility* -- the measure of the practicality of a specific technical information system solution and the availability of technical resources
- *economic feasibility* -- the measure of the cost effectiveness of an information solution (i.e., comparing the old system to the new system in terms of economic benefits, both tangible and intangible). A cost-benefit analysis is performed during the economic feasibility study

The *requirements analysis* activity is a process to determine the wants and needs of the users. It consists of:

- reviewing a description of the existing system
- comparing the current system to the ideal system
- identifying client and user expectations
- evaluating various information gathering methods to identify the users' needs

Some information gathering methods consist of interviews, questionnaires, observation, procedure analysis, and document survey. There are advantages and disadvantages to each type of information collection tool or method. Factors like cost, response rate, ability to tailor to specific users, number of users, reliability, validity, and time should be considered when identifying a collection method.

Design

The design of the system begins with the *conceptual design.* Depending on the systems development methodology (e.g., computer-aided software engineering [CASE], object-oriented, relational, etc.) data flow diagrams, data dictionaries, entity-relationship models, object diagrams, and other tools are developed to create the conceptual design. HIM professionals play a particularly important role in this process, as they possess the critical knowledge of data flows throughout the organization, necessary inputs to the system, and needed outcomes data from the system.

The next step is the actual *physical design,* which consists of prototyping, construction, and testing of the system. Prototyping takes place when a scaled-down version of the system is built and tested before the final system goes into production. It involves developing part of a system (that is not fully functional), placing an emphasis on user interfaces like screens and reports. The prototype emphasizes user involvement to develop the systems requirements. However, not all systems are good candidates for prototyping. For example, large-scale, transaction-processing systems are poor candidates for prototyping due to the well-defined user requirements. Good candidates for prototyping are systems for which it is difficult to specify user requirements, such as systems that require new technology or systems that support high-level decision making.

Software construction and testing is the next step. The requirements and design specifications provide the blueprint for construction. Depending on the systems development methodology, this step can vary greatly. Software testing strategies include:

- *top-down testing* -- begins with high-level views of the system that are subsequently decomposed into more detailed views of the system
- *middle-out testing* -- begins somewhere in the middle of the system and moves to testing more detailed, higher-level modules
- *bottom-up testing* -- begins with the detailed modules of the system and proceeds to look at higher-level modules of greater aggregation

There are two types of testing. White box testing views the system from the inside and examines the code in the system, checking for errors. Black box testing views the system from the outside and examines the results of passing test data to the

modules, checking for accuracy and adherence to specifications. There are two levels to testing: alpha and beta. Alpha is the first cut of testing, performed in-house using a simulated environment with special test data. Beta is the second round of testing, using the real environment and actual "live" data. Many other different testing techniques can be used as well.

Implementation

Conversion is the first activity in the implementation stage. There are three basic methods of conversion. The first is a cutover conversion, which involves an abrupt changeover on a specific date. The second is a parallel conversion in which both systems are run simultaneously until the system is fully converted. The third is a staged conversion, which can be either pilot or phased. Pilot conversion involves implementation of the full system at a limited number of sites (this only works with organizations that have more than one site). Phased conversion involves implementing portions of the entire system and adding components over time. When selecting a conversion strategy, consider these factors:

- design of the information system
- user needs and preferences
- risk factors such as down time and meeting customer service expectations
- cost structure of the organization

Training, the next activity, involves getting the user to actually use the new system. Customized training and education for the users is necessary, and the system may need to be modified or changed during or after training, so the development team may still need to be involved. There may be cultural effects to the organizational change that a new information system presents. Therefore, an important part of implementation is preparing the organization for changes that will occur. Critical factors for a successful implementation are:

- user commitment
- organizational trust
- open communication
- final commitment from management
- common view of the development and implementation strategy

Also, policies and procedures must be updated to reflect the new system. After the new system eventually becomes integrated into the organization, ongoing evaluation, maintenance, and monitoring of the system is necessary to keep it running properly.

Reference

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