

# KIT IS/ICT MANAGEMENT REFERENCE MODEL

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## ABSTRACT

*Information Systems / Information and Communication Technologies (IS/ICT) Management Reference Model is designed to maintain detail information about enterprise informatics structure and management (e.g. services, documents, licenses, management processes, measures.). The most important advantage of such model (compared with the “traditional” meta-information systems) is that in the beginning of implementation the model does not contain empty structures, but “reference” content. The content represents in this context generalized knowledge (“best practices”) of model developers in the area of IS/ICT management. Reference models should play a key role during implementation or improvement of management processes in enterprise informatics. Implementation based on reference model is much faster and easier than traditional “building from scratch” approach. The base principles of reference models and their implementation in the area of IS/ICT management, the structure and content of reference model developed at the Dept. of Information Technologies, University of Economics, Prague are described in this paper. Then the implementation process of structured IS/ICT management using this reference model is briefly discussed. Paper concludes by presenting the “lessons learned” from the model implementation in a real business environment.*

## 1. Reference Models as a Part of Modern Management

For a long time, the conventional wisdom in business was that managers should do little else but keep a close eye on what their subordinates were doing: monitor, supervise, control - making sure that things below are proceeding properly [1]. Deficiencies of this approach started to appear in the end of the last century when organizations were confronted with new requirements for rapid adaptation to emerging business models, political, regulatory, societal and environmental conditions. Need for fast response (usually provided by flexible redesign of the organization business and process models) became the key criterion of the managerial work.

### 1.1 Evolution of Management Approaches

New management theories and approaches were created in order to answer the above identified issues. As an example we can provide ideas of Hammer and Champy [2] who state that an organization: „Has to be changed thoroughly, radically and dramatically, if we are to progress in critical spheres of activities, such as: expenses, quality, services and swiftness”. These approaches were often based on business process reengineering (e.g. [3], [4]). From the perspective of the information and communication technologies (IS/ICT) they were enabled by the specific process oriented information systems and tools. As IS/ICT matured, it started to provide significant strategic value to the management of organizations and management approaches could evolve to the new generation presented as “IT Enabled Management, or „Information Management”. [5]

Information Management as a relatively young discipline of the modern science represents new and approach to management of organizations - significantly supported by IS/ICT. General goal of Information Management is to provide data satisfying management information needs as well as to provide so called data logistics – transport of relevant data to relevant people (or job positions) at the right time[6]. Information Management is also using special tools such as mathematical models, business intelligence elements and applications or decision support systems. Reference models recently became a new member of this set of tools.

### 1.2 Reference Models and Reference Modelling

When we model the organization and its activities from different perspectives, we can use a number of different modelling and categorization techniques (e.g. business process modelling, functional

modelling, data, object or business object modelling, service and product catalogues.). Such modelling work has to be usually started from scratch and always consumes a lot of resources. Since the early days of organization modelling, researchers and practitioners have been attempting to achieve reuse of models already developed in one organization for other similar organizations.

In order to keep the possibility of being reused, in many cases the construction of the models have to be able to abstract from enterprise-specific characteristics. We therefore distinguish between enterprise-specific information models and reference models. While enterprise-specific models refer to a particular enterprise context, reference models give target recommendations for a class of businesses [7].

Reference models are usually developed by consultancy companies, software developers, standardization institutions and academia. As an example we can list the SAP R/3-reference models [8] and BAAN IV reference models [9] (note: Baan and Baan products were acquired by SSA Global in 2003), arisen from the commercial practice or [10] and [11] primarily arisen from cooperation of academia and standardization institutions.

The term “reference model” is still not very well defined and we can find many variants of its definition. One of the reasons for such situation is that this area could cover wide range of model types used for different purposes (e.g. business process models [8], [9] or quality models [12]). For our purpose we will use the following definition [13]:

“Reference model contains relevant structures and relationships among the model elements (process structures, levels, document structures.) and also the predefined knowledge (best practice examples) already included in these structures.”

Reference models usually combine strengths of mathematical and data modelling techniques for its structure and knowledge management principles for its content. The most significant advantage of reference models is that they represent the best practices and knowledge in the formalized model structure, and therefore allow easier knowledge replication.

Reference modelling differs from traditional modelling. When we model the organization “traditionally”, we are building its models from scratch. When we use reference modelling principles, we select the relevant reference model(s) and later adapt them for the specific organization purposes. As stated in [7], it

promises on the one hand, savings in time and costs to those carrying out business engineering projects and on the other hand, an increase in the quality of the model to be constructed because reference models represent general recommendations for the subject area being studied.

The principle of the reference modelling is described on example (the process models in) [14] on the Figure 1.

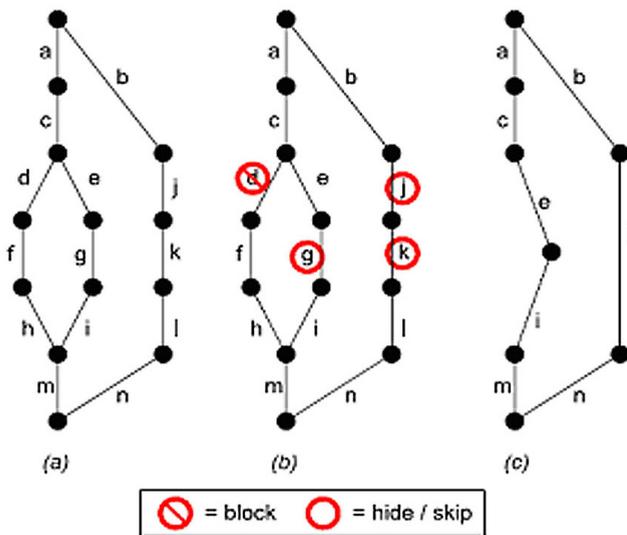


Figure 1: Three labelled transition systems: (a) the initial model (e.g., the reference model), (b) a particular configuration hiding and blocking specific edges/labels, and (c) the resulting model [14]

The most advanced area of reference model implementation can be found in business (or business process) modelling. Business reference models are business models representing generally accepted way to manage, control, and execute activities specific to a certain industry or specific to certain business processes. They contain generalized knowledge (“best practices”) of model developers in the model subject area. Best practices are not described in text form, but they are structured and formalized into reference model components (e.g. business processes, business functions, roles.) and their relationships. Reference models therefore enable modelling of processes, business functions and other model components, training, re-use of best practices and assessment of actual practices.

In this area we can find the following types of reference models [9]:

- production reference models (e.g. assembly to order, make to stock),
- industry processes reference models (e.g. automotive, wholesale),
- function domain reference models (e.g. finance, human resources management).

## 2. Reference Models in IS/ICT Management

Management of IS/ICT in the enterprise has been increasing in importance and nowadays it is one of the critical success factor of any type of business. Application functionality overlap, technology and knowledge heterogeneity and constantly changing business pressures make this task very difficult. There is a strong need for methodologies and recommended best practices in this area.

Using the reference model principles (formalized structure and predefined content) in the area of IS/ICT management would help to address the above listed issues. If we accept that IS/ICT management conforms to the same principles as the management of e.g. logistics or production, there is no reason for not applying reference models also in this area.

There are two major sources of knowledge on which the IS/ICT management reference model could be elaborated:

- IS/ICT management methodologies,
- IS/ICT management tools,

Their role in the Reference model elaboration could be explained as:

### IS/ICT management methodologies

IS/ICT management processes and some of the best practices are already described in several IS/ICT management methodologies, e.g. ITIL [15], COBIT [16] or ISO/IEC 20000 [17]. The problem is that they are described in a form of a plain text. Implementation of such methodology in a real environment still needs a substantial effort to be effectively used as structured management system [18].

IS/ICT management reference model should contain above listed best practices (mapping to relevant IS/ICT methodologies should be provided), but they have to be expressed and managed as formalized procedures, forms, relationship tables and other structured content, which could be instantly used for IS/ICT management. This suggestion is based on empirical experience gained while implementing the IS/ICT management principles in real projects.

### IS/ICT management tools

IS/ICT management tools [19] (formerly also called meta-models) are used mainly for tracking information about IS/ICT assets structure (e.g. SW and HW location and configuration) and about events (e.g. incidents, problems). They contain predefined, partially customizable structures for each asset

and event. The disadvantage is that the tools come without reference content, so it is necessary to fill all the structures with data from scratch. They also usually do not track information about all the IS/ICT objects required for the IS/ICT management (e.g. documents or procedures, processes).

IS/ICT management reference model should contain structures for all the IS/ICT assets, but it should also include predefined content for such structures (where it is appropriate).

Combination of the above listed sources into the IS/ICT management reference model can provide to IS/ICT manager with a powerful tool for supporting tactical and strategic tasks. As an example (based on our empirical experience) we can list:

- cost of application upgrade (impact analysis) – application upgrade (e.g. new version of the SAP R/3 software package) usually comes with higher desktop hardware requirements (e.g. larger screen, more memory.). With data stored in the IS/ICT management system one can easily identify all the desktops, where the SAP client software is installed and their configuration. Then the real cost of the upgrade including the replacement of relevant desktops can be calculated.
- Service Level Agreement (SLA) chargeback calculation – SLA are usually calculated in a “per user” or “per computer” mode. With the real data in the model structure it is easy to calculate how many users are using the specific service or on how many computers it installed. Such data are then used for precise internal or external billing of IS/ICT services provided to enterprise organizational units,
- process catalogue – predefined (reference) process catalogue is usually used as a base for IS/ICT management implementation. In this case it is not necessary to build everything (model all the processes) from scratch, but only update the processes which will be managed differently from the common practice,
- document examples – document examples are used in the same way – if there is a need for any IS/ICT management document, its structure and outline could be found in the reference model and it could be instantly used.

### 3. KIT IS/ICT Management Reference Model

The aim of the research of the Department of Information Technology, University of Economics,

Prague (KIT) is to formulate process, data and organization models for efficient management and innovative development of IS/ICT and at the same time ensure that IS/ICT correspond to new complex tasks in the area of business, management, state and public authorities, supports processes not only inside organization and social subjects but also among themselves, takes into account the changing user requirements for information and knowledge handling.

Therefore we decided to elaborate the reference model for the IS/ICT management (KIT Reference Model) using the same principles which were successful in “traditional” business reference models subject areas described above. Aim of our IS/ICT management reference model was to:

- support service oriented IS/ICT management implementation,
- provide structured (formalized) overview of the enterprise informatics structure and base for its planning and management,
- support the operational IS/ICT management tasks,
- support the long-term IS/ICT management tasks.

Core of the KIT model is based on the service oriented approach to IS/ICT management [20]. It means, that IS/ICT provides for the organization (for business processes) defined IS/ICT services. These services are provided by specific IS/ICT processes using specific IS/ICT resources.

The model incorporates domain knowledge gained from the several “traditional” implementations of the IS/ICT management in a real-world environment. These implementations were previously carried out by the reference model developers. They cover the following issues:

- Information Strategy Document Definition,
- IS/ICT management processes definition and their documentation,
- implementation of IS/ICT metasystem for IT asset management,
- implementation of service catalogue and SLA,
- measurement of service quality, and costs.

Client specific information was removed from outcomes of these projects. Then the generic material was updated and amended using the Cobit framework

[16]. Finally it was restructured into self-contained building blocks of the reference model and their mutual relationships. Consistency checks were used to identify inconsistencies and omissions in the model structure.

### 3.1 KIT Reference Model Structure

KIT Reference Model contains (and tracks the structured information about) the following key components:

- Enterprise processes – information about business processes in the enterprise,
- IS/ICT Processes – information about processes in IS/ICT,
- IS/ICT Activities – information about IS/ICT activities (parts of process flows),
- Services - information about IS/ICT services

provided to enterprise,

- Applications (SW) – information about IS/ICT applications,
- Computer (HW) – information about the hardware,
- Users – information about users of IS/ICT services,
- Organization Units – information about organization units in the enterprise.

KIT Reference Model also tracks the key relationships among the components (Figure 2). The structure of relationships allows IS/ICT manager to identify e.g. which organization unit is using the IS/ICT service and how many users (or computers) from the unit are using it etc.

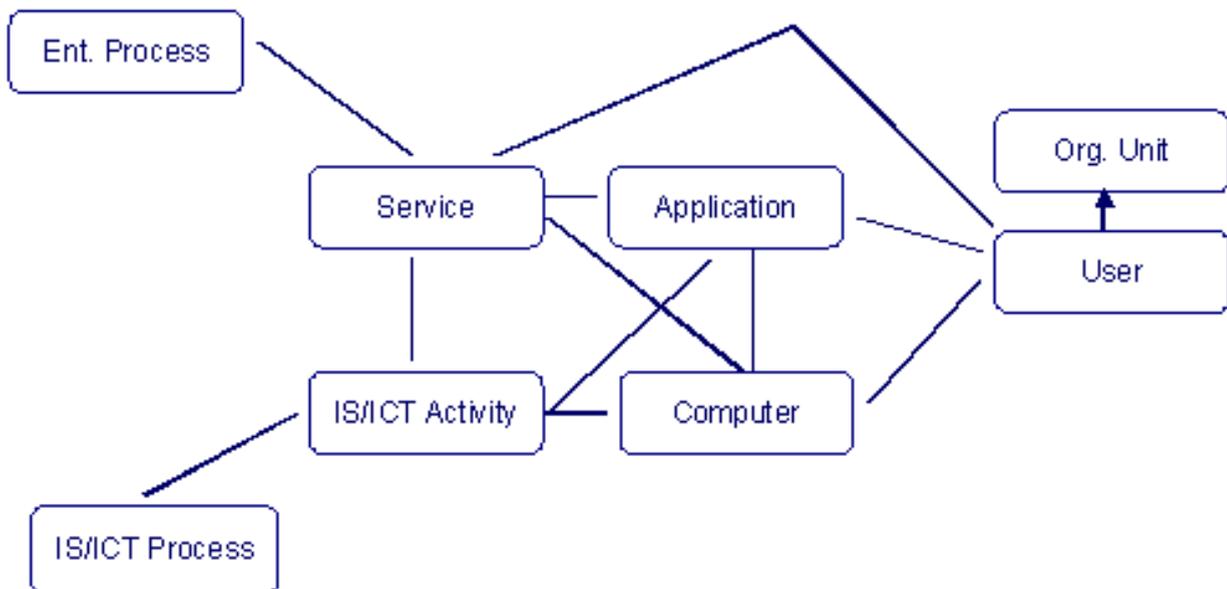


Figure 2: KIT Reference Model – key relationships tracked among model components

### 3.2 KIT Reference Model Content

It is clear, that for some components of the reference model (e.g. list of users or organization units) is not possible to prepare common content, because of the differences in each model implementation. Some components could be only partially filled by the generic categorization (e.g. services catalogue). Following key components in the KIT Reference Model contain the predefined “best-practices” structure:

**Fully predefined content (could be adopted without any amendments):**

- IS/ICT Processes – IS/CT Process catalogue,
- IS/ICT Activities – IS/ICT Activities catalogue,

- IS/ICT Services – IS/ICT Service catalogue.

**Partially predefined content (only generic content which has to be amended by real content from the enterprise)**

- Applications (SW) – information about IS/ICT applications,
- Computer (HW) – information about the hardware.

Examples of the KIT Reference Model content are provided on the Figure 3 (process description) and on the Figure 4 (process flow)

**IS/ICT Process Attributes**  
(e.g. Title, Description, Rules, Links)

**Related Model Components**  
(IS/ICT Activities, Data, Roles, CSF)

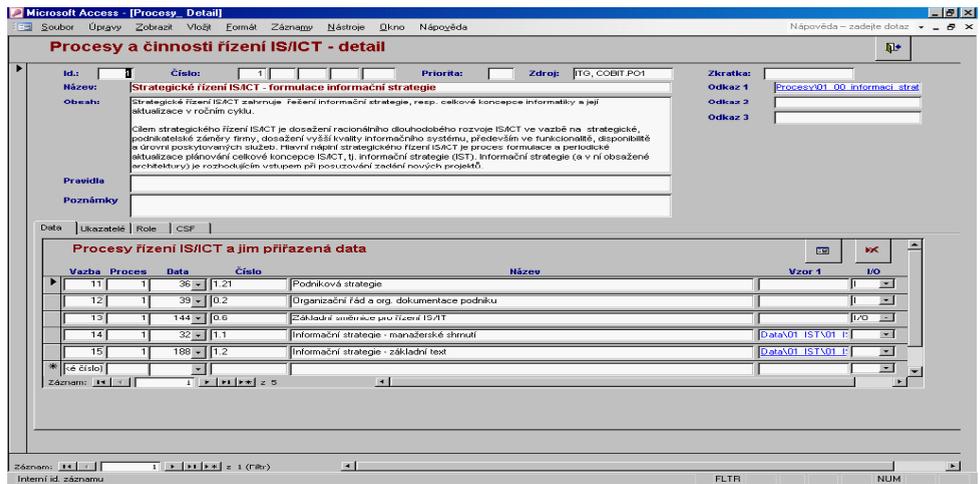


Figure 3: KIT Reference Model predefined content – Process Description (Note: KIT Model is developed in the Czech language version only)

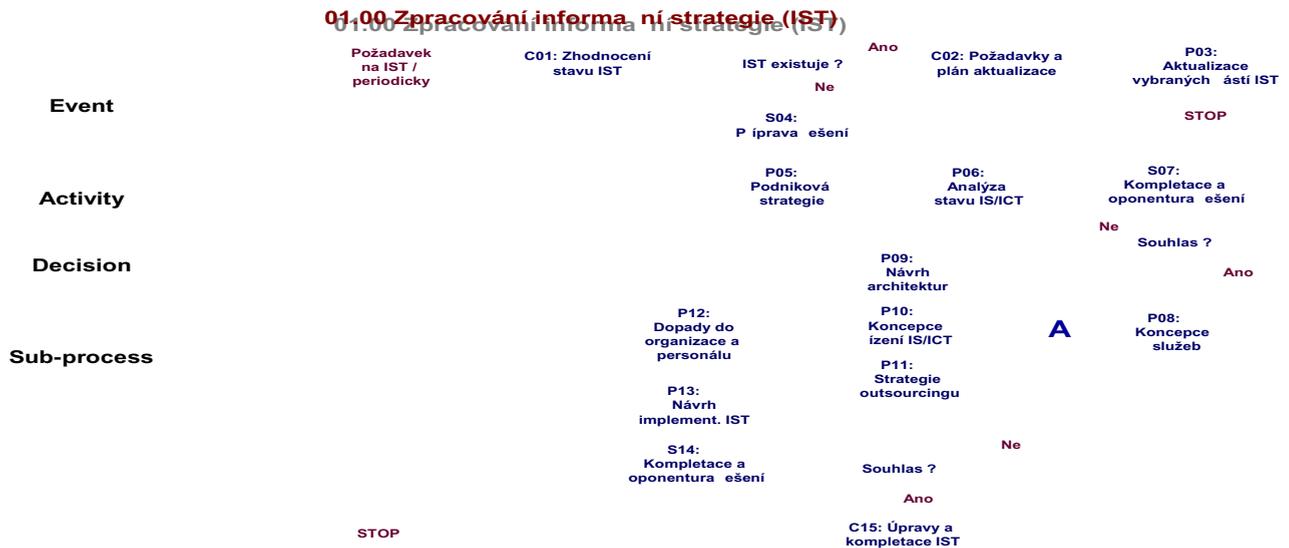


Figure 4: KIT Reference Model predefined content – process flow (Note: Simplified process notation is used in order to enable faster initial KIT Model implementation)

#### 4. Implementation of the KIT Reference Model

Structured IS/ICT management has to be carefully planned and implemented. “Traditional” approach of implementation of IS/ICT management processes in the company consist of the following steps:

a) analysis of the status and needs of IS/ICT and its management. It is based on business needs, SWOT (Analysis of the Strengths and Weaknesses of an organization and the Opportunities and Threats facing), information strategy and other strategic documents. Core of this phase is in most cases

based on SWOT analysis of IS/ICT, which defines the core problems and project requirements,

b) formulation of the IS/ICT management concept respecting the conclusions of the previous phase,

c) detail analysis and design of the IS/ICT management components (functions, processes, documentations, roles, measures.),

d) implementation of the designed solution (organizational and technological),

e) ongoing monitoring and support.

For all the above phases (in particular phases a, b and c) it is usually necessary to hire a consultant (either external or internal) to prepare the solution. Major problem of this approach is the significantly longer timeframe and limited participation of the internal IS/ICT specialists – they are usually only reviewing the results of the consultancy work. It could result in refusing the proposed solution or in the different ways of disrupting of the proposed actions.

On the other hand, implementation of the IS/ICT management using the reference model is based on the assumption, that the most of the work is done by users of the model and not by the consultants. Users are only involved when selecting appropriate model components and updating the model content.

When implementing KIT Reference Model in the real-world environment, we adopt the following procedure:

- a) analysis of the status and needs of IS/ICT and its management. It is based on business needs, company SWOT analysis, information strategy and other strategic documents. Core of this phase is in most cases based on SWOT analysis of IS/ICT, which defines the core problems and project requirements,
- b) kick-off workshop – the purpose and principle of the reference models is described to users,
- c) model components selection – users by themselves select the model components they will be using in the IS/ICT management,
- d) model relationships selection - users by themselves select the relationships among model components they will be using in the IS/ICT management,
- e) model database and front-end customization – model database application is customized based on the user requirements (list of components and relationships),
- f) model front-end training – users are trained, how to work with the model database application,
- g) component and relations editing (coached)

– users are editing, updating and amending the model content,

h) integrity reports generation – number of integrity reports is generated. It allows to identify the editing mistakes and problematic spots in the management system,

i) implementation of the designed solution (organizational and technological),

j) ongoing monitoring and support.

The main advantages of this approach is the engagement of the internal IS/ICT specialists with the IS/ICT management processes formulation and shortening the time necessary for the transfer of knowledge included in reference model into the target environment.

## **5. Current Project Status**

KIT Reference Model is currently used for the Information Strategy document elaboration (initial collection of data in the enterprise), for IS/ICT management processes and tasks definition (base for definition of IS/ICT management system in the enterprise) and for IS/ICT management support (tool for everyday IS/ICT management support). This model has been in the last two years implemented in five organizations:

- governmental institution under Ministry of Justice, Czech Republic,
- public transportation company,
- national railway company,
- regional distributor of electric power,
- pension fund.

KIT Reference Model is provided as standalone MS Access database application linked with external documents and document templates prepared in MS Office formats. Currently multi-user access is not supported and only the native multi-user management provided by MS Access is used. Therefore it is recommended to use it by the limited number of analysts/managers and not to be implemented as a regular IS/ICT management tool. For such purpose it has to be further replaced by more robust application (the KIT model is used as a prototype for such applications).

Using the MS Office environment and its features as the platform for the KIT model application allows easy and fast implementation in any organization without the need for an additional initial investment for

modelling or special database tools. It also allows fast implementation and model transfer in the company where it is implemented.

Currently the Department of Information Technology has received a three-year research grant for further KIT model enhancement with special aim of process consistency required by new versions of Cobit and ITIL methodologies, amendment of the metrics component and introduction of the IS/ICT effectiveness measurement and its dynamic modelling.

## 6. Lessons Learned and Open Issues

During model implementation in a real-world environment we have found several interesting issues presented here as “lessons learned”.

IS/ICT management team was usually very interested in building “their own” IS/ICT management system “by themselves” rather than an externally delivered solution. Selection of the MS Access database application as a core model environment suits the best for the customization needs and it is intuitive when used in real-world environment – moreover the initial cost of the model implementation and customization is far lower than when using other more robust tools (e.g. Aris Toolset). We also received positive feedback for the structured approach (using the templates for documents and structures for component records.). It assures far better integrity of the management information (compared to plain text descriptions used in methodologies). Lastly, but not least, positive outcome was associated with the fact that users understood the advantages of sharing the information in the management systems – and knowledge was moved from “their heads” to a shared and structured resource.

Contrary to our expectations we have found that KIT Reference Model could not be distributed like other “package software”. In reality it can not be distributed and implemented without some training and customization.

We were quite surprised, by the variety of the model implementations, especially on emphasis which was given on different part of the model by different IS/ICT managers in the different organizations. This could be explained by the fact that IS/ICT managers have different personalities and therefore each implementation has to be different. Each manager needs different information for the successful management of his tasks, so each customization addresses different areas of the model.

There are still some open issues connected with KIT Reference Model. As stated above, during the implementation we need to rely on the experience of consultants helping the managers with the component selection. In order to solve this issue, we are planning (during the research project mentioned in the previous chapter) to replace the consultant role (at least partially) by the content and structure profiling and incorporating an expert system tool for the selection of appropriate content and relationships.

## 7. Conclusions

When implementing structured IS/ICT management system in an organization, it is highly desirable to exploit the “best practices” included in the KIT Reference Model. We do not expect to use it without changes, because customization is needed for each implementation. The duration of implementation of the IS/ICT management system using the reference model is much shorter than building it from scratch.

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