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Design of the Registry System for the Namibian Office of the Auditor General

-A Database Design Process in a Developing Country

Bachelor's Project

January 2003

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Abstract

Sida and the Swedish National Audit Office (RRV) have had a mutual cooperation with the Namibian Office of Auditor General (OAG) since 1994. As part of this cooperation the RRV and WM-data have computerised certain routines at the OAG. The RRV carried out a feasibility study at the OAG, which indicated a demand for a computerised Registry System. We were assigned by WM-data to design that system. We have performed the conceptual, logical and parts of the application design.

When we got the assignment we asked ourselves the four questions that follows. What shall the Registry System contain? Which design shall the interface of the Registry System have? What special considerations should be made in the design of the Registry System for an organisation in a developing country? Which obstacles may we come across, when we design the Registry System for an organisation in a developing country?

To perform this assignment we have studied the feasibility study, written sources and software. We have also had meetings with our assigners at WM-data and we visited the RRV for the purpose of studying their registry routines and to meet one of the authors of the feasibility study in person. We used a database design methodology to support the design of the Registry System's database.

The Registry System will improve the handling of documents at the OAG. The design meets the requirements in the feasibility study and the system will be slim with only the basic features. The design is based on the OAG's terminology and organisation.

The special considerations that we made during the design process include considering the technical environment, the technological infrastructure, and the organisational culture. A major goal was also to make the OAG independent of foreign expertise when maintaining the system.

Preface

During our project we have been supported by several people. With their help we could overcome obstacles and proceed with our work. We would like to thank our tutors at WM-data, Mr Jan Säll and Mr Bo Erlandsson. They have been willing to help us and we felt that we could contact them at any time. It was nice that they gave us the possibility to have access to a work space at WM-data.

We would also like to thank Mrs Loretta Smith, the registry clerk at OAG. She gave us an insight into how the registry works at OAG. She was very helpful and gave us quick and informative answers. We are also grateful that Mrs Malou Norrman at RRV took time to help us.

Our tutor at Karlstad University, Mr Stig Håkangård, has helped us with the writing of the Bachelor's Project and we thank him for his support. Mr Alex Price, a student from England, has proofread the Bachelor's Project in order to check our English. We are thankful for his help.

Our husbands, Mr Örjan Rosengren and Mr Mårten Stolt, supported us during the project with our households and helped us with our babies. Without their help we wouldn't have been able to do a Bachelor's Project. They have a special place in our hearts.

Contents

1 Introduction

1.1 Background

Namibia became an independent state in 1990 after 70 years of South African control. Namibia is a society in a development phase, and the country requires external expertise for its development. [20] According to the report "Information Technology in Sub-Saharan Africa" Africa is the least computerised continent though it is the second largest continent and the report establishes the importance of not leaving out more than 500 million people from the "global information society". The report says that Information Technology is as a tool for growth, as vital to Africa as it is to America or Europe. [2]

In 1994 mutual cooperation started between the Swedish National Audit Office (RRV) in Sweden and the Office of the Auditor General (OAG) in Namibia [19], where the RRV in Sweden supported the development of the OAG with, among other things, software and hardware. This project was financed by SIDA. [20] A part of this assignment has been to develop a time recording system. WM-data (Public Partner) in Karlstad was given the assignment to design the Time Recording System. The Time Recording System is now partly implemented at the OAG. [17] There is additional need to extend this system with a registry system. This need was discovered when Mrs Eva Eriksson and Mrs Malou Norrman (RRV) did a feasibility study at the OAG "Report on Development of Databases, Use of Internet and Computerised Library and Registry- phase 1". [6]

The manager of the OAG visited the RRV in Stockholm in August 2002. Mr Jan Säll at WM-Data asked him if the OAG had any interest in a Registry System. The management at the OAG were interested but they had no budget for this project. The development of the Registry System would consequently be a non-profitable project. [24]. We had the possibility to design the Registry System as a non-profitable project and Mr Säll gave us the assignment to design the Registry System for the OAG in Windhoek.

1.2 Problem Definition

- What shall the Registry System contain?
- Which design shall the interface of the Registry System have?

- What special considerations should be made in the design of the Registry System for an organisation in a developing country?
- Which obstacles may we come across, when we design the Registry System for an organisation in a developing country?

1.3 Purpose

One purpose is to design a database on the basis of a previous feasibility study, to improve registration of in- and outgoing documents in the registry at OAG. Our assigners can use this design in further development of the Registry System.

Another purpose is to describe the design process in a developing country where the conditions can be quite different in both culture and administrational traditions compared to western correspondences.

1.4 The Scope of our Bachelor's Project

A database system design has many steps which a designer must go through to create a system that will satisfy the users needs. Our design of the Registry System will not cover every step in the chosen methodology (fig 2.2). The design will start from an analysis of a feasibility study and will also cover the conceptual and the logical design. Finally we will produce an interface application design for the Registry System and list which reports the Registry System will generate.

The reason for not continuing the design process with physical design and implementation is that we do not have time to fully satisfy the users needs. If we were to design these later stages in our BP's 10 week period, we would be unable, because of the shortage of time, to be as thorough as we would like. Consequently the risk would be that the final system wouldn't satisfy the users needs.

Our intention is to describe the process of designing the Registry System for the OAG, not to draw general conclusions about how to design systems in a developing country. However our process description can be used to guide other designers who will design systems in developing countries.

1.5 Target Groups

1. Our assigners WM-data and the OAG.
2. The people who will implement the Registry System.
3. People who want to get an insight in the development process of designing a database in a developing country.
4. Information Technology interested people at University level.

1.6 Our Experience in the Field

We are currently studying Computer Science and Information Systems at Karlstad University. We have permission from our Departments to work interdisciplinary in our Bachelor's Project (BP) because we do the BP during our maternity leave. Our interest in database design awakened when we attended a five point database course. When it was time for our BP we searched for a company who needed help in this area. We wanted to do a BP that would be useful in a real context, by designing a Registry System for OAG, we have that possibility.

We have no experience of working in a developing country so the Registry System is our first project in this area.

2 Theoretical Framework

2.1 Namibia

Since 1990 Namibia has been a constitutional and democratic country with a multiple party-political system. The country did experience political disturbances during the earlier days, however Namibia is now characterised by political stability. There are a variety of ethnic groups living in Namibia, but there are no significant disagreements between them, and the occurrence of corruption is relatively low. [20]

Namibia's prospects for development are very bright because of the combination of political stability and the natural assets, for example, minerals, gas, oil, the meat- and fish industry, the future potential of tourism and a growing sector of services (ibid).

The Namibian finances are small but stable. The country in recent times managed its inflation and budget deficit, but lately they have increased. The poverty in Namibia is widespread, almost 50 percent of the population is estimated to live below the poverty level. Unemployment is high and during the next five-year period it's not likely that the foreign investments will dramatically improve employment and decrease the poverty. Five percent of the population is white, and they own a great deal of the private sector. (ibid).

The decision making is centralised around Windhoek, the capital of Namibia. Though most of the Namibian population lives in the countryside, it is the urban population who has the power to influence decisions. The rural population hasn't got the same possibilities. Almost 40 percent of Namibia's population is made up of self-subsistent households. (ibid).

Namibia is one of few of the countries in Africa that has a retirement annuity system. Education has been made a high priority and almost 25 percent of the budget has been allocated to this purpose since liberation in 1990. (ibid).

2.2 What is Audit?

Audit means to inspect account, administration, efficiency and goal fulfilment. The inspection is performed independently in relation to the assigner, the audited and groups with a vested interest. [13]

There are two branches of audit, they are the annual audit and the performance audit. The annual audit examines the annual reports. The performance audit examines the performance and goal fulfilment of governmental undertakings. (ibid).

In all democratises the governmental audit is of great importance as an independent control authority and as a resource for knowledge [14].

2.3 The Swedish National Audit Office

In Sweden the RRV is the independent institution for central government audit and inspection. The RRV represent Sweden as its Supreme Audit Institution. In other European countries and in the OECD-countries the governmental audits independence is safeguarded by law. In Sweden there is no such law at the present, but in year 2003 a new authority for independent governmental audits will be established. The audits independence will be secured by the constitution. [14]

The RRV audit how well agencies, public utilities, government-owned companies and government foundations function in relation to the decisions of the Government and Parliament and requirements in respect to rule of law, provision of services, and responsible administration of tax funds. The RRV audit the central government's funds, which also includes the administration of EU funds. The tasks include annual and performance audits. This work generates about 270 audit reports, 230 audit certificates and 140 other reports annually. In addition the RRV has international undertakings, these include international development work, international cooperation and exchange of experiences. The RRV is a member of the International Organisation of Supreme Audit Institutions (INTOSAI). INTOSAI has drawn up standards that a member state shall comply with. [13][14]

The RRV has about 290 employees and its main office is in Stockholm, there are also local offices in Uppsala, Karlstad and Jönköping [13].

2.3.1 The RRV's Registry

The text that follow below is an extract from Appendix A.5.

2.3.1.1 Handling of the Mail

Every morning the registry clerk opens all mail that is addressed to the RRV where RRV is written first on the item of mail. If the item of a mail has a name or a function written before RRV, the mail is sent directly to the concerned person, but the submitter/manager must contact the registry if the content of the mail must be registered. Fax, e-mail and phone calls are also public documents.

2.3.1.2 Register

The registry makes difference between incoming, outgoing and internal subject–matters. The RRV has a so called registry of subject–matter, and this means that a subject–matter have the same case number from the execution of the first document until the closure of the actual subject-matter. Everything that happens with the subject-matter is registered (further about this in project below). In practise a subject-matter can be dealt with over several years, but it is also possible to close the subject-matter directly when it has been executed (for example when a letter is sent in a new matter).

When a document is registered it gets a dossier number, which is established by the Archive of The National Archive. If types of subject-matters must be added, you have to report this to the Archive of The National Archive. Staff matters, applications for employment, government assignments, reports for comments, annually audits, efficiency audits, contacts with law of audit in Luxemburg, the commission of Europe are examples of dossier. The dossier number is followed by a date number and then a registration number. An example of the numbering is 30-2001-0432, where 30 is the annually audit, 2001 is the year and 0432 is the registration number.

The annual audit register of the documents concerns every documents during an audit year (this is not the same as a calendar year) and per object of audit (for example authority). The subject-matter is closed when the audit for the year is completed and approved. Most of the audit reports are only filed for five years. Fifteen so called type authorities audits are filed forever.

In the efficiency audits there is a so called project register for the inspections. When the project is executed and the project plan is complete, the first registry of the project can be done. The project/subject-matter gets a registration number which follows the project/subject-matter the whole time until it is closed. During the project only important in-and outgoing events are registered. The project manager notes all the detailed events that happens with the project. This day-book is a complement to the register and it is filed together with the subject-matter. Agreements are registered separately and they are held together as agreements in order to facilitate searches for them.

2.4 The Office of Auditor General in Namibia

When Namibia achieved independence from South Africa they appointed a constitutional committee who wrote a new Constitution. Under that Constitution the OAG was created. It also laid out how the Auditor General should be appointed. The president nominates him and the appointment is approved by Parliament. The removal of the Auditor General can only be effected by Parliament with a two-thirds majority, this is to try to make the OAG as independent as possible. [10][19]

The OAG's responsibilities includes the audit of the accounts, account-books and the registers of the central Government, parastatals, regional councils, municipalities, towns and settlements. The duties of the OAG is to perform financial and performance auditing. This work generates over 100 reports annually. [8] When the auditors at the OAG come across irregularities the OAG report to the Parliament, but if these irregularities border on fraud or corruption they report directly to the police. The police deal with these matters in accordance with the criminal law. [10] The OAG is a member of INTOSAI. The OAG has about 90 employees and the main office lies in Windhoek. [15]

2.4.1 The OAG's Registry

During Mrs Norrman and Mrs Eriksson's feasibility study [6] at the OAG they studied the registry in depth and found out the following.

Mrs Loretta Smith is in charge of the registry. She handles the daily mail, circulates incoming mail to the management, handles the registry files and sends material to the National Archive. Another duty of hers is to file Treasury approvals and Tender exemptions coming in from the Ministry of Finance. [6]

The structure of the filing system was suggested by the OAG and approved by the National Archive. The National Archive has to approve every change in the system. The file structure consists of several levels. The same structure will apply to every ministry in Namibia. [6]

Each file can consist of several volumes. The volumes will be closed when they are approximately three centimetres thick and a new numbered volume with the same file number will be opened. Only when a Ministry is discontinued will the file be closed. (ibid)

Before each document is filed it is date stamped and receives a folio number. The folio number is unique for the actual file and it is written on the document. A list of folio numbers is attached to each volume of the file. A notation is made on the folio number list when a document is lent out from the registry. When a volume or a whole file is borrowed from the registry, a green card with notes concerning the loan is placed in the cabinet instead of the volume or file. (ibid)

A strenuous duty in the registry is to handle all the Treasury approvals and Tender exemptions arriving from the Ministry of Finance. The documents are filed annually according to the concerned Ministry. The approvals come with an index but not the exemptions. No further registration is being made. The documents are used by the auditors. (ibid)

Problems in the Registry (ibid):

- Missing files. Loans are not always properly registered. They have difficulties retrieving documents and files that are on loan.
- Difficulties tracing a single document that has arrived or left the OAG. They aren't searchable. To trace a single document you must know the vast filing system in detail. Some documents are "lost" because they are filed in the "wrong" file.

Norrman and Eriksson also interviewed people at different levels at the OAG regarding their opinions, among other things, the registry. Everybody interviewed was of the opinion that better access to information in databases/files would be a great asset to the audit work. Some of the ideas that were suggested were (ibid):

- Access on every PC to important documents, such as audit manuals, audit documentation, policies, annual reports etc.
- Access to databases with registry material.
- Arrange a place in the registry were you can sit down and look through files and reports then copy the pages you are interested in. This would decrease the need to check-out material from the registry.

Norrman and Eriksson made the following conclusions and recommendations (ibid):

- Develop a database for registration of each incoming and outgoing document in the registry.
- Develop a database as an index to all the Treasury approvals.
- Develop a database as an index to all the Tender exemptions.
- Everybody should be able to search for documents in the registry over an OAG intranet.

The databases could be built in MS Access, which the OAG has already installed. The databases should be accessible to all staff through an the OAG intranet. Someone from the OAG should be involved in the development process. The OAG must not be dependent on external expertise to make changes/updates in the databases. (ibid)

2.4.2 Technical Equipment

The OAG has two NT servers for data storage and programmes. One of the servers is used as a backup machine. At the OAG most of the employees have PCs, and the PCs are equipped with MS Office and Internet Explorer, which means that access to internal links are possible. Management, Chief Auditors and lead auditors have access to Internet communication. About 30 PCs are or are going to be connected to Internet. The OAG has 10 licences for SQL 6.5 and one licence for MS Access 97. Mrs Erica Dien, the data system analyst, is familiar with MS Access but she has no experience in development for Internet/intranet. [6][17]

Most of the auditors have very little experience of using the Internet because of the very slow connection when they use it as a search tool [6].

2.5 The Cooperation between the RRV and the OAG

Sweden and Namibia became friendship states during Namibia's struggle for liberation. When Namibia was liberated from South Africa in 1990, a mutual cooperation between Sweden and Namibia began. Sweden thought that the young nation Namibia needed support to develop a political system that would lead to a lasting and improved standard of living for the Namibian population. [20]

The Swedish Governments decision from 1998-04-02, specifies an outline for the task of working out a country wide strategy for Namibia. The strategy will guide Sweden's cooperation with Namibia during the period from 1 January 1999 to 31 December 2003. There should be a review of the cooperation during 2001. (ibid)

The cooperation's goal is to catalyse Namibia's own efforts for economical growth and to minimise differences in society. (ibid)

Most of the foreign aid to Namibia is dedicated to competence development in different fields and to social development, health and fisheries. On the administration front the aid has been used to build up the Statistic Bureau and the Office of Auditor General. The Swedish Statistic Bureau and The Swedish National Audit Office have cooperated with the corresponding Namibian units. The aid has been used to computerise certain routines, educate personnel, and provide personal expertise. The goal of the cooperation is to build up competent organisations, which can work without external help in the future. The goal concerning the Office of Audit General is achieved. (ibid)

The purpose of the aid to the Namibian administration is to strengthen democracy and improve management with public assets (ibid).

The cooperation between the RRV and the OAG is predicted to end in 1998. In the following years Namibia shall be gradually responsible for the development costs. (ibid)

2.6 Information Systems in Developing Countries

Computer users in developing countries are often faced with contextual problems. Some of the problems that influence computer usage in these countries are weak fit between models in western design and applications in southern context, semantic discrepancies in the formulation and understanding as well as references to different value terms and different concepts of rationality. [16]

Many enthusiastic computer projects in developing countries that have been introduced and later failed to perform, where computer solutions that have been successfully implemented somewhere else. Often because the actual reality never was fully understood according to the authority pattern, time concepts, rationality, values etc. (ibid)

2.6.1 Success Factors

There are a number of factors in Information System implementation in developing countries that are important if you are to achieve success [5].

2.6.1.1 Environmental Factors

The *economic environment* of a developing country has a clear impact on the long term success for IT implementation. The economy determines such things as the availability of funds for hardware, software and support. In developing countries the cost of IT investments are typically very high, as compared to the cost of labour. This encourages the use of more traditional labour intensive methods rather than the use of computer-based systems. [5]

Every society needs to be an information society. Can manual systems with their plentiful supplies of manpower generate the needed information? The answer appears to be no. In most developing countries there are problems with the manpower's education and experience, it can be hard to find workers with the right skills. The reason for developing computer systems in developing countries is not to reduce manpower but to transform inefficient systems to efficient ones. [2]

Technological factors, such as the sophistication, or even the existence of needed IT infrastructure, are important considerations in the study of telecommunications implementation in developing countries. [5]

Culture is also an important element in the implementations success. There is a difference between national culture and organisational culture, both are relevant to implementation studies. Computer applications are culturally bound, and the national culture has a direct impact on implementation failure. Lack of sensitivity to national culture issues will increase the risk for the project failing and lead to ineffective utilization of IT. (ibid)

The *political environment* of a developing country is also important. It has negative implication for successful IT implementation if the countries government severely restricts an organisations operations. On the other hand, governmental policies can create a positive environment for implementation. (ibid)

And finally the *regulatory environment* of relevant IT sectors in a developing country. Deregulation can be a major factor for expansion of the telecommunication industry. The regulatory environment impacts the amount of competition in sectors such as telecommunication. Deregulation leads to increased services, increased competition and decreased costs for the customer. (ibid)

2.6.1.2 Technical Factors

Prior *training* of individuals involved in an IT implementation project is seen as a critical element for success. Inadequate technical skills in the host country can be a difficult obstacle to overcome. [5]

The state of the enterprise’s existing *technological infrastructure* is important for successful IT implementation. The unavailability of adequate software can be an significant problem in developing countries. (ibid)

The selection of *appropriate, sustainable technology* is a critical factor for success. It can be difficult to find qualified technicians in the developing countries who can maintain the equipment. Implementation of IT in a developing country should promote for the development of a country’s infrastructure. Exclusive reliance on high-skilled foreign workers, without transfer of their expertise to locals, undermines the long term sustainability of the IT infrastructure. (ibid)

2.6.1.3 Inter Organisational Factors

Organisational culture plays an important role in the success of implementation. Technology has different social meanings in different cultural settings. Cultural meaning can emerge over time, the users who use the system gains experience of the technology, the user can see its potentials to support certain culture values and threaten others. A new system can represent negative themes such as American imperialism or it may have positive themes such as economic development and technological progress. During a successful implementation in Panama a major reason for the success was found. The new system was viewed positively because it was compatible with the Panamanian business culture. [5]

Multinational IT organisations must balance between the need for local autonomy and the need for standardisation. To much standardisation makes the system rigid, and it may not adjust to the uneven state of technological development in different countries. (ibid)

2.6.1.4 Intra Organisational Factors

When organisations in developing countries seeks partners to help them with their IT projects, it is important that the partners are appropriate in their *goals and objectives*, and what they "bring to the table" [5].

The *resources* that the partner provide need to be appropriate. Another important success factor is *trust* between the partners. (ibid)

Another important factor is the *design and management* of the partnership project. To achieve effective project management the responsibilities of each of the partners should be clarified and committed. (ibid)

2.6.1.5 Successful Project Implementation

Success is a dependant variable in IT implementation studies. One way to define this variable is by [5]:

- Meet partners objectives
- Use of the system by subsidiaries
- Achievement of global economies of scale¨
- Effectiveness of a technology transfer
  and
- Customers demand the new service that the IT implementation provides

The preceding descriptions has demonstrated that there are many factors that have an impact on successful IT development in developing countries, figure 2.1 summarise these considerations.

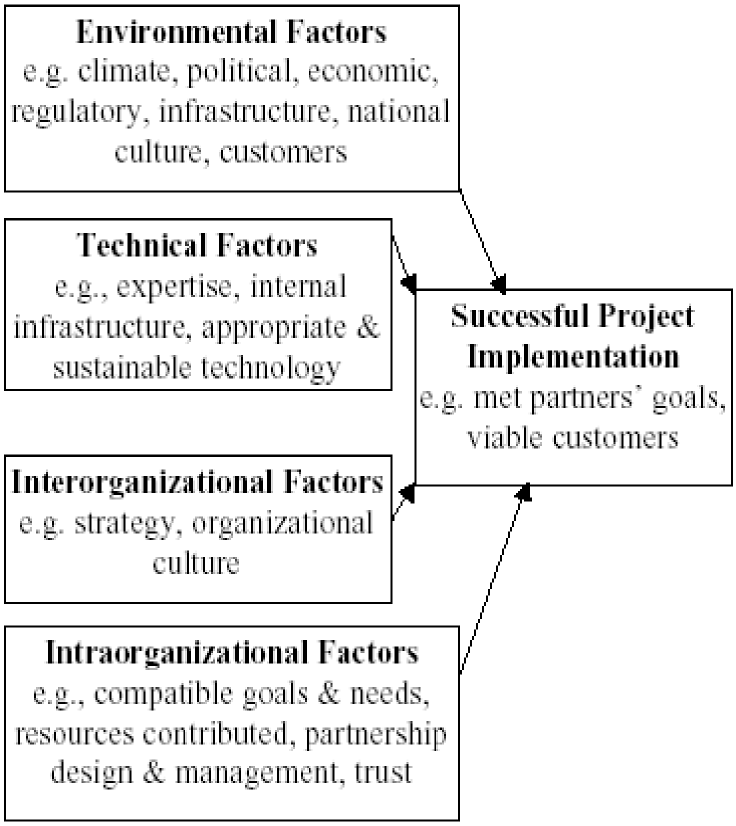

figure 2.1 Framework for successful IT implementation for developing countries [5].

2.7 WM-data Public Partner

Public Partner Human Resource in Karlstad is a business unit within WM-data. Public Partner works with tasks concerning development and administration of modern computerised salary- and personal administration systems. The primary market is public authorities and their organisations and to satisfy the customers needs. Public Partner offers a standard solution called PALASSO. At the present 100 000 employees are administrated by PALASSO. [21]

Besides PALASSO Public Partner also develops systems for certain tasks. An example is a military service salary system to the Swedish Armed Forces. Public Partner also delivers a decision support system for the private market, called PARAGRAF. (ibid)

Public Partner has consultants who can support investigations concerning agreement– and work methods issues, integrations with other systems, security issues, and technical investigations concerning operation environments. (ibid)

Public Partner has 45 collaborators with different competence and experience. The consultant collaborators are highly experienced in agreement issues, system solutions and education. The IT- collaborators have great competence in system design, programming data communication, security and system administration. (ibid)

2.7.1 Time Recording System

Public Partner has developed and partially implemented a Time Recording system for the OAG. The OAG has together with SIDA and the RRV listed several problem areas within a certain budget. IT-related projects on that lists are [18]:

1. Time Recording System
2. Library System
3. Registry System
4. Internal information through intranet

A future Registry System should be an extension of the Time Recording System. Consequently the systems must be compatible with each other. [24]

The management at the OAG gave priority to the Time Recording System. The decision to choose a unique system before a standard software solution was taken on the precondition that the system would be kept easy and slim with features designed for the OAG. [17] One reason for developing the Time Recording System was to make dataflow (for example payroll information) more efficient. The system would also facilitate follow-ups like hours spent on a project, and to make employees aware of time and resources. It would also enable them to do invoices and to have better awareness when planning the next project, these were further reasons for development of the Time Recording System. Because it was cheap and easy to manage, Public Partner decided that a Microsoft Access database would be enough for this purpose. (ibid)

The Time recording system's interface was developed in Visual Basic 6.0 (ibid).

2.8 The Database Design Methodology

A Design Methodology is a structured and top-down approach that uses procedures, techniques, tools and documentation aids to support and facilitate the process of design [3].

2.8.1 Critical Success Factors in Database Design

The critical success factors are from Thomas Connolly's database design methodology. [3]

1. Work interactively with the users as much as possible.
2. Follow a structured methodology throughout the data modelling process.
3. Employ a data driven–approach.
4. Incorporate structural and integrity considerations into the data model.
5. Combine conceptualisation, normalisation and transaction validation techniques into the data modelling methodology.
6. Use diagrams to represent as much of the data models as possible.
7. Use a Database Design Language (DBDL) to represent additional data semantics.
8. Build a data dictionary to supplement the data model diagrams.
9. Be willing to repeat steps.

2.8.2 Conceptual Database Design

This is a process for constructing a model of the information used in the enterprise. It's independent of all physical considerations. The data model is built using the information documented in the user's requirements specification. The conceptual data model of the enterprise is a source of information for the logical design phase. [3]

2.8.3 Logical Database Design

This is a process of constructing a model of the information used in an enterprise based on an specific model, but independent of a particular Database Management System and other physical considerations. The conceptual data model created in the previous phase is refined and mapped into a logical data model. [3]

2.8.4 Database Design Methodology

The steps below are from Thomas Connolly's methodology [3].

2.8.4.1 Conceptual Database Design

Step 1 Build logical conceptual data model for each user view

Step 1.1 Identify entity types

Step 1.2 Identify relational types

Step 1.3 Identify and associate attributes with entity or relationship types

Step 1.4 Determine attribute domains

Step 1.5 Determine candidate and primary keys attributes

Step 1.6 Specialise/generalise entity types (optional step)

Step 1.7 Draw Entity-Relationship diagram

Step 1.8 Review local conceptual data model with the user

The entity types are identified as a first step in building the conceptual model. This is done by defining the main objects that the users are interested in. One method is to look for nouns in the user's requirements specification. [3]

To identify the relationships between the entities the requirement specification can be used. Relationships are indicated by verbal expressions. (ibid)

The attributes can be identified in the requirement specification where the noun or noun phrase is a property, quality, identifier or characteristic of one of these entities or relationships (ibid).

A fully developed data model specifies the domains for each of the model's attributes and includes allowable sets of values for an attribute and sizes and formats of the attribute fields (ibid).

A candidate key is an attribute or a set of attributes of an entity that uniquely identifies each occurrence of that entity. If more than one candidate key is identified, one must be chosen to be the primary key. (ibid)

The Entity-Relationship diagram is a conceptual representation of a user view of the enterprise [3].

2.8.4.2 Logical Database Design for the Relational Model

Step 2 Build and validate logical data model for each users view

Step 2.1 Map conceptual data model to logical data model

Step 2.2 Derive relations from logical data model

Step 2.3 Validate model using normalisation

Step 2.4 Validate model using transactions

Step 2.5 Draw Entity-Relationship diagram

Step 2.6 Define integrity constraints

Step 2.7 Review local logical data model with the user

When mapping the conceptual data model into the logical data model, transformation of undesirable structures must be made. M:N relationships, complex relationships, recursive relationships and redundant relationships are examples of structures that can't easily be

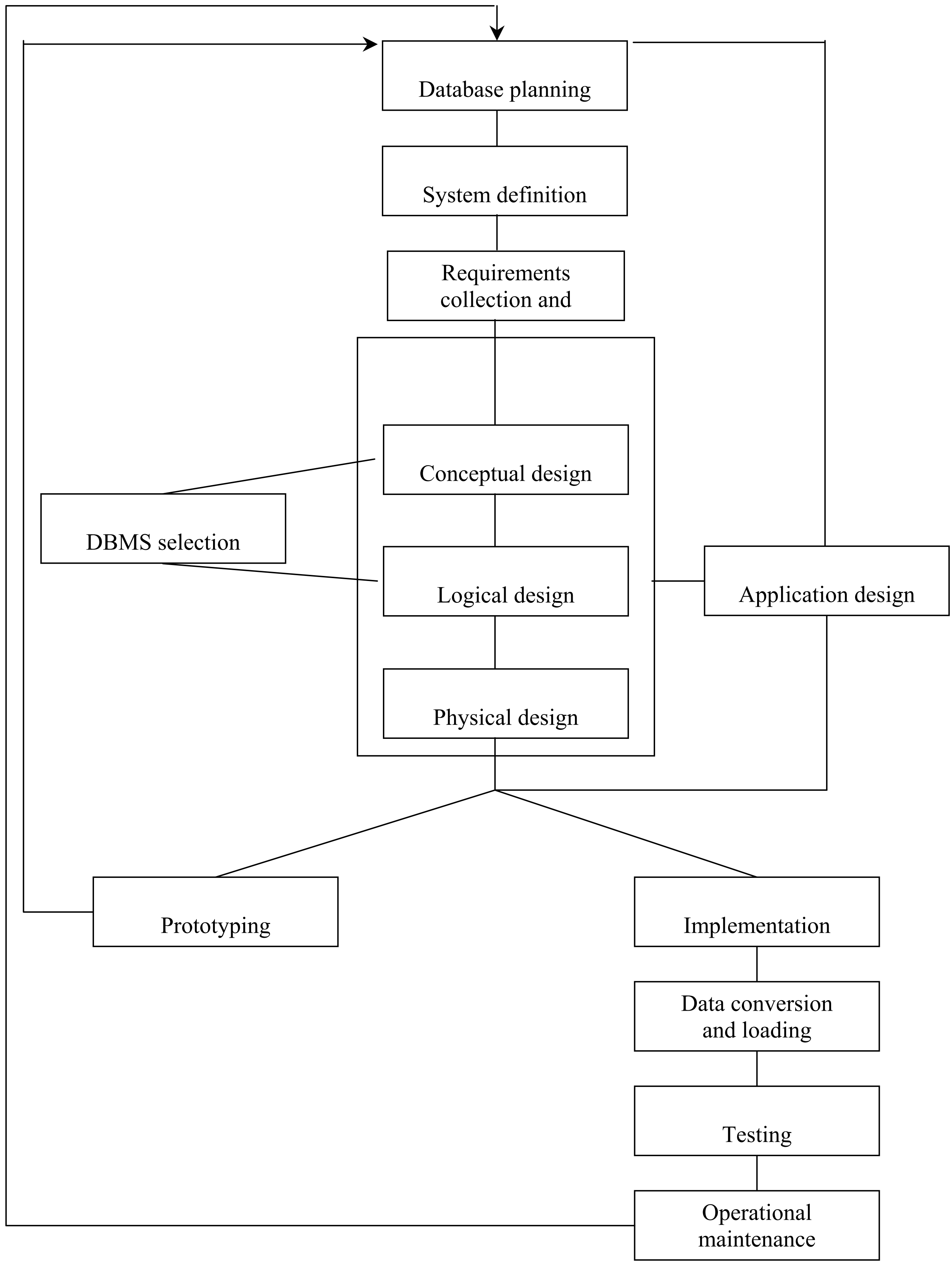

Figure 2.2 The database application lifecycle [3].

modelled by conventional database management systems. The process makes the designer think more carefully about the meaning of the data and, consequently, leads to a truer representation of the enterprise. [3]

Normalisation is used to improve the model so that it satisfies various constraints that avoid unnecessary duplication of data. Normalisation ensures that the resultant model is a closer model of the enterprise that it serves, it is consistent and has a minimal redundancy and maximum stability. (ibid)

Transactions validate the model. E/R-diagram, the data dictionary and the primary/foreign key links shown in the relations are used in the attempt to perform the operations manually. If there is a problem in doing this, there is a problem with the data model and must therefore be further developed. (ibid)

Integrity constraints are imposed constraints that protect the database from becoming inconsistent. Required data, attribute domain constraints, entity integrity, referential integrity and Enterprise constraints are the types of integrity constraints that would be considered.

Step 3 Build and validate global logical data model

Step 3.1 Merge local logical data models into global model

Step 3.2 Validate global logical data model

Step 3.3 Check for future grow

Step 3.4 Draw final Entity-Relationship diagram

Step 3.5 Review global logical data model with the user

2.8.5 Modified Database Design Methodology

To gain the required knowledge the methodology must be changed so it can be used in its right context. Certain well-established methods must be formed in detail so they fit for the actual knowledge development. [7] Step 1 will be changed from a *local* conceptual model into a *global* conceptual data model. A local data model is a model for each user in the enterprise and a global data model is a model of multiple users views of an enterprise. It is a centralised approach when you merge separate user requirements that represent distinct user views into a single set of user requirements, and then build the global logical data model. [3]

The reason for doing this is that the design of the Registry System will be based on a feasibility study where the interviews are summed up in the requirements specification. Step 2 is modified for the same reason. The Local conceptual data model in Step 2.1 is changed into a global logical data model. Step 3.1 is left out because in this design phase the model already is a global logical model.

2.8.6 Consistency in the Interaction Design

2.8.6.1 Physical Consistency

Both operational and representational consistencies are important in interaction design. Operational consistency means that the system only should support a few ways of issuing commands. In addition to consistency of operations, a consistent representation should be employed. For example, error messages should look the same and appear in a consistent place on the display in relation to the rest of the dialog.[12]

2.8.6.2 Conceptual Consistency

There are number of aspects to conceptual consistency [12]:

1. A consistent metaphor should be chosen. Metaphorical consistency is very culture-dependent.
2. Entities, which perform a similar role should be treated consistently.
3. Task consistency is when the task allocation has been carried out so that the user has to perform similar tasks on similar objects.

3 Methodology

In our approach to this task we will focus on the data in the enterprise. This approach has its starting point in the circumstances inside and outside the enterprise that are of interest for the enterprises co-workers to have information about. These interesting circumstances are called entities. When the approach is focused on the data, you want to register information about the entities. The information will be stored as data. [1]

We will use different methods for the different phases in our development process. The phases and their methods are described below and figure 3.1 shows how the phases and the description of the design process relate with each other.

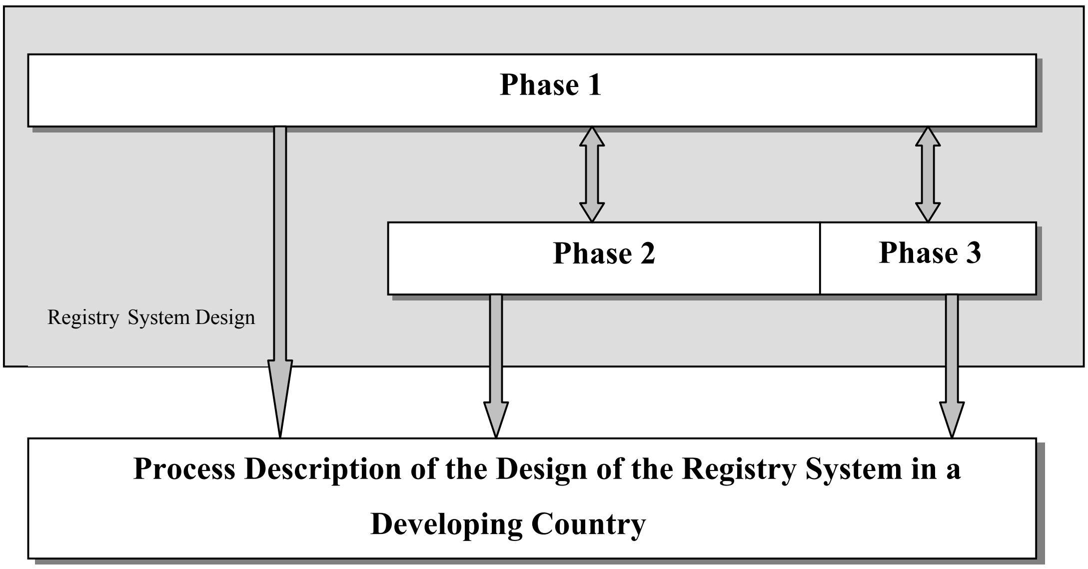

Figure 3.1 The structure of our Bachelor's Project's methodology

3.1 Phase One - Survey of the Enterprise

In this phase we will survey the enterprise that we are going to develop the Registry System to. We must penetrate the enterprise so our system will meet the users expectations. This phase proceeds parallel with the other phases because it's necessary to continuously analyse the enterprise in the design process. The logical designer is concerned with identifying the data (that is, the entities and attributes) and the relationship between the data, and the constraints on the data that are to be stored in the database. The logical database designer must have a thorough and complete understanding of the organisations data and its business rules. [3] First we must become familiarised with the OAG. We will get familiarised through source studies, on the Internet, brochures, software and reports. We will also visit the RRV in Stockholm to get an insight into how a registry at a National Audit Office can work. We will penetrate the feasibility study that was performed at the OAG in year 2000 [6], then we will update the feasibility study by sending questions by e-mail to key persons in the enterprise.

It is important to have a critical approach when choosing the relevant sources for a project. The sources must be veracious, and they have to be chosen in the purpose to answer the questions in the project. To criticise a source in an appropriate way you must know how, when, where and why the sources have come into their existent. [11]

Most of the Internet sources that we will use in the design of the Registry System shall be published books, articles and reports. These should be written by well respected authors from universities, governments etc. The documents that we will use in order to gain knowledge about the registry routines at the OAG, will be provided from people who have analysed the registry routines. The Time Recording software will be given to us by the developers of that system. We will choose literature that is written by well-known authors to ensure the reliability.

The data that will be analysed from the various data generating sources listed above will be quantitative data. Quantitative data is something that can be categorized in some way but cannot be reduced to numerical measurements. [12] The ambition of analysing quantitative data is an attempt to understand and analyse the entirety [11].

We have chosen to collect information with these methods because a feasibility study had already been done, and our work will build upon that study. We can use existing knowledge because the routines in the registry are the same. To do a new study would cost money and there is no budget for that. We do not have the money or the ability to travel to Namibia so we can't see the enterprise with our own eyes. A disadvantage with this approach is that we only get second hand information which we have to interpret. During the interpretation certain things may be ambiguous and it may take time to get them cleared up by e-mail.

3.2 Phase Two - Conceptual and Logical Design

This phase deals with the conceptual and logical design of the Registry System (figure 2.2). It is important to produce a well-laid design because a poorly designed database may generate errors. These errors may lead to bad decisions being made, which may cause serious repercussions for the enterprise. Unfortunately, database designing methodologies aren't very popular. Many organisations and individual designers rely very little on methodologies when they design a database. This is considered as a major flaw in the development of information systems. Due to the lack of structured approaches to database design, the time or resources required for the database is underestimated, the developed database is inadequate or inefficient in meeting the demands of the application, documentation is limited and maintenance is difficult. [3]

To prevent the disadvantages that can occur with a system design without structure, we will support our design of the Registry System with Thomas Connolly's Database Design Methodology.

We wanted to work with Data Modelling with a Database Perspective, this due to the fact that we are going to have minimal contact with the users, because of the distance involved. The Database Perspective means that the experts do the work and the users contributes with factual information [1]. We have modified Thomas Connolly's Database Design Methodology so that it has minimal user involvement.

Our design method is an analytical approach. The advantages of this approach are that these methods have been refined over time and now they serve as an detailed recipe for the developer to follow. A disadvantage is that it is hard for the users to get a grip of how the future system will function, it is hard for them to understand the abstract notation. A further risk is that the users expectations may not be fulfilled by the new system. It is easier for the user to get a good grasp of the future system if the developers work with prototyping (an experimental approach). By doing this it is more likely that the new system will meet the workers' requirements. But prototyping means that the users need to be involved frequently and we don't have that possibility so we can't use prototyping in this phase. [1]

3.3 Phase Three – Application Design of the User Interface

Here we will work with the design of the user interface for the Registry System. User interface design is one aspect of application design (figure 2.2) [3]. We will design the interface in Visual Basic 6.0 (VB) [4]. The reason for choosing VB instead of Microsoft Access is to enable us to move the database to a SQL-server in the future. This makes the Registry System compatible with the Time Recording System. [24]

The interface should present the required information in a "user-friendly" way. The interface is one of the most important components of the system. The users will be inclined to make good use of the system if it's easy to learn, simple to use, straightforward and forgiving. If the interface has none of these characteristics, the system undoubtedly will cause problems. [3]

4 Performance

4.1 Phase One - Survey of the Enterprise

Mr Säll at WM-data gave us the feasibility study "Report on Development of Databases, Use of Internet and Computerised Library and Registry- phase 1" during a project start meeting. The feasibility study was carried out by Mrs Norrman and Mrs Eriksson two years earlier in Namibia. We also received reports of the Time Recording System [17] from Mr Säll.

To familiarise us with the OAG's registry routines we read the feasibility study carefully. At the same time we also learned about Namibian culture by studying Namibian facts from Internet sources and by verbal information from meetings with Mr Säll. Mr Säll had together with Mr Bo Erlandsson, also an employee at WM-data, been in Namibia and developed the Time Recording System [25] so he had experiences from both the country and the OAG's organisation. Unfortunately he had very little knowledge about the specific registry routines. In the beginning of the analysing phase there were two meetings with Mr Säll and the one hour long meetings took place at WM-data. In the meetings Mr Säll told us about his stay in Windhoek. He also told us that Mrs Norrman in Stockholm would help us with the specific registry routine questions.

Mrs Norrman has earlier worked at the RRV's registry but after her retirement a few years ago, she has free-lanced for the RRV. After a phone call from us in August 2002, we visited the RRV in Stockholm for the purpose of studying the registry routines at the RRV and to meet Mrs Norrman in person. Mrs Isabelle Berglund also participated in this meeting. Mrs Berglund works at the RRV as a project manager and she is among other things involved in different OAG projects. This meeting with Norrman and Berglund provided us with further information about the registry routines and the people working at the OAG. Mrs Norrman told us about how the different documents were physically stored at the OAG, the Treasury approvals and Tender exemptions are stored in heaps, in a little room, no further registration is attempted, this making a search very difficult, the other documents are stored in cabinets. They also answered our questions about how the feasibility study had been carried out. The results of the feasibility study were based on open interviews with chosen staff at the OAG. We also got real copies of documents from the OAG's registry. Our visit to the RRV in Stockholm ended with a run-through of the RRV's computerised registry system. The registry clerk at RRV showed us different screen pictures design and functionality. [23] To get further knowledge about RRV, we read their homepage on the Internet [13]. They have published a book with facts about the organisation which also is accessible on the Internet [14].

Because it was two years ago that Mrs Norrman conducted the feasibility study [6], she couldn't remember the registries routines in detail. As we proceeded with the analysis of the OAG's registry routines, certain questions arose. It was very important for us to get these questions answered, otherwise we ran the risk that the Registry System wouldn't satisfy the users needs. As a result of this we began to communicate by e-mail with Mrs Dien, the data system analyst at the OAG, and thereafter with Mrs Smith, the registry clerk at the OAG [22]. This communication is explained further in phase two.

We also had access to the Time Recording Systems documentation [17] and program [25]. We studied the material thoroughly to make the Registry System compatible with the Time Recording System.

Phase one was an iterative process that continued throughout the design (figure 3.1). Our understanding of the registry routines changed as we worked with the conceptual and logical design. Phase one will therefore be further described in phase two and three.

4.2 Phase Two - Conceptual and Logical Design

In the beginning of this phase we wanted to do an Entity-Relationship Diagram (E/R Diagram) for the future computerised system. We began our work by looking for entities in the feasibility study. We used a white board and wrote the entity names on post-it notes that we placed on the board. When we were finished with the entities we tried to place them in relationships with each other, we used whiteboard pens and drew the relationships between the entities. A problem that we came across was our understanding of the different levels in the storage routine. We didn't grasp how the files, volumes and documents were compounded together. We were also confused over the numeration of the subject. However we completed a first draft of our conception of the enterprise.

The next step was to create the tables in MS Access, during this task we searched for the attributes that were connected to the entities. We read the documents that we got from Mrs Norrman over and over again, especially the Filing System Example (Appendix C.1). We imported the tables that the Registry System will share with the Time Recording System [25], to make them compatible with each other. We felt very unsure of our understanding of the enterprise and we tried to contact Mrs Dien, the data system analyst at the OAG, but our efforts to contact her were in vain. We tried to contact her for three weeks with no result, our emails just kept coming back, the delivers of the e-mail failed one time after the other. The e-mails didn't get through to the OAG probably because of some connection trouble. When we were done with our first version of the Registry System we arranged a meeting with our tutors at WM-data, Mr Säll and Mr Erlandsson. We described our solution for them and we discussed how the numeration of the documents is done. They said that the numeration procedure is crucial for the system design, and we told them that we had tried to contact Mrs Dien but with no result. We agreed that we had to obtain a better understanding of the numeration and we asked them who we could contact to get some answers. They suggested that we should contact Mrs Smith. In the end of the meeting we received Mrs Smith's, the registry clerk at the OAG, e-mail address.

When we wrote an email to Mrs Smith we finally got an answer. This time we didn't use hotmail for sending the mail, we tried with Telia instead. During our e-mail contact (Appendix A Mail) with Mrs Smith we got a clearer picture of how the routines at the registry worked, and she explained the numeration of the documents. We understood that our former solution was incorrect due to the fact that we had misunderstood the registry routines. We had thought that the volume number was included in the file number and we thought that every Ministry just had one file. Now we learned that every correspondent to the OAG has one file per subject. Now we finally understood how the different levels in the numeration worked. So now we drew a new E/R diagram (Appendix B.1) and on the basis of that we designed new tables in MS Access.

After the tables were done we had a new meeting with our tutors at WM-data. Now they thought that our tables and relations seemed to be more appropriate than our former solution. Mr Erlandsson thought that we should break down the file number in smaller parts and we decided to do so. They thought that our design was ok if we made these modifications.

We completed our final design of the database and now we could move on to phase three. We split up the filing number into the smallest level that we could grasp. We were aware that the filing number could be further divided, but we chose to stay on the level that we understood so that no irregularities would be stored in the database. During phase two we have also continuously documented our work with the design process, especially when we were stuck in the work process because we were waiting for answers from the OAG.

4.3 Phase Three - Application Design of the User Interface

Our aim was to design the Registry Systems interface like the Time Recording Systems interface as much as possible [24]. As the Registry System should be compatible with the Time Recording System we looked at the latter systems screen pictures to get an understanding of the design. Asking Mr Säll and Mr Erlandsson, the designers of Time Recording System, solved the ambiguous matters.

The next thing we did was to analyse the registry routines at the OAG with the purpose of understand what the users wanted to do, supported by the Registry System, and how this should be accomplished. We began with drawing sketches of the screen pictures, one on each paper page. After the sketches we sent an e-mail to Mrs Smith with questions about the design. This made it possible for her to influence the interface design in the facilitating functionality matter. After all she is the one that will have the most frequent use of the Registry System as she is the registry clerk. Unfortunately she did not answer this mail.

Other users of the Registry System, than the registry clerk, are the auditors. These two different types of users will have different access to the Registry System. The registry clerk will be able to register in and out going documents to the registry, make loans and search for documents, Treasury approvals and Tender exemptions. The registry clerk will also be able to add and remove certain objects in the Registry System. The other users will only have the possibility to search for documents, Treasury approvals and Tender exemptions.

We designed the interface in Visual Basic 6.0.

5 Results

5.1 Detailed Description of the Registry System

5.1.1 The Structure of the Registry System

Here we will describe in detail the data base tables that the Registry System consists of.

5.1.1.1 Shared Tables

First we describe the tables that the Registry System share with the Time Recording System, i.e. Employee, Division, Vote and Rank. These tables handle the personal data of the employees at the OAG. The connection to our tables is between the Employee table and the loan table. The employee who has loaned the volume is registered. A connection between Employee and Document exists only if someone at the OAG is responsible for the document. There is a connection between Vote and TA or TE that designates which Ministry sent the Tender exemption or the Treasury. We have made a minor change in the employee table, we added the attribute e-mail because we want the Registry System to be programmed for sending e-mails to the persons that are late with loans. For further information about primary keys and the specific attributes in each entity see Appendix B Design.

5.1.1.2 New Tables

Now over to the tables that we have created for the Registry System. They are Loan, File, Org_type, Organisation, Volume, Document TA and TE. A textual description will follow bellow. If you want a more detailed description over the entities primary keys, attributes and the tables relations see Appendix B Design.

Loan Table

The Loan table contains information concerning the loans of Volumes and Files from the Registry System. In the Registry System the staff at the OAG will be able to make loans of Files and/or Volumes. It registers the employee number of the person who has made a loan, which Volume that he or she has borrowed, from which date, the due date and finally the returned date. The system shall be programmed in a way that if a person loans the same volume twice or more the former loan register is overwritten. The Loan table is connected with the Volume table and the Employee table.

File Table
The File table contains information concerning the files. That is what Organisation the file belongs to, what the Subject Type of the file is and what the Subject is in the File. The registry clerk can add new Files if that is necessary. The File table is connected to the Volume Table and the Organisation table.

Org_type Table
The Org_type table contains information of what types of organisations that correspond with the OAG. The information that is stored is the organisation type number and the name of that type. Org_type is connected to Organisation table.

Organisation Table
This table contains the names of the organisations that have a File in the Registry System. The OAG did not have such a number in the former Registry System so we introduced the number 00 for the OAG's own correspondence. The Organisation table is connected to the File table and the Org_type table.

Volume Table
The Volume table consists of information about the volumes. That is, which File the volume belongs to, when it was opened and if the volume is closed. If it is closed, the date it was closed is listed. Here lies also information concerning the volumes status, is on loan or not. The system shall be programmed so that when a loan is made the status field of the volume is changed to out (o). The volumes will be closed when they are approximately three centimetres thick. Due to that fact the registry clerk must first check the volume before she files the documents, and if it is about three centimetres thick she will close that volume and when she does that the system will be programmed to generate a new volume. The volume table is connected to the Loan table, Document table and the File table.

Document Table
The document table handles the information about the documents in the registry. That is, the title of the document, person responsible for the document (if any), the date that the document arrived, what date it was filed in to the registry and in which volume it lays. We wanted to have both the received date and registry date because they may not be the same and staff at

the OAG might be interested in which documents are available in the registry today. The Document table is connected to the volume table.

TA Table

The TA table contains information about the Treasury approvals that arrive to the registry. With this information you can perform a search. It will not be possible to loan the Treasury approvals but the staff at the OAG can make copies of them at the registry. The TA table is connected to the Vote table.

TE Table

The TE table contains information about the Tender exemptions. With this information you can perform a search. The Tender exemption does not come with an index so we have created an index for them, that is the tenderno. It will not be possible to loan the Tender exemptions but the staff at the OAG can make copies of them at the registry. The TE table is connected to the Vote table.

5.1.2 The Interface of the Registry System

Our interface design resembles the interface design of the Time Recording System in the choice of colours and the basic structure. The screen pictures that we have designed is available in Appendix D Interface. In Appendix D Interface we describe the interface design in detail.

5.1.3 Advice for the Programming of the Registry System.

Here we will describe how we want the Registry System to be programmed. We have some items that we have come across during our design. They are:

- We want the Registry System to be programmed so that an e-mail is sent to the person who is late with a loan, i.e. the due-date in the table has passed and no return-date is yet filled in.
- The system shall be programmed in a way that if a person loans the same volume twice or more the former loan register is overwritten.
- When a Volume is closed the system shall be programmed so that a new Volume for the actual file is generated.
- The system shall be programmed so that when a loan is made the status field of the Volume table is changed to “out” (o), and when the volume is returned it will be changed back to “in”(i).

- When a new File is opened the system shall generate a new Volume with volume number one.
- When an Organisation is disconnected, the last Volume in all Files belonging to the actual Organisation shall be closed and the system wont generate new Volumes for these Files.
- Check with the OAG how long they want to store the Volumes in the registry. The volumes should be automatically removed when they have been stored for the time that the OAG requires.
- If the due_date have passed and no returned date is noted, the fonts of the information row for that Loan should be in red colour, this is in the interface of Loan (i.e. the loan information list, in the loan window).

5.2 Results from the Design Process in a Developing Country

In the process of designing the Registry System for the OAG we have faced difficulties that have influenced the design process. The physical connection through Internet sometimes failed and this made it hard for us to communicate with the users in Namibia. At first we tried to send mail from hotmail, but after three weeks of failure we changed hotmail connection to a connection provided by Telia. After this we got through to Namibia and the only thing that continuously took time was to get our questions answered by the registry clerk at the OAG. One problem was that we unfortunately did not get every e-mail answered.

Another thing that made it harder for us than we thought it would be, was that the feasibility study was carried out two years ago. A consequence of this was that we couldn't get detailed information concerning the registry routines from the people who had done the feasibility study.

There are differences in the RRV's and the OAG's organisational cultures. This is based on our experiences of western organisational culture obtained from our everyday experiences with western organisations. In this case the RRV will serve as an example of an organisation from a western country and the OAG will serve as an example of an organisation from a developing country. These differences became obvious to us during the survey process of the OAG.

One difference is that you cannot follow a certain subject-matter at the OAG. This is possible at the RRV were the computerised system shows where in the process the subject-matter is.

Another difference is that the documents at the OAG files according to their subjects, not after their unique numbers. The documents at the OAG doesn't have unique numbers. This made it difficult for us to understand at first, because in western organisations it is more or less natural to number the documents uniquely. It is easier to keep track of the documents when they are filed when they have their unique numbers.

In the OAG's organisation there are also other differences in their way of thinking compared to the way of thinking that we are used to. They have a three level classification of files, volumes and documents. In western thinking we are for example used to classifying documents after documents numbers or filing date.

Something else that we came across and experienced as hard to understand, was the manual opening and closing of a volume. The registry clerk must arbitrary assess when the volume is three centimetres thick, then close it and open another volume. We found it quite difficult to transfer the file, volume and document level thinking and the manual routines into a computerised system.

In the registry of the OAG the physical filing of the documents works a bit different from the RRV's physical filing. At the RRV the documents are filed and thereafter placed in a cabinet. In the OAG's registry some of the documents, Tender exemptions and Treasury approvals, lies visible in a little room and they are filed annually.

It is only the staff at OAG who has access to OAG's documents. This is a big difference comparing to the documents at RRV. At RRV it is allowed for the public to read the documents, this is guaranteed by the Swedish Constitution and it is called the offentlighetsprincipen (Appendix A.5).

6 Analysis

Here we will compare our results with the theoretical framework in this Bachelor's Project. We will begin with our design solution, to see if we have accomplished what we were assigned to do, and then we will analyse our experiences from the development process in Namibia, a developing country.

6.1 Analysis of the Registry System Design

6.1.1 Analysis of the Database Design

First we will see if the System Design that we have developed can solve the problems that the registry encountered.

According to the feasibility study [6] the registry had problems keeping track of the volumes and the files that were on loan. This resulted in problems getting back files and volumes that were on loan. (ibid) With the new Registry System there is a Loan table were all loans will be registered by the registry clerk. If a person is late with a loan the person will receive a reminder e-mail from the system. The registry clerk will also see if a person is late with old loans when the clerk performs a new loan for that person. It is possible for the registry clerk to print out a report of all delayed loans. With our new system the registry will have a greater chance keeping track of loans and thus a greater chance to get them back.

Another problem that was mentioned in the feasibility study was the difficulties to search for documents which have arrived or left the OAG (ibid). You had to know the vast filing system in detail to find a single document. In the new computerised system you will be able to search for a document by word from subject type, subject or title, the whole subject type, subject or title, intervals of arrival date and register date, the type of organisation, organisation, and by the document's unique number. Users will no longer be dependent on the knowledge of the whole filing system, and this will make it easier to search for documents, volumes and files. This means that it will no longer be a problem with the search for documents.

The feasibility study (ibid) also highlights some of the wishes from the OAG's staff towards features of a new registry system. Everybody who was interviewed on the OAG felt that better access to information in databases/files would be of great assess to the audit work.

One idea that was suggested was access, from every PC, to important documents, such as audit manuals, audit documentation etc (ibid). The new system does not support this idea because this lies outside our project.

Another idea was access to databases with registry material (ibid). The new Registry System makes it possible for all staff at the OAG to search for documents/volumes/files, and see if they are available for loan. With the new system all staff will have access to the registry files so we have fulfilled that requirement.

One final idea was that there should be a place in the registry were the OAG staff could sit and look through files and reports then copy the pages they were interested in (ibid), this wish lies outside the borders of the Registry System.

Norrman/Eriksson made several conclusions and recommendations (ibid). We have fulfilled them in the following way.

The first recommendation was to develop a database for all ingoing and outgoing documents in the registry (ibid). We have designed just such a system.

The second and third recommendation concerned the development of a database as an index to all Treasury approvals and a database as an index to all Tender exemptions (ibid). We did not make separate databases for them instead we created tables for them in the Registry System, thus making them searchable. By doing this we have fulfilled the requirements.

The fourth and last recommendation was the need for people at the OAG to be able to search for documents in the registry over an OAG intranet (ibid). As mentioned earlier, our system will support that alternative.

The database should be built in MS Access (ibid) which we have done. They wanted someone from the OAG to be involved in the development process (ibid). We have used Mrs Smith, the registry clerk, to learn more about the OAG. The feasibility study states that the OAG must not be dependent on external expertise to make changes/updates in the databases (ibid). Therefore we think that Mrs Dien, the data system analyst, should be involved in the final implementation of the system. We have designed the system to be as slim as possible and with the basic features to make the system easier to understand and maintain.

In our opinion we have fulfilled every requirement in the feasibility study. Our opinion is therefore that we have also met our assigners' requirements.

6.1.2 Is our Design a Successful Database Design?

We have the opinion that it's hard, almost impossible, to know if our design is successful until the system is programmed, implemented and used for a while. But here we will check it against Connolly's Critical Success factors [3] to see if we have followed them during our design process. Our comments are written in italics.

1. Work interactively with the workers as much as possible. *Our ability to work interactively with the workers have been very limited, the only way we have been able to communicate with them is through e-mail. We had to rely heavily on the feasibility study that were carried out on site at the OAG office, Windhoek, Namibia.*
2. Follow a structured methodology throughout the data modelling process. *We have followed every step in Connolly's Database Design Methodology [3].*
3. Employ a data driven approach. *Due to the lack of user contact we have really concentrated on the data in the organisation so our approach has been data driven.*
4. Incorporate structural and integrity considerations into the data model. *We have defined the necessarily integrity constraints and the Appendixes B.5, B.6 and B.7 present these constraints.*
5. Combine conceptualisation, normalisation and transaction validation techniques into the data modelling methodology. *By using Connolly's Database Design Methodology we have combined conceptualisation and normalisation but we haven't included the transaction design because our BP doesn't include that part of the application design. We have only designed screen pictures in the application design and given directions for some features that we want the system to include when it is programmed.*
6. Use diagrams to represent as much of the data models as possible. *We have used an ER-diagram to represent our data model (Appendix B.1).*
7. Use a Database Design Language (DBDL) to represent additional data semantics. *Instead of using a DBDL, for example* ***Organisations*** *(Otypeno, Orgno, Name)* ***Primary Key*** *Otypeno, Orgno, have we created tables over the data semantics in the databases (Appendixes B.4, B.5).*
8. Build a data dictionary to supplement the data model diagrams. *We have explained the data in the database in our tables in the Appendixes B.3 and B.5.*
9. Be willing to repeat steps. *We repeated the steps several times, we have drawn a number of ER-diagrams during our conceptualisation phase to understand the enterprise in depth.*

We have followed the ten success factors as much as possible in the frame of our BP. The main risk factor for our system design lies in the fact that we haven't been able to work interactively with the users as much as we wanted.

6.1.3 Analysis of the Interface Design

The theoretical framework claims that the physical consistency in interface design is of great importance. In the operational part of the physical consistency it is important to only have a few ways to issue commands. [12] We do only allow the user to perform each task in one way in our interface design. Each screen picture handles only one function, for example the user has different screen pictures when he/she searches for documents, Treasury approvals and Tender exemptions (Appendixes D.6-D.11).

Another part of the Physical consistency is the representational consistency of the system. The designer must keep the screen layout consistent throughout the system. (ibid) In our interface layout we have considered this by for example placing the command buttons at the same place of the screen pictures. We have also tried to resemble the Time Recording System's interface as much as possible, in choice of colour and structure, to make the OAG's information system consistent (Appendix D Interface).

There are aspects in the conceptual consistency which are important to consider in an interface design (ibid). In the interface design we have considered the first aspect, to choose a consistent metaphor (ibid), by using the OAG's own terminology and organisation in the system (Appendix D and Appendix B.8). The second aspect, to treat entities which perform a similar role consistent (ibid), we have considered by treating the entities "tables" the same way in the Registry System interface (Appendixes D.13-D.17). The final aspect, to carry out the task allocation so the user has to perform similar tasks on similar object (ibid), do we consider by letting the user of the Registry System search for documents, Treasury approvals and Tender exemptions in a similar way (Appendixes D.6-D.11). We have according to the theoretical framework [3] thought that the system will be easy to learn by designing the system as similar as possible as the Time Recording System. The Time Recording System is already in use at the OAG, and we believe that this will shorten the learning period of the Registry System, for the staff at the OAG. The Registry System will also be forgiving with warning messages when the user will, for example, clear the screen and use save- and delete functions.

6.2 Analysis of the Design Process

Here we will analyse which special considerations we made in the design of the Registry System for OAG, an organisation in a developing country. We will also analyse the obstacles that we came across during the design process.

When designing a system you must have in mind that the system will be implemented in the future [24]. We think that it is therefore important to think about implementation success factors for developing countries during the design process. In the analysis of the design process we will analyse if we have taken the success factors from the theoretical framework under consideration to facilitate the future implementation of the Registry System.

The survey of the OAG's organisation as a whole and the registry routines in detail, served together with facts about Namibia, as a knowledge base in our understanding of the context in which the future Registry System would be implemented in. This should, according to the theoretical framework, improve the Registry System's chances to be successfully implemented.

In the Bachelor's Project "From Tomtom to Cyberspace - A Descriptive Study of the Present IT- situation in a Rural Zambian District [16]" the authors claims that it is important to understand the actual reality according to authority patterns, time concepts, rationality, values etc in order to successfully implement a computer solution. For the same reason it is important to understand the difference in semantic formulation and understanding and differences in value terms and concepts of rationality (ibid). A successful implementation is dependent on an understanding of the inter- and intra organisational culture [5]. The system can then work as a tool to produce economical and technological progress instead of being another failed computer implementation (ibid).

A success factor that will influence the implementation of the Registry System is the Namibian political and economical state [5]. The economy determines such things as the availability of hardware, software and support. It has negative implications for successful IT implementation if the countries government severely restricts an organisations operations. On the other hand, governmental policies can create a positive environment for implementation. According to the theoretical framework Namibian society is now characterised by political stability and the Namibian finances are small but stabile. The cooperation between Sweden and Namibia, indicates that there is a political will to develop the country and computerise certain routines at public services (ibid).

There were, according to the theoretical framework, differences in how the OAG and the RRV are organised, and these were considered during the design. An example of the OAG's different terminology and organisation was the usage of the three level system of files, volumes and documents in the registry [6]. The manual numbering of the files, volumes and documents in the registry at the OAG is another example of the differences between the RRV and the OAG (ibid). The manual routines in the OAG's registry made it hard for us to understand the organisation, because, as representatives of western culture, we are used to the computerised routines in western organisations. It was difficult for us to think in other ways in order to understand the registry routines at the OAG completely and the process was educational but time consuming.

Before we started with the design of the Registry System we presumed things about the culture in Namibia. We had heard from verbal sources that it could take time to get answers by e-mail because of the different attitude towards rationality. One example given to us was that people waiting for the bus could wait the whole day because "the bus would come whenever in the morning". As we began communicating with Namibia by e-mail, we realized that the communication with the users wasn't time consuming because of the culture, but because of the physical connection. Our e-mails didn't even get through to OAG's mail server. The theoretical framework claims that the *Technological factors*, such as the sophistication, of needed IT infrastructure, are important when you work in developing countries [5]. In our case we don't know if our problems with the e-mail communication were caused by the physical connection, their security routines or because of hardware problems. But when our e-mails got through we received prompt answers.

The theoretical framework claims that there can be differences in concepts of rationality in different cultures (ibid). We think that these differences depend upon where you will implement the system. In our case the Registry System will be implemented in an office located in a capital city, were the conditions are different from an office located in a rural district. According to the theoretical framework there are differences in urban and rural culture in Namibia. For example, the possibility to influence decision-making is concentrated to the urban population. [20] We think that it is very important to analyse the enterprise in an unbiased manner in order to get an understanding of the enterprise that is as close to the reality as possible.

One of the factors of a successful implementation in the theoretical framework is the trust between the people who have ordered the system and the people who will implement it [5]. In our case there already was a working cooperation between WM-data and the OAG because of the partly, but successful, implemented Time Recording System. The successful implementation of the Time Recording System will make it easier to implement the Registry System.

Another important factor in a successful implementation is the technical factor of designing a non-complicated system [5]. The theoretical framework asserts that the IT structure in the country will be more stabile if the system can be maintained by people from the country itself (ibid). The country wide strategy between Sweden and Namibia has, as one of the goals, to build up competent organisations which can work without external help in the future [20]. In the design of the Registry System we have tried to take this under consideration and consciously chosen to make a slim system without misleading extra functions. The Registry System will also be able to be used in the OAG's present technical environment and this will, together with the fact that the Registry System is slim, facilitate the maintenance of the system. The technicians in Namibia already have some of the needed skills and the data system analyst at the OAG can with some extra training manage the maintenance of the Registry System.

Because of the country wide strategy, that the Swedish Government formed together with Namibia, the cooperation between the RRV and the OAG has resulted in the OAG's functional organisation. One of the goals was to supply the OAG's needs to computerise certain routines. [20] The theoretical framework says that the state of the enterprise's existing technological infrastructure is important for successful IT implementation [5]. The process to computerise certain routines at the OAG have been in progress for a while. According to the theoretical framework, the OAG has two NT servers and most of the employees have PCs. The PCs are equipped with MS Office and Internet Explorer and the OAG has ten licenses for SQL 6.5 and one license for MS Access 97 [6][17]. The Registry System is designed to suit that computer environment.

Our design of the Registry System is not based on an existing standard solution. The Registry System is designed after the OAG's terminology and their organisation in the registry. The theoretical framework claims that too much standardisation makes the system rigid, and it may not adjust to the uneven state of technological development in different countries [5].

7 Conclusions

Here we present our conclusions that we have drawn on the basis of our results and analysis.

7.1 Conclusions from the Registry System Design

- Our new Registry System gives the registry more possibilities to keep track of loans and to retrieve the documents that are on loan to the registry.
- The new Registry System will make it easier to search for documents, volumes and files because you don't have to know the vast filing system to be able to search.
- The Registry System is slim and it has few extra features, this makes the system easy to understand and maintain.
- The Registry System is feasible to meet the users expectations because our design fulfils the requirements in the feasibility study.
- The main risk factor for our system lies in the fact that we haven't been able to have so much interactively work with the users at OAG.
- We have fulfilled the assigners requirements.

7.2 Conclusions from a Design Process in Namibia a Developing Country

- The developing country's technical environment can be different from our western conditions. The Physical Connection through Internet for e-mail communication might fail. This can delay the project.
- It's important to take the technological infrastructure under consideration and adjust the design to the enterprises existing computer equipment. Our design of the Registry System is designed on the basis of these conditions.
- The organisational culture at the OAG was different from the western organisational culture we were used to. This made it harder for us as designers from the west to understand the enterprise in depth.
- It's important that the developing country will not be dependent of foreign expertise when maintaining the computerised system. We have considered this during the design and the system is therefore slim with basic features.

8 Discussion

According to one of *Connolly's* success factors [3], it is important to work interactively with the workers as much as possible (ibid). In the design of the Registry System we have only communicated with one of the future users of the system and this communication has been by e-mail. In the beginning we thought that we also should be in contact with the data system analyst at the OAG, but our e-mails to her were not answered. It took time to communicate with the registry clerk because some of our e-mails weren't answered. During our design we got answers to about fifty percent of our e-mails.

We may have understood the OAG's organisation wrong and designed the Registry System from the wrong conclusions. These factors may cause the Registry System to be a system that the users do not understand and do not want to use. We think however that the risk that the system not will satisfy the users needs is relatively small. The reason for this is that our design is based on a thorough analysis of OAG's organisation and registry routines, the answered e-mails from the registry clerk and the study of the previous and successful implementation of the Time Recording System [25]. We have also continuously checked the design with our assigners [24], WM-data, and they have helped us in the design with technical supervision.

Before we began with the design of the Registry System we thought that we would save a lot of time by not involving the users too much in the design process. During the design we became aware that it was very time consuming trying to figure out how the registry routines worked without the users participation and without actually being on site. If we had designed the system in Namibia we are quite sure that we also would have programmed the system during the time it now took to do the design.

It also took time for us to change our understanding of the registry routines after our first understanding. We knew that there was something wrong with our first solution. It was for example hard to understand how it worked with the numeration of the three level system of files, volumes and documents. We felt that we could not continue without more information. It was the registry clerk who e-mailed more information and it solved many ambiguous matters that had come up after our reading of the feasibility study.

The feasibility study, carried out two years ago, (ibid), also contributed to the difficulties we had during the design process. In the beginning we thought that the people that had carried out the feasibility study on site would answer our questions about the registry routines. We think that it had been easier if this had been possible. It was unfortunately and understandably hard for them to remember the details and they couldn't help us even though they wanted to. It was after this that we began to communicate with the staff at the OAG.

The registry clerk at the OAG that we had contact with was very nice and willing to help us, but it is important to know that she helped us of her own free will. She did not get any compensation and the help that we got from her was invaluable. She is also going to be the one who will interact most frequently with the system, so it was lucky for us that she wanted to help. It would have been great if we had had contact with the data system analyst also, because she will maintain the system. This would have made it easier for the people who will implement the Registry System.

It is important that the people who will implement the Registry System check the design with the users and make necessary changes before they implement it. We have followed the methodology through every step except the reviews with the users and therefore we think that this must be done before implementation in order to make the Registry System as good as possible.

The economic situation directed our choice of methodology, thus not involve the users as much as we would have liked. If there had been a budget for this project, it had been appropriate that we had done the design in Namibia, and used prototyping as a methodology in the design. We think that it would have been easier to design a system with prototyping, but we do not know if the design would be better than the design that we have done. We do not know if the design is good or bad until the Registry System is implemented and evaluated. The prototyping methodology on site would have solved many of the ambiguously matters that now occurred in our design. We had also to contend with being from a western country with our western thinking This made it harder for us to understand certain routines at the registry because it was in a developing country with different organisational forms and terminology than we are used to. Lastly we communicated with the users by e-mail. This, together with the fact that the communication was in English, made it more difficult to communicate with the users than if we had communicated face to face.

We have suggestions for further research in the field:

- To implement and evaluate the Registry System.
- To develop a method for distance system design.

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A Appendix Mail

A.1 Dear Loretta Smith!

Your name was given to us by Jan Säll at WM-data in Sweden. We're two students from Karlstad University and we're working on our Bachelor's project Jan is our tutor.
The Bachelor's project is to design a registry database for OAG in Namibia. The feasibility study " Report on Development of Databases, Use of Internet and Computerised Library and Registry – Phase 1" made by Eva Eriksson and Malou Norrman (at Swedish National Audit Office) will serve as the basis of our design. We have some questions about how your registry functions today. We hope that you can help us by answering the questions that follows bellow.

1. Is it only the staff on OAG that can lend document from the registry?
2. We got a document from Malou (sending a copy of it in the attached file, "Filing System example") which illustrated how the registry documents gets their unique numbers. We doesn't understand how the procedure works! Is this document an example of how you number the registry documents?
3. 3/08/10/2/2 what does the numbers stand for? This question is crucial for our project
4. Is the folionumber that belongs to each document unique or is it only unique in each file?

That is all for now. We would appreciate you please could give us a quick answer. We hope that you will be able to help us and we look forward to hearing from you.

Yours sincerely
Annicka Olsson and Maria Lindberg (maria.stolt@telia.com)

A.2 Dear Maria

Dear Maria

Warm greetings from our "Sunshine" country.

It is a big pleasure to answer your questions.

1. Yes, it is only the staff of OAG that can lend files (not documents)- NB. All documents must be placed on a file and cannot be removed from that specific file. If you want to work on a document you must take the file and not only remove the document or one can make a copy of the original document.

2. The document is an example of how we are numbering the specific files(not documents) . We deal with our office's own correspondence,

Auditing Section, different Ministries, Regional Councils, Municipalities and Boards.

Our system starts from 1- 6 eg.

1- Series is For Office administration (dealing with the office's correspondence) Under this we will get different issues and we will number it according to that specific subject like:

1/1 - Legislation (OAG's Act and Policies)
1/2 - Organisation and Control (Office instructions and procedures)
1/3 - Finance (Budget control of the office and Financial Matters)
1/4 - Accommodation (Official Housing and Parking Facilities)
1/5 - Transport and Journeys (Official Vehicles and Official Trips)

2- Series - Auditing

2/1 - Supreme Auditing
2/2 - Select Committees on Public Accounts
2/3 - Comments
2/4 - Press Releases and Related Comments
2/5 - Legal Advice and Opinions
2/6 - Co-Operation Project - SIDA/RRV
2/7 - Performance Audit Projects

3- Series - Ministries

3/01 - Office of the President
3/02 - Office of the Auditor General
3/03 - Prime Minister Office
3/04 - Ministry of Civic Affairs
3/05 - Ministry of Police
3/06 - Ministry of Foreign Affairs
3/07 - Ministry of Defence
3/08 - Ministry of Finance

4- Series -Regional Councils

5- Series - Municipalities

6- Series - Councils and Boards.

I really hope this can help you in any matter. If you have any further questions don't hesitate to contact me.

Loretta Smith

A.3 Dear Loretta Smith!

From: Annicka Olsson

To: lsmith@oag.gov.na

Subject: one more Q

Date: Fri, 15 Nov 2002 13:55

We have penetrated your e-mail further and we have realized that our former solution was incorrect. Now we have a clearer picture, but we still have some questions that we hope you can answer.

Last week we wrote you an e-mail, but it is sufficient if you answer only this e-mail's questions.

1. Have you changed the registry routines since 25 November 2000 when Malou Norrman and Eva Eriksson's did their feasibility study? If that is the case how does it work now?

You wrote:

> All documents must be placed on a file and can not be removed from that specific file. If you want to work on a document you must take the file and not only remove the document or one can make a copy of the original document.

We want to know:

2. Does this mean that you can't lend a single volume in a file, do you have to lend the hole file?
3. Can you loan any smaller object than a volume?
4. Does a single document have a unique number?
5. The feasibility study mentions "folio number" what is that?

We would appreciate if you are able to answer this e-mail as fast as you can.

Sparkling greetings from a snowy Sweden,
Yours sincerely Annicka and Maria

A.4 Dear Annicka & Maria

From: Loretta Smith [mailto:lsmith@oag.gov.na]

Sent: den 15 November 2002 16:10

To: Olsson Annicka

Subject: Re: one more Q

Very warm greetings from me here in Namibia. I wish I can send you some of our sunshine and one of my greatest wishes is to be in Sweden when it snow. I was there last year June but it was totally a different picture. I am really in love with your country.

Back to work. It is a pleasure to answer the following questions.

1. No it is still the same since Malou and Eva did their feasibility study.
2. No. You cannot lend a single document in a file. You have to lend the whole file and you cannot lend a smaller object than a volume.
3. A single document does not have a unique number. You start a volume with documents that you receive. If you receive a letter or document you will start number it from 1-3. It depends how thick the document is. Any other documents you receive in the future you just go on numbering each page.
4. So for each document you put on a file(Volume) will get a folio number in the top right corner of each page.

I hope this can help you in any way.

If it is possible please send my greetings to Malou and her husband, Eva and her family, Jan and Gunilla.

Stay well Annicka and Maria. I hope I can meet you one day.

Warm Greetings

Loretta Smith

A.5 Svar på öppen fråga från oss om RRVs registrerings rutiner.

Malou Norrman 2002-12-13

En kort beskrivning över hanteringen (rutinerna) i RRVs registratur

Postöppning

Varje morgon öppnar registrator all post som är adresserad till Riksrevisionsverket d v s där Riksrevisionsverket står **först** på försändelsen (oavsett om det sedan finns ett namn eller funktion angiven).
Post där namn/funktion står före Riksrevisionsverket skickas direkt upp till denna men handläggare/chef är då skyldig att ta kontakt med registraturen om innehållet rör ärenden som ska registreras.

Registrering/diariebeteckning

Vid registrering i registraturen skiljer man mellan inkommande, utgående och interna ärenden.
RRV tillämpar s k ärenderegistrering d v s ett ärende hålls samman under samma nummer från det att det har upprättats till det är avslutat. I ärendet registreras sedan allt som händer (se också nedan projekt). I praktiken kan alltså ett ärende löpa över flera år men kan också avslutas direkt när det upprättas (t ex skicka i väg ett brev i ett nytt ärende)

Vid registrering anges först ett s k **dossienr** som följer en upprättad och av Riksarkivet godkänd plan. Lägger man till typer av ärenden i denna plan måste man anmäla detta till Riksarkivet. Exempel på dossier är t ex personalärenden, ansökan till tjänst, regeringsuppdrag,
Remisser, löpande ärenden (årlig revision), löpande ärenden (effektivitetsrevision), kontakter med Revisionsrätten (Luxemburg), Europeiska kommissionen etc.
Efter dossienr följer **årtal** och därefter ett **löpnummer (diarienummer)** för året.

Ex på **diariebeteckning:** 30-2001-0432
30 = löpande ärenden, årlig revision
2001= året
0432= löpnummer (diarienummer)

Vid registrering av handlingar för den årliga revisionen innebär ett ärende alla handlingar under ett revisionsår (som ej är identiskt med kalenderår) och per revisionsobjekt (myndighet eller motsvarande). Ärendet avslutas när årets revision är klar och godkänd.
De flesta årliga revisioner arkiveras endast ca 5 år. Ett 15-tal s k typmyndigheters revisioner sparas för evig tid. (annars skulle man behöva enorma arkivutrymmen)

För effektivitetsrevisionen använder man sig av s k projektdiarieföring för granskningarna. Då projektet startas och projektplan är klar sker den första registreringen i registraturen och projektet/ärendet får en diariebetecknng som sedan följer ärendet/projektet hela tiden tills det avslutas (kan ta från några månader upp till ett eller flera år). Under projektets gång registreras endast viktigare in och utgående händelser i diariet. Projektet/projektledaren för en s k projektdagbok med alla detaljerade händelser under arbetets gång. Denna dagbok är ett komplement till diariet och arkivläggs sedan tillsammans med ärendet.

Betr arkivering kan jag också tillägga att så länge en myndighet lever och är aktiv är det upp till myndigheten att avgöra när man vill leverera till Riksarkivet. Varje myndighet måste numera nämligen själv betala för arkivutrymme där. Då en myndighet upphör måste givetvis leverans till Riksarkivet ske.

Avtal

Avtal diarieförs för sig och hålls samman som avtal för att man snabbare och lättare ska kunna hitta dem.

Till sist lite om det unika för Sverige nämligen:

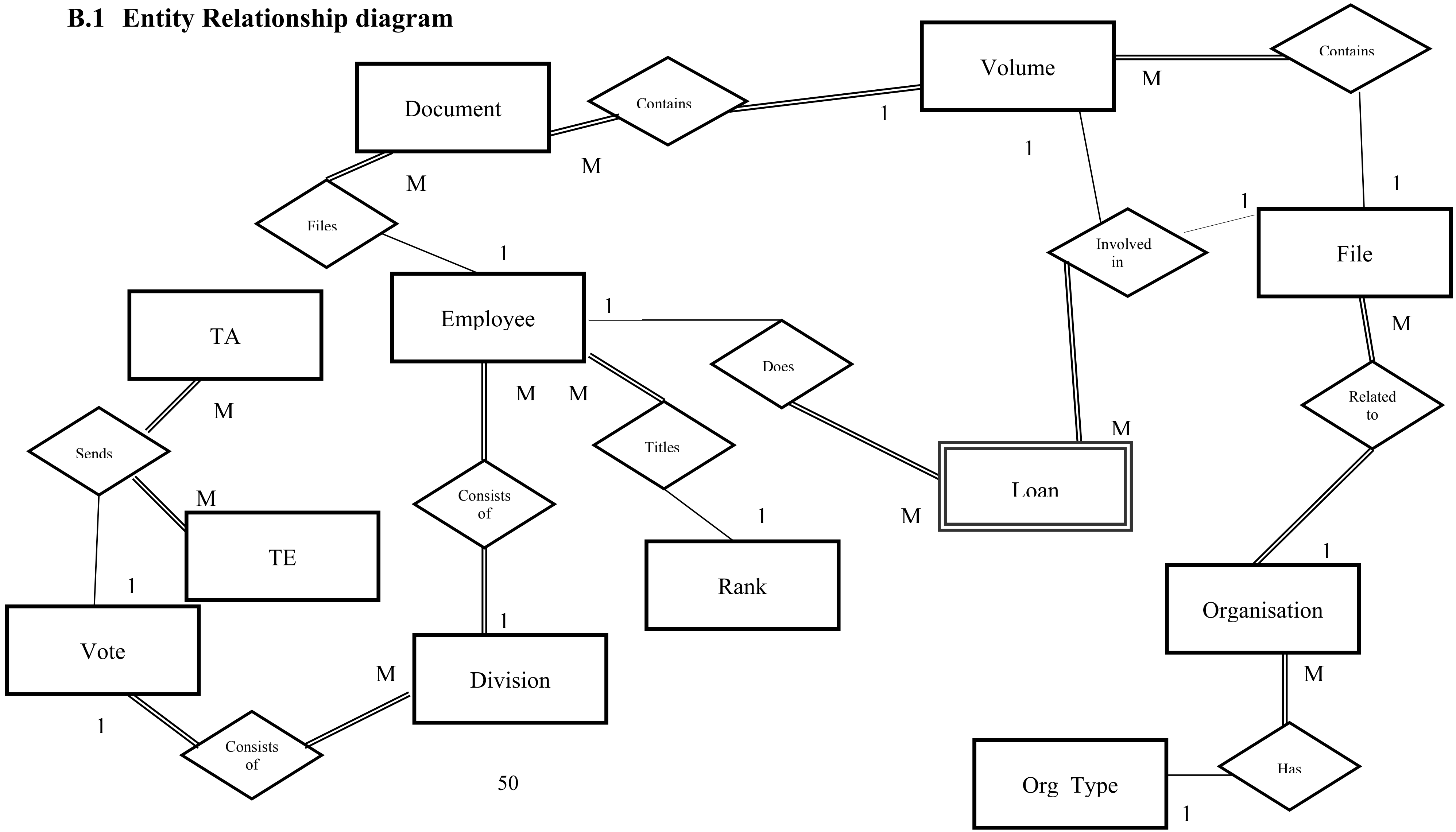
Offentlighetsprincipen

Offentlighetsprincipen innebär att alla allmänna handlingar (med detta avses handlingar som har inkommit till, upprättats vid eller är förvarade vid en myndighet) kan vem som helst begära att få läsa och ta del av om de inte av något skäl är sekretessbelagda. Sekretessbeläggning kan endast ske med stöd av paragraf i sekretesslagen.

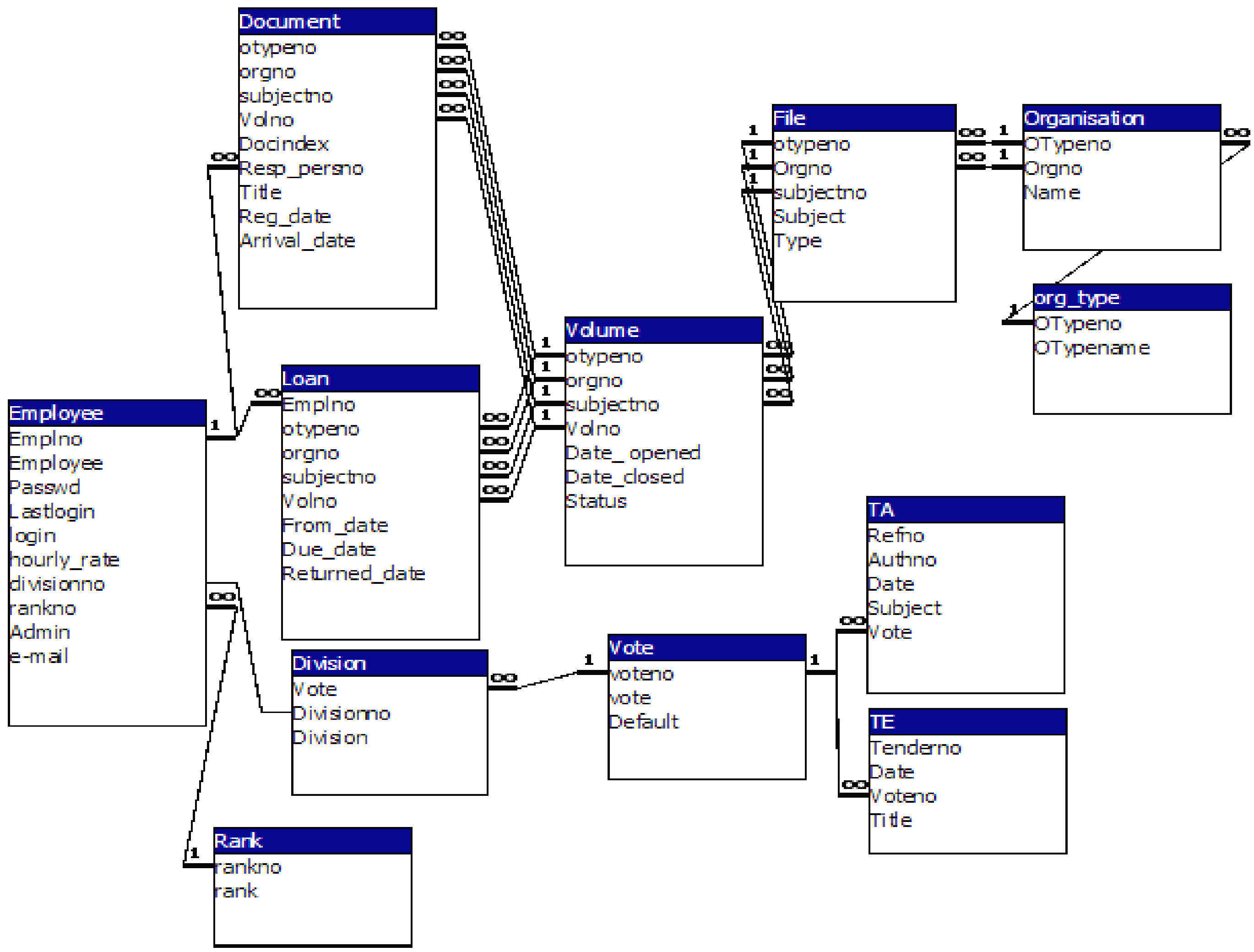
Till allra sist …
Allmänna handlingar behöver inte bara komma den vanliga postvägen. Numera räknas även dit det som kommer via fax, e-post, telefon etc.

B Appendix Database Design

B.1 Entity Relationship diagram



B.2 Relationships in MS Access



B.3 Entity Types for the Registry System

Entity name	*Entity name In Swedish*	*Description*	*Aliases*	*Occurrence*
Employee	Anställd	All staff employed by OAG		Each member of staff works at OAG
Division	Avdelning	The divisions at a vote i.e. OAG		Employees works at a division
Vote	Departement	Contains details about the Ministries	Ministry	Ministries are responsible for Treasury approvals and Tender exemptions. Ministry i.e. OAG, has divisions.
Rank	Rang	The ranks an employee can have at OAG		An employed has a rank
Loan	Lån	Contains details about loans of volumes and files in the registry		Employees at OAG loan volumes and files from the registry.
File	Fil tabell	Consists of the subject type and subject that a File contain.		A File contains a subject type and a subject.
Org_type	Typ av Organisation	Contains the different types of organisations that OAG correspondences with.		An organisation has an organisation type
Organisation	Organisation	Contains details of the correspondence organisations		A file belongs to an organisation
Volume	volym	Contains details about the volumes		A file consists of volumes
Document	Dokument	The documents which are filed in OAG's Registry System.		Organisations send in documents which are filed in the registry in volumes
TA	Regleringsbrev	The Treasury approvals which are filed in the registry	Treasury approval	Votes sends in Treasury approvals
TE	Upphandling	The Tender exemptions which are filed in the registry	Tender exemption	Votes send in Tender exemptions

B.4 Attributes Associated with Entities

Entity type	*Names of Attribute*
Employee	Emplno Employee Passwd Lastlogin login hourly_rate divisionno rankno Admin email
Division	Vote Divisionno Division
Vote	Voteno Vote Default
Rank	rankno Rank
Loan	Emplno otypeno orgno subjectno Volno From_date Due_date Returned_date
File	otypeno Orgno Subjectno Subject Type
Org_Type	Otypeno Otypename

Entity type	*Names of Attribute*
Organisation	Otypeno Orgno Name
Volume	otypeno orgno subjectno Volno Date_opened Date_closed Status
Document	otypeno orgno subjectno Volno Docindex Resppersonno Title Regdate Arrdate
TA	Refno Authno Date Subject Vote
TE	Tenderno Date Voteno Title

B.5 Entity and Attributes in the OAG's Registry System

Entity	Names of attributes	Names of attributes *In Swedish*	Description	Data type *And length*	*Constraint*	*Alias*	*Null value*
Employee	Emplno	Anställningsnummer	Uniquely identifies employee	Char 5	Primary key		No
	Employee	Anställd	Employee name	Char 35			No
	Passwd	Lösenord	Password for access to the system	Char 15			No
	Lastlogin	Senaste_inloggning	Date for last login	Char 10			No
	Login	Användarnamn	Username	Char 25			No
	hourly_rate	timkostnad	The cost per hour	Char 12			No
	divisionno	Avdelningsnummer	Division number at vote	Char 2			No
	rankno	Rangnummer	Rang number for employee	Char 2			No
	Admin	Administratör	The administrator	Char 1			No
	e-mail	e-mail	Employees e-mail	Char 50			Yes
Division	Divisionno	Avdelningsnummer	Number that uniquely identifies division	Char 2	Primary key		No
	Division	Avdelning	Name of department	Char 2			No
	Vote	Departement	Vote number of Ministry that division belongs to	Char 25	Primary key	Voteno	No
Vote	Voteno	Departementsnummer	Number that uniquely identifies vote	Char 2	Primary key	Ministryno	No
	Vote	Departement	Name that uniquely identifies vote	Char 50	Alternate key	Ministry	No
	default	default		Char 1			No
Rank	rankno	Rangnummer	Uniquely identifies rank	Char 2	Primary key		No
	rank	rang	Employees rang	Char 50	Alternate key		No
Loan	Emplno	Anställningsnummer	Uniquely identifies employee	Char 5	Primary key		No
	otypeno	Organisationstypsnr	Uniquely identifies the type of org.	Char 2	Primary key		No
	orgno	Organisationsnummer	The organisations number	Char 3	Primary key		No
	subjectno	Ämnesnummer	The number of the subject	Char 30	Primary key		No
	Volno	Volymnummer	The number of the volume	Char 4	Primary key		No
	From_date	Från datum	Date when document is borrowed	Char 11			No
	Due_date	Till datum	Date when document shall be returned	Char 11			No
	Returned_date	Återlämningsdatum	Date when document is returned	Char 11			Yes

Entity	Names of attributes	Names of attributes *In Swedish*	Description	Data type *And length*	*Constraint*	*Alias*	*Null value*
File	otypeno	Organisationstypnr	Uniquely identifies the type of org.	Char 2	Primary key		No
	Orgno	Organisationsnummer	The organisations number	Char 3	Primary key		No
	Subjectno	Ämnesnummer	The number of the subject	Char 30	Primary key		No
	Subject	Ämne	The subject of the file	Char 100			No
	Type	Ämnestyp	The type of the subject	Char 50			No
Org_type	Otypeno	Organisationstypnr	Uniquely identifies the type of org.	Char 2	Primary key		
	Otypename	Organisationtypsnamn	The name of the organisation type	Char 50			
Organisation	Otypeno	Organisationstypsnr	Uniquely identifies the type of org.	Char 2	Primary key		No
	Orgno	Organisationsnummer	The organisations number	Char 3	Primary key		No
	Name	Namn	The name of the organisation	Char 50			No
Volume	otypeno	Organisationstypsnr	Uniquely identifies the type of org.	Char 2	Primary key		No
	orgno	Organisationsnummer	The organisations number	Char 3	Primary key		No
	subjectno	Ämnesnummer	The number of the subject	Char 30	Primary key		No
	Volno	Volymnummer	The number of the volume	Char 4	Primary key		No
	Date_opened	Öppningsdatum	The date of opening the volume	Char 11			No
	Date_closed	Stängningsdatum	The date of closing the volume	Char 11			Yes
	Status	status	Indicates if a volume is on loan with In or Out	Char 1			No
Document	otypeno	Organisationstypsnr	Uniquely identifies the type of org.	Char 2	Primary key		No
	orgno	Organisationsnummer	The organisations number	Char 3	Primary key		No
	subjectno	Ämnesnummer	The number of the subject	Char 30	Primary key		No
	Volno	Volymnummer	The number of the volume	Char 4	Primary key		No
	Docindex	Löpnummer för dok	The number of the document	Char 4	Primary key		No
	Resppersonno	Ansvarspersonsnr	The person who is responsible for doc	Char 5	Foreign key	Emplno	Yes
	Title	Titel	Title of document	Char 255			No
	Regdate	Registrerings datum	Date when document was filed	Char 11			No
	Arrdate	Ankomstdatum	Date of arrival to registry clerk at OAG	Char 11			No

Entity	Names of attributes	Names of attributes *In Swedish*	Description	Data type *And length*	*Constraint*	*Alias*	*Null value*
TA	Refno	Referensnummer	Index to Treasury approval	Char 30	Primary key		No
	Authno	??	Index to Treasury approval	Char 6	Primary key		No
	Date	datum	The date stamped on the Treasury app.	Char 11			No
	Subject	Ämne	The subject of the Treasury approval	Char 50			No
	Vote	Departementsnr	The vote that the Treasury app concerns	Char 2		Voteno	No
TE	Tenderno	Anbudsnr	Index for Tender exemptions	Char 3	Primary key		No
	Date	Datum	The date stamped on the Tender Exemp.	Char 11			No
	Voteno	Departementsnr	The vote that the Tender Exemp. concern	Char 2			No
	Title	titel	The title of the Tender Exemption	Char 50			No

B.6 The format of the attributes

Entity	Names of attributes	Data type *And length In MS Access*	In data mask *in VB*
Employee	Emplno	Char 5	Int
	Employee	Char 35	Char
	Passwd	Char 15	Char
	Lastlogin	Char 10	Date
	Login	Char 25	Char
	hourly_rate	Char 12	Int
	divisionno	Char 2	Int
	rankno	Char 2	Char
	Admin	Char 1	Char
	e-mail	Char 50	Char
Division	Divisionno	Char 2	Int
	Division	Char 2	Char
	Vote	Char 25	Int
Vote	Voteno	Char 2	Int
	Vote	Char 50	Char
	default	Char 1	Char
Rank	rankno	Char 2	Char
	rank	Char 50	Char
Loan	Emplno	Char 5	Int
	otypeno	Char 2	Int
	orgno	Char 3	Int
	subjectno	Char 30	Int
	Volno	Char 4	Int
	From_date	Char 11	Date
	Due_date	Char 11	Date
	Returned_date	Char 11	Date
File	otypeno	Char 2	Int
	Orgno	Char 3	Int
	Subjectno	Char 30	Int
	Subject	Char 100	Char
	Type	Char 50	Char
Org_type	Otypeno	Char 2	Int
	Otypename	Char 50	Char
Organisation	Otypeno	Char 2	Int
	Orgno	Char 3	Int
	Name	Char 50	Char
Volume	otypeno	Char 2	Int
	orgno	Char 3	Int
	subjectno	Char 30	Int
	Volno	Char 4	Int
	Date_opened	Char 11	Date
	Date_closed	Char 11	Date
	Status	Char 1	Char

Document	otypeno orgno subjectno Volno Docindex Resppersonno Title Regdate Arrdate	Char 2 Char 3 Char 30 Char 4 Char 4 Char 5 Char 255 Char 11 Char 11	Int Int Int Int Int Int Char Date Date
TA	Refno Authno Date Subject Vote	Char 30 Char 6 Char 11 Char 50 Char 2	Int Char Date Char Int
TE	Tenderno Date Voteno Title	Char 3 Char 11 Char 2 Char 50	Int Date Int Char

B.7 Document Relationship Types for the OAG´s Registry Database System

Entity type	Relationship type	Entity type	Cardinality ratio	**Participation***
Vote	*Sends* *Sends* *Consists_of*	TA TE Division	1:M 1:M 1:M	P:T P:T T:T
Division	*Consists_of*	Employee	1:M	T:T
Employee	*Does* *Files*	Loan Document	1:M 1:M	P:T P:T
Rank	*Titles*	Employee	1:M	P:T
File	*Involved_In* *Contains*	Loan Volume	1:M 1:M	P:T P:T
Volume	*Involved_In* *Contains*	Loan Document	1:M 1:M	P:T T:T
Organisation	*Related_to*	File	1:M	T:T
Org_Type	*Has*	Organisation	1:M	P:T

*P represents partial presentation and T represents total participation

B.8 Tables in the Registry System's Database

Employee : Tabell

Emplno	Employee	Passwd	Lastlogin	login	hourly_rate	divisionno	rankno	Admin	e-mail
001	Esegiel Makari	12345	06-27-2001	makarie		02	AA		
002	Liezl van Schalkwyk	12345		ilies		02	DD	N	
003	Ridley van Wyk	54321	27-07-2001	wykr	100	01	CA	N	
004	Notty Kutyowa	12345		nots		03	A	N	
005	Kevi Xarages	12345				02	AA		
006	Walther Bart	12345		walb		01	DD	N	
009	erlandsson bo	bo	25-10-2002	bo	100	01	AA	Y	
900	dfruju	jjjj		jjjj	2	01	A	N	

Loan : Tabell

Emplno	otypeno	orgno	subjectno	Volno	From_date	Due_date	Returned_date
001	3	08	11/3	1	05 dec 2002	12 dec 2002	
001	3	08	11/3	2	05 dec 2002	12 dec 2002	
001	3	08	11/3	3	05 dec 2002	12 dec 2002	
002	3	08	10/10	1	01 nov 2002	15 nov 2002	

Volume : Tabell

otypeno	orgno	subjectno	Volno	Date_opened	Date_closed	Status
3	08	10/10	1	01 nov 2002	07 nov 2002	o
3	08	10/10	2	07 nov 2002		i
3	08	11/3	1	04 nov 2002	06 nov 2002	o
3	08	11/3	2	06 nov 2002	01 dec 2002	o
3	08	11/3	3	01 dec 2002		o

File : Tabell

otypeno	Orgno	subjectno	Subject	Type
3	08	10/10	medical aid scheme	medical aid scheme
3	08	11/3	tax and duties	revenue

Document : Tabell

otypeno	orgno	subjectno	Volno	Docindex	Resp_persno	Title	Reg_date	Arrival_date
3	08	10/10	1	1	001	doctors guide	01 nov 2002	31 oct 2002
3	08	10/10	2	1	003	ghghgh	07 nov 2002	27 oct 2002
3	08	11/3	1	1		tdtd	04 nov 2002	01 nov 2002
3	08	11/3	1	2	003	tditdi	04 nov 2002	04 nov 2002
3	08	11/3	2	1		ojojoj	07 nov 2002	05 nov 2002
3	08	11/3	3	1		yuyuy	04 dec 2002	03 dec 2002

Rank : Tabell

rankno	rank
A	Auditor
AA	Assistent auditor
C	Clerk
CA	Chief Auditor
D	Director
DD	Deputy Director

Vote : Tabell

voteno	vote	Default
01	Ministry of environment	
02	Office of the president	
26	OAEG	Y

Org_type : Tabell

OTypeno	OTypename
3	ministries

Organisation : Tabell

OTypeno	Orgno	Name
3	08	ministry of Finance

TA : Tabell

Refno	Authno	Date	Subject	Vote
220/11/1/01	664 sc	15 sep 2000	Transfer free of	02

TE : Tabell

Tenderno	Date	Voteno	Title
001	17 mar 2000	01	Request for ten

Division : Tabell

Vote	Divisionno	Division
26	01	Division1
26	02	Division22
26	03	Division3
26	04	Division4
26	05	Division 5

C Appendix Basic Data

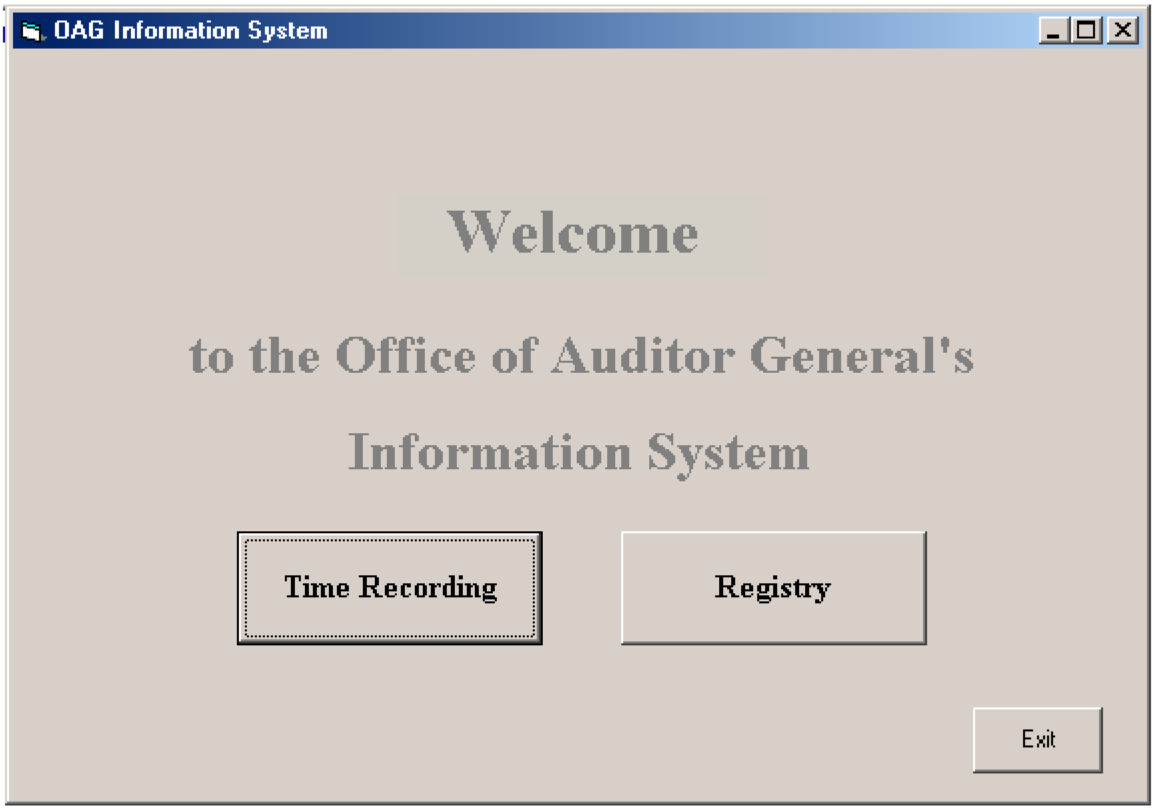
C.1 Filing System Example

3. MINISTRIES

NUMBER	SUBJECT	DISPOSAL GUIDELINES
FINANCE		
3/08/1	Legislation, regulation and directives	
3/08/2	Treasury and Tender Board approvals and Cabinet resolutions	
3/08/3	Planning, programming and progress	
3/08/4	Annual report compilation of	
3/08/5	Audit queries	
3/08/5/1	Formal Queries	
3/08/5/2	Informal Queries	
3/08/6	Audit opinions	
3/08/7	Irregularities, losses and deficiencies	
3/08/8	Inspections	
3/08/9	Controls, bookkeeping, records and systems	
3/08/10	Special Accounts	
3/08/10/1	Operating and trade accounts	
3/08/10/2	Fund accounts	
3/08/10/2/1	Motor Vehicle accident Fund	
3/08/10/2/2	Amortization Fund	
3/08/10/2/3	Assistance Fund	
3/08/10/3	Investments	
3/08/10/4	Loans received	
3/08/10/5	Revenue Fund, Collection returns	
3/08/10/6	Housing Loan scheme for employees	
3/08/10/7	Motor Vehicle financing scheme	
3/08/10/8	Loans granted	
3/08/10/9	Parliamentary Pension Scheme	
3/08/10/10	Medical Aid Scheme	
3/08/11	Revenue	
3/08/11/1	Department revenue, fines and forteitures	
3/08/11/2	Loan recoveries	
3/08/11/3	Tax and duties	
3/08/11/4	Contributions and loans	
3/08/12	Expenditure	
3/08/12/1	Appropriations	
3/08/13	Budget trends	
3/08/14	Personnel/Records	
3/08/15	Appointment of Accounting Officer/Sub-receiver of Revenue	
3/08/16	Notification of Stockpoints and changes	

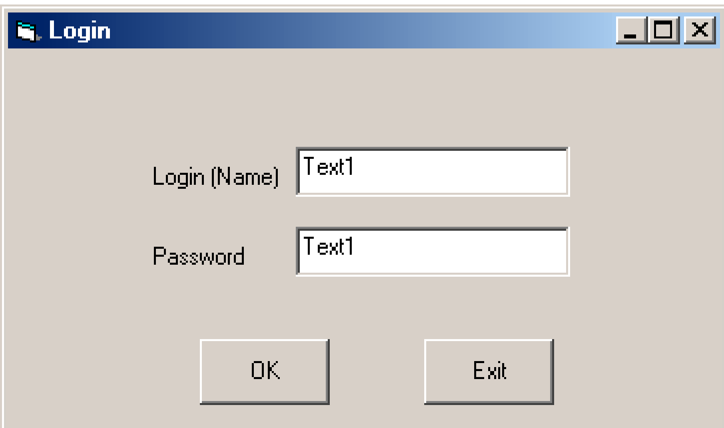
D Appendix Interface

D.1 Choice of System



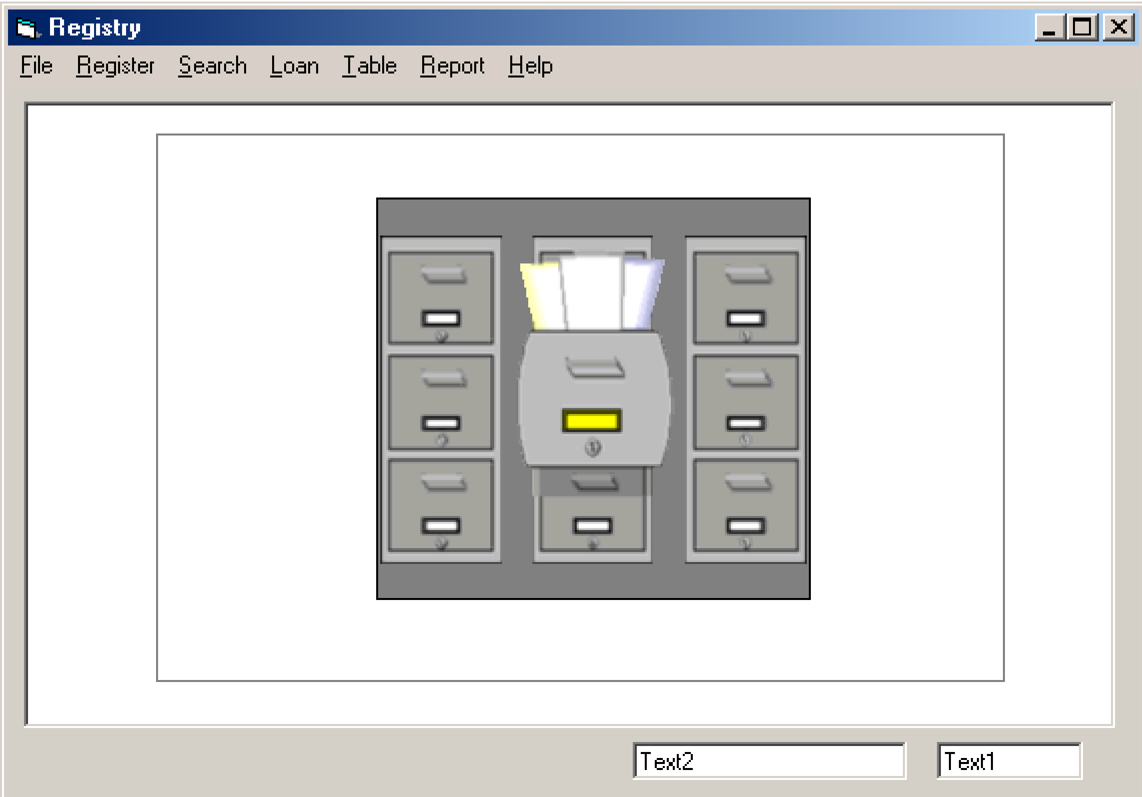
- In this menu you choose the program you want to work with.

D.2 Login for the Registry System



- After chosen the program you want to work with you login with your name and password.

D.3 The Main Menu



- This is the Registry System’s main menu. The text boxes at the bottom of the picture show who uses the program with the users name, text 2, and the date of today, text 1. Wherever the user is in the system the user gets back to the main menu by clicking the exit button in the actual screen picture.

- In the menu you can choose different functions in the program.

File: **Change password:** Has the same design as Time Recordings change password screen picture.
Exit: Exit from the program back to the choice of program.

Register: It is only the registry clerk who will be able to register objects.
Doc: When documents arrive to the registry, the registry clerk can register them in ”register Doc”. The design of the screen picture ”Register Document” is shown in Appendix D.3
Ta: When Treasury approvals arrive to the registry, the registry clerk can register them in ”register Ta”. The design of the screen picture ”Register Treasury approval” is shown Appendix D.4
Te: When Tender exemtions arrive to the registry, the registry clerk can register them in ”register Te”. The design of the screen picture ”Register Tender exemption” is shown in Appendix D.5

Search: Everyone in the staff is able to search for objects.

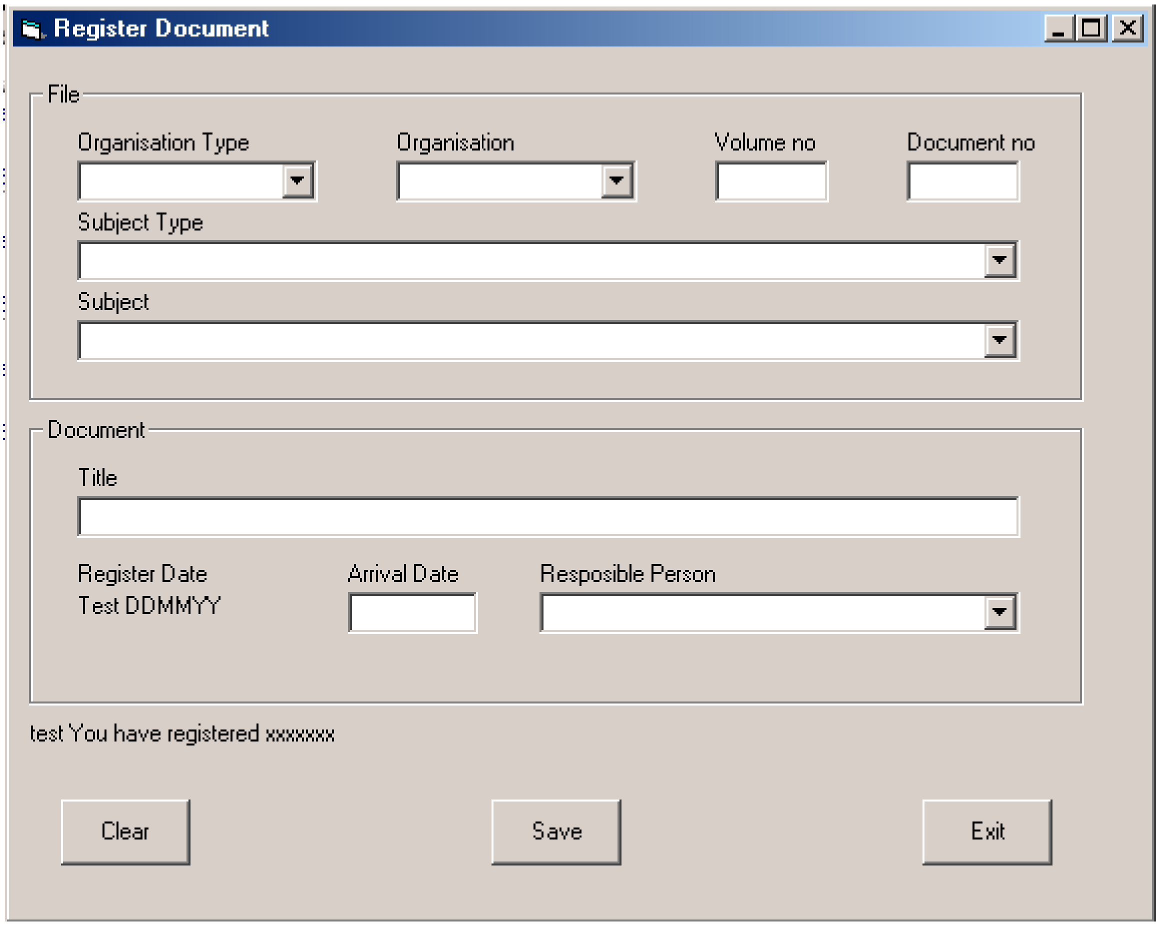
Doc: The staff at the OAG can search for documents and they can do this by chosing ”Search doc”. The design of the screen picture ”Search for Document” is shown in Appendix D.6
Ta: The staff at the OAG can search for Treasury approvals and they can do this by chosing ”Search Ta”. The design of the screen picture ”Search for Treasury approval” is shown in Appendix D.8
Te: The staff at the OAG can search for Tender exemptions and they can do this by chosing ”Search Te”. The design of the screen picture ”Search for Tender exemption” is shown in Appendix D.10

Loan: Everyone in the staff can loan documents, with assistance from the registry clerk, but the Treasury approvals and Tender exemptions are only searchable
Loan: The design of the screen picture ”Loan” is shown in Appendix D.12

Table: It is only the registry clerk who can add or remove objects from the database. Here it is possible to make the necessary changes in the database tables.
Volume: The design of the screen picture ”Volume” is shown in Appendix D.13
Subject: The design of the screen picture ”Subject” is shown in Appendix D.14
Org Type: The design of the screen picture ”Organisation type” is shown in Appendix D.15
Org: The design of the screen picture ”Organisation” is shown in Appendix D.16
Vote: The design of the screen picture ”Vote” is shown in Appendix D.17
Report: The registry clerk can get reports from the system. These are:
Folio number list of a volume and a list of all delayed loans.

Help:
About Registry: Here is information about the program. The design of the screen picture ”About Registry” is shown in Appendix D.18.

D.4 Register a Document



- When a new document is registered, the registry clerk can choose the organisation type number, the organisation number, the subject type and subject in the droplists. She can however fill in any subject type and subject when it is necessary. Volume number and document number can't be filled in by the registry clerk. The volume number and the document number are generated by the system.

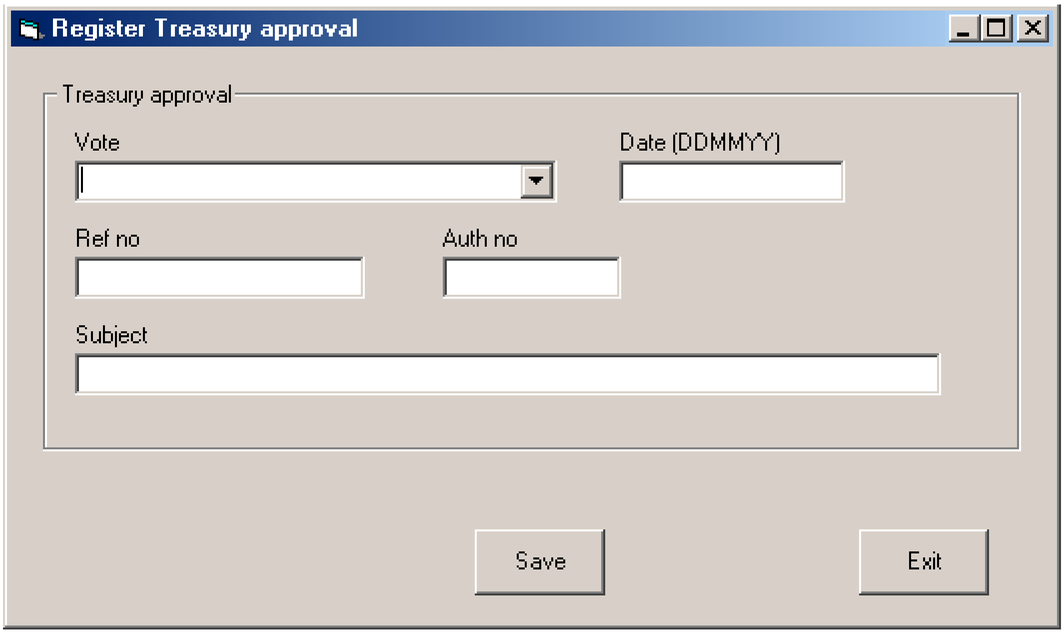
- The registry clerk fills in the document title in the corresponding textbox.

- When the documents arrive to the registry, they are stamped manually with the arrival date. It is not certain that the documents are registered the same day as they arrive to the registry so it is important to separate arrival date and register date.

- When the registry clerk has filled in the textboxes correctly, she clicks on the "save"-button and the document is registered in the database. If the registry clerk wants to change in the textboxes when she already has filled in many of them, she has the possibility to clear the textboxes with the "clear"-button. When the "save"-button has been activated, information of the registered document is displayed in the information field, the grey area that is displayed by the text "Test you have registered xxxx".

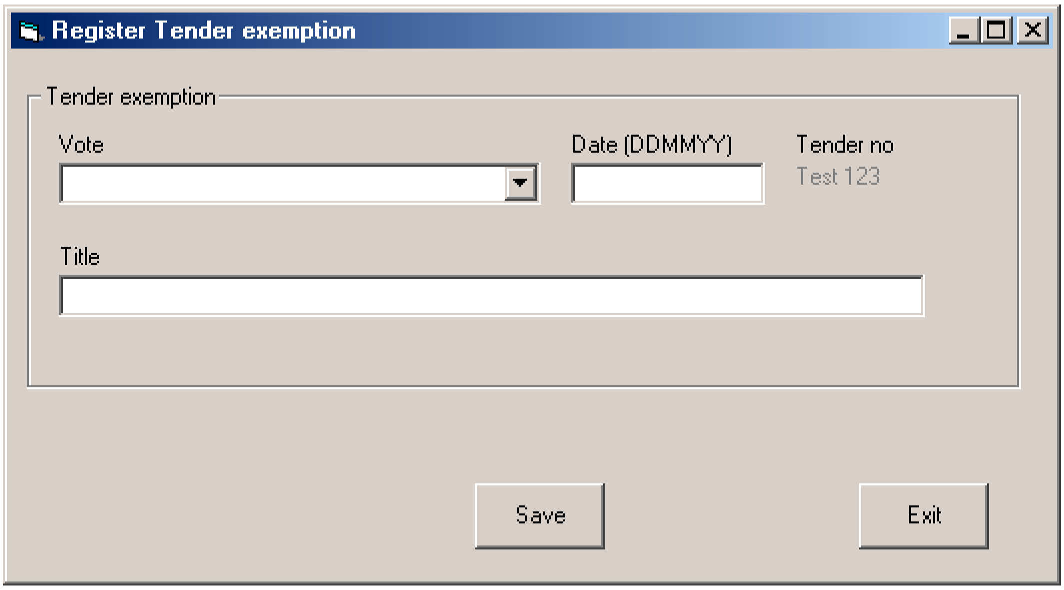
- The registry clerk can not delete a single document from the database, but the system can delete the files from the database when the document has a certain age. For example five years that the RRV in Sweden has as a filing period of the documents.

D.5 Register Treasury Approval



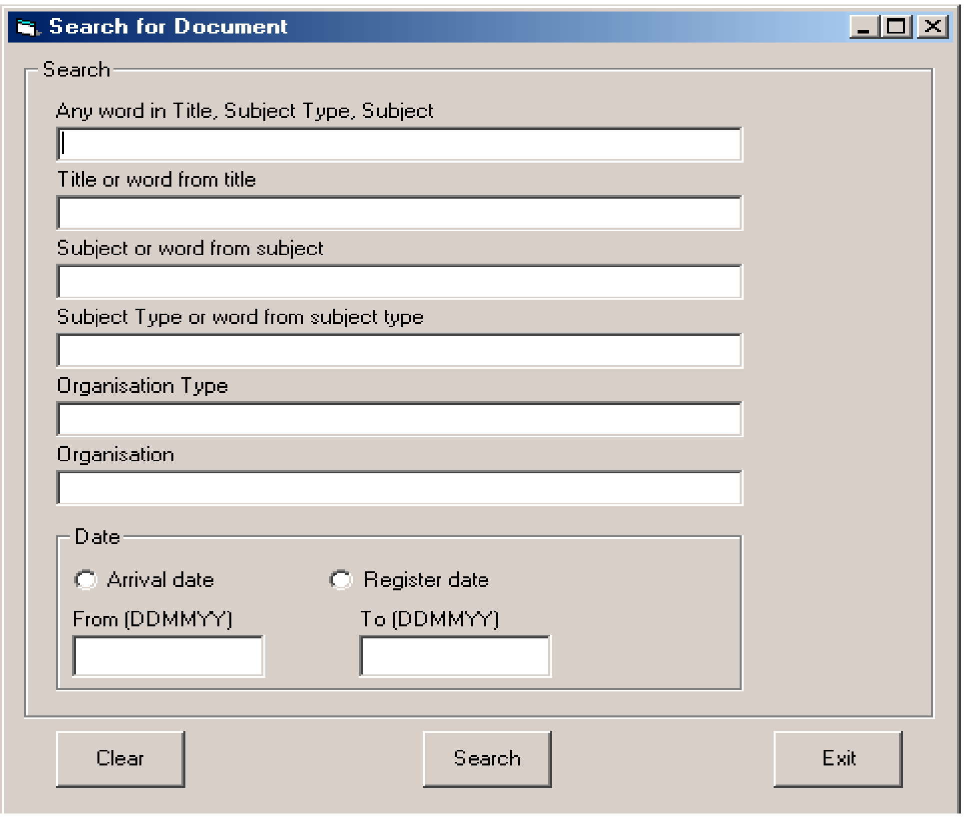
- The registry clerk fills in the information about the treasury approval in the textboxes and then clicks on the ”save”-button. The vote combo box lists the votes that she can choose from. The data about the treasury approvals is saved in the database.

D.6 Register Tender Exemption



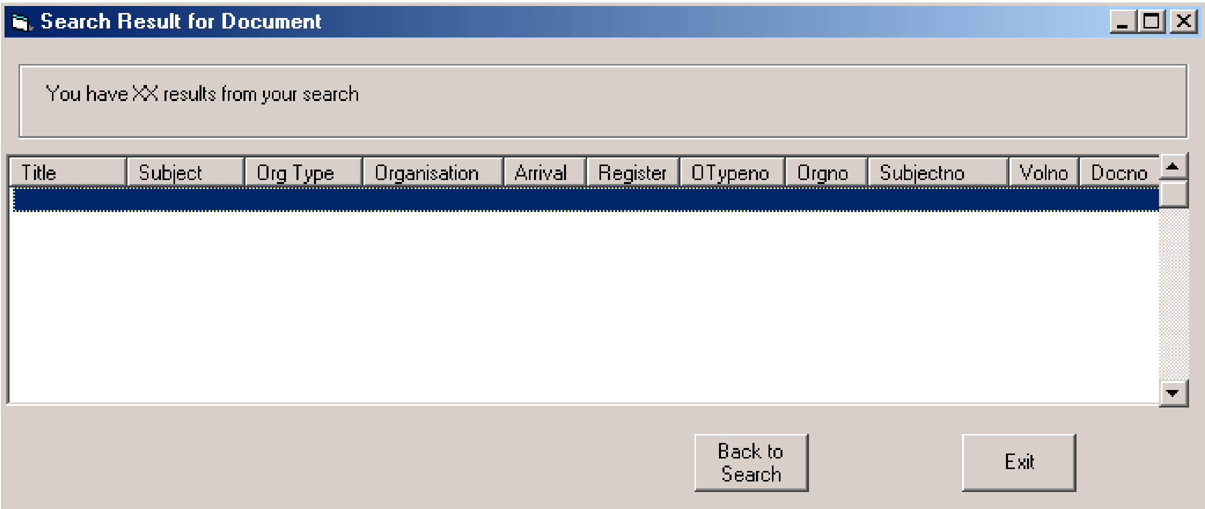
- The registry clerk fills in the information about the tender exemption in the textboxes and then clicks on the ”save”-button. The vote combo box lists the votes that she can choose from. The data about the tender exemption is saved in the database.

D.7 Search for Document



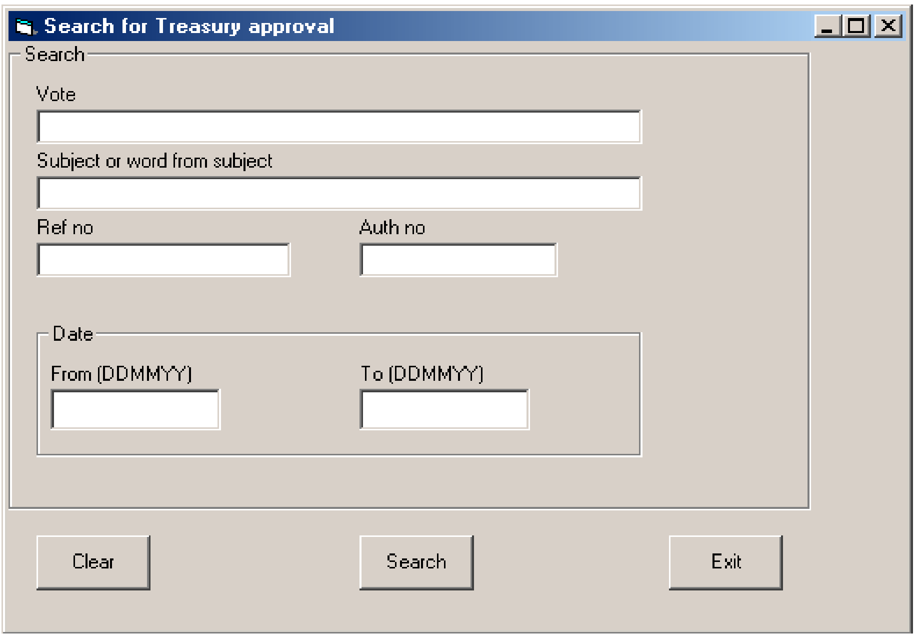
- In the textboxes the user can write different search words for searching certain documents. If the user writes something in the textbox ”Any word in Title, Subject Type, Subject”, the search result can be from all three search areas. The user specifies the search in all the other textboxes or the check boxes. The “clear”-button clears the textboxes if the user wants to change the information before a search.
- The user can fill in one or more fields in the search window.
- To perform the search the user fills in the necessary information and then clicks on the “search”-button. Then the search results are displayed in the screen picture “Search Results for Document”.

D.8 Results for Document Search



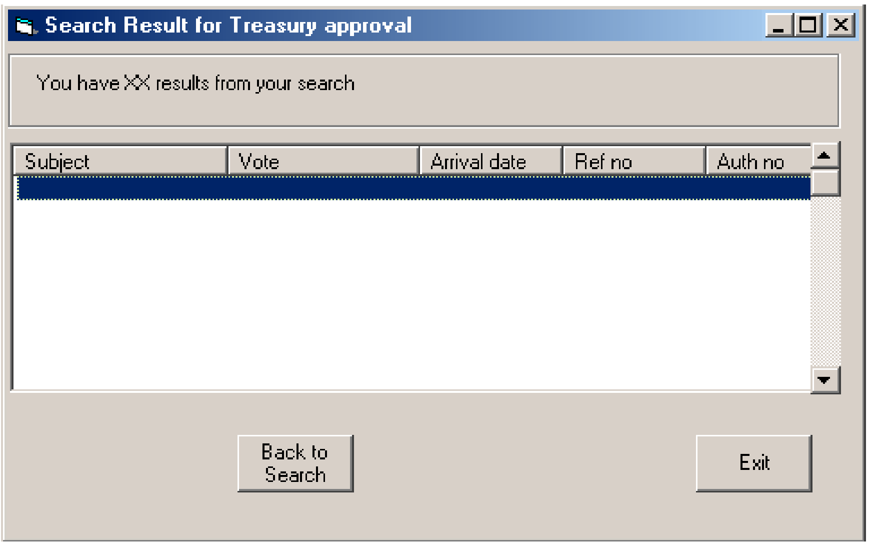
- The number of search results are displayed above in the screen picture. If the user wants to do another search, he clicks on the "back to search"-button.
- The information from the searched documents is displayed in the information field.

D.9 Search for Treasury approval



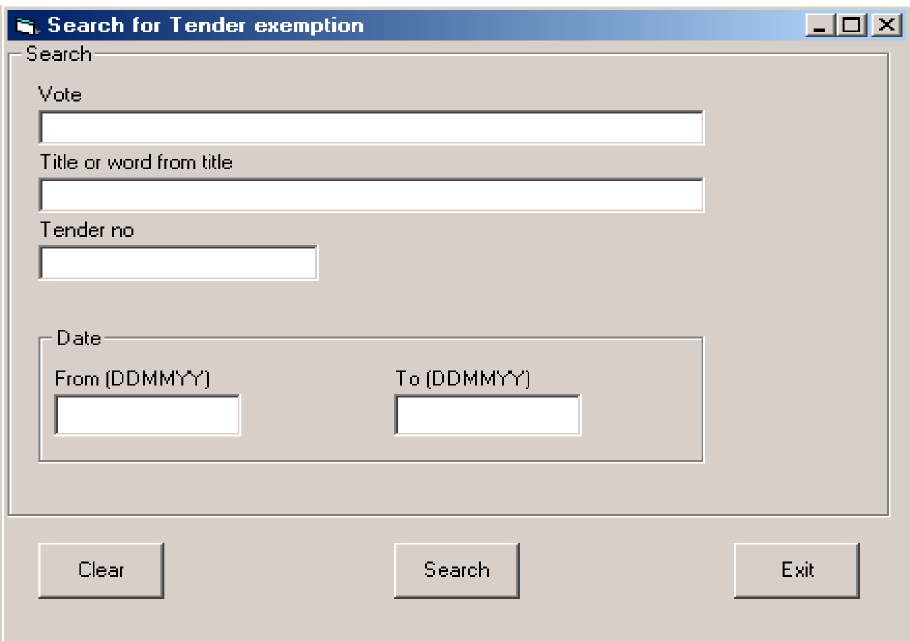
- In the textbox the user can write the whole subject or parts of the subject for searching certain Treasury approvals. The user can also search the treasury approvals that a certain vote has sent to the OAG or by ref no auth no or arrival date. The user specifies the search in the textboxes. The "clear"-button clears the textboxes if the user wants to change the information before a search.
- The user can fill in one or more fields.
- To perform the search the user fills in the necessary information and then clicks on the "search"-button. Then the search results are displayed in the screen picture "Search Results for Treasury approval".

D.10 Results for Treasury Approval Search



- The search result for Treasury approval screen picture has the same function as the search result for document screen picture, besides the column headlines in the information field.

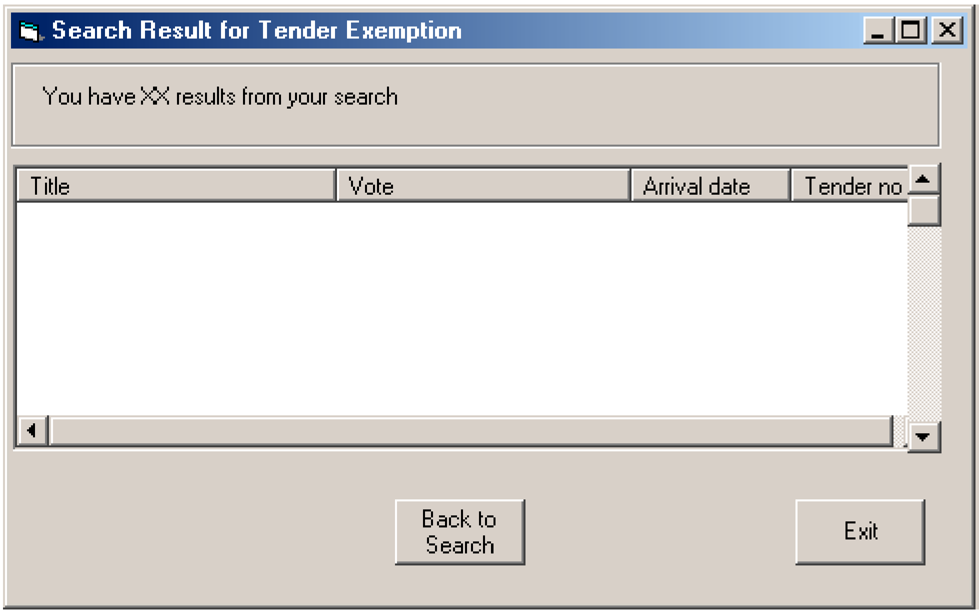
D.11 Search for Tender Exemption



- In the textbox the user can write the whole title or parts of the title for searching certain Tender exemptions. The user can also search Tender exemptions that a certain vote has sent to the OAG or by tender no or arrival date. The user specifies the search in the textboxes. The “clear”-button clears the textboxes if the user wants to change the information before a search.

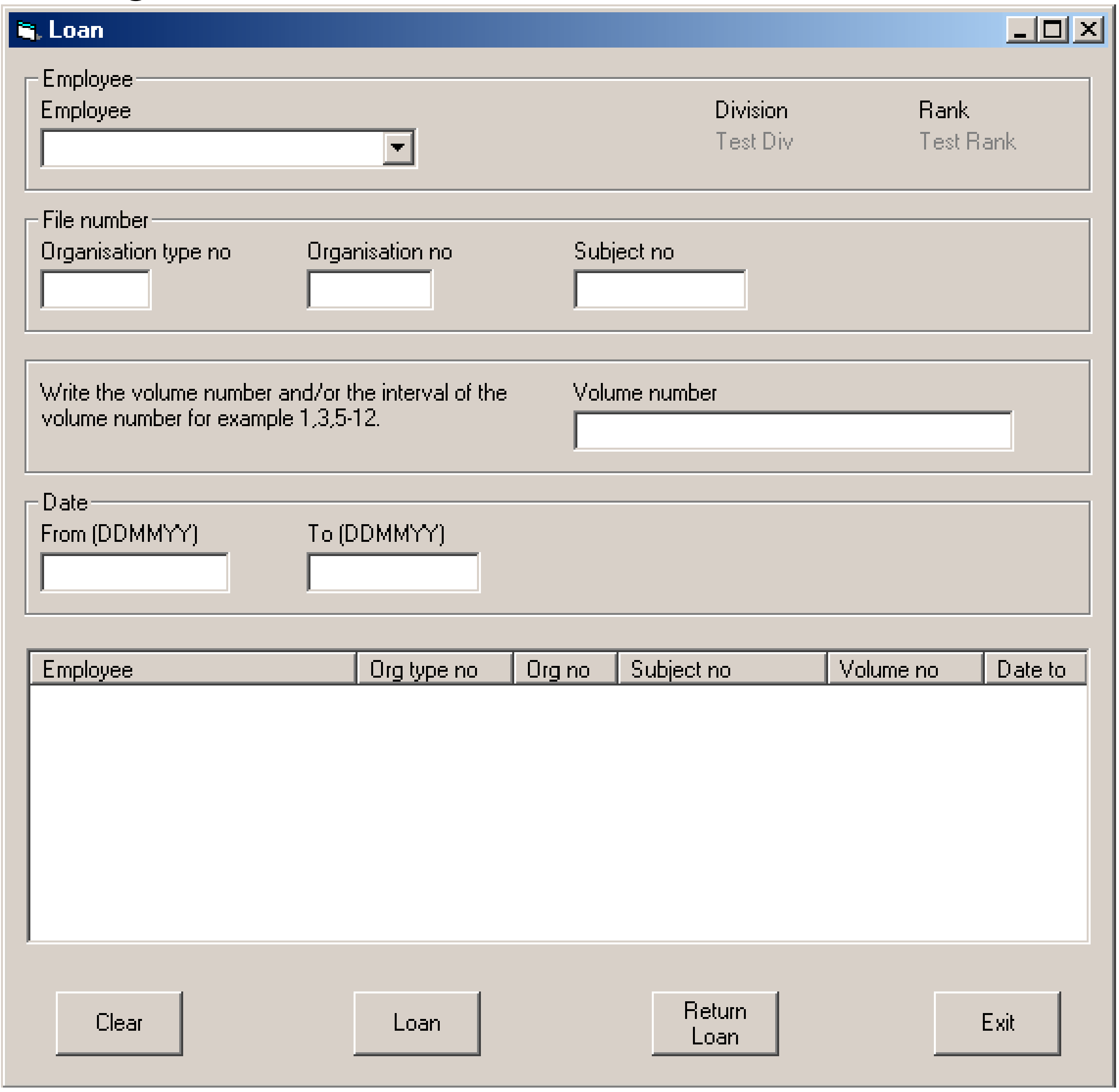
- To perform the search the user fills in the necessary information and then clicks on the "search"-button. Then the search results are displayed in the screen picture "Search Results for Tender exemption".

D.12 Results from Tender Exemption Search



- The search result for Tender exemption screen picture has the same function as the search result for document screen picture, besides the column headlines in the information field.

D.13 Register a Loan



- When the registry clerk register an employee's loan, she fills in the necessary information in the text boxes. In the combo box "employee", the employee number and employee name becomes visible when the user clicks the drop list.

- Because the files consists of volumes, the registry clerk fills in the volume numbers. When a whole file is lent out she fills in the first volume in the file to the last volume in the file. The registry clerk must fill in every textbox in "loan" and it is impossible to make a lone until this is done.

- When every textbox is filled in, the registry clerk clicks on the button "loan", then the information about the loan is displayed in the information field. It will be possible to scroll in the information field when it is full of information about different loans. If the registry clerk has filled in wrong information about the loan, it can be deleted by marking the actual lone in the information field and then click on the button "Return loan". The register in the database will be deleted. It is possible to mark several objects in the information field which will facilitate the handling of several loans.

- The date when the loaned volumes must be returned to the registry is displayed in the information field. If the loan is delayed, the row of that loan will turn red. This red marking serves as a facilitating for the registry clerk, because she gets information about delayed loans when she handles a loan for that person, This means that she can remind the person about the delayed loan. The Registry System will send out an e-mail when the loan is delayed. This is a reminder to the loaner.

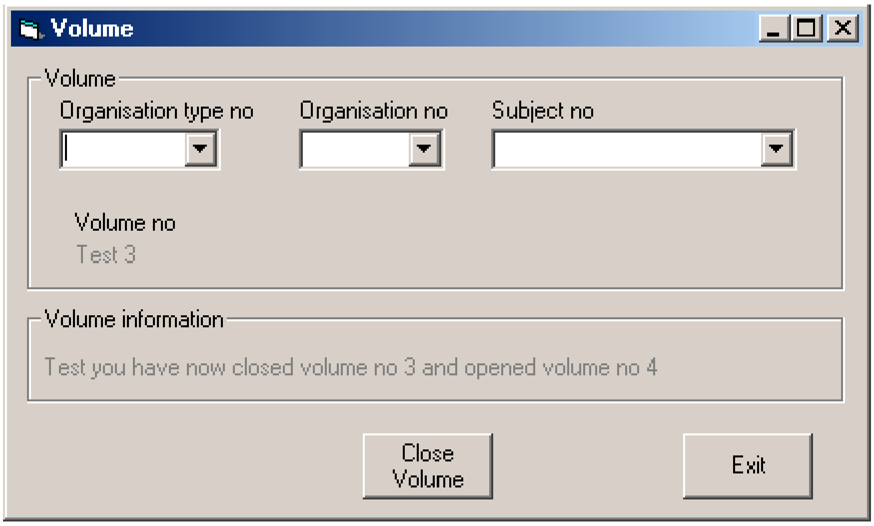
- If the user clicks on the button ”clear” the text in all textboxes disappears. This can facilitates the change of data in many textboxes.

Return a Loan

- The return of the loaned volumes will be in the same screen picture as the loan. First the registry clerk fills in the employee combo box. This action generates information about that person’s loans in the information field.

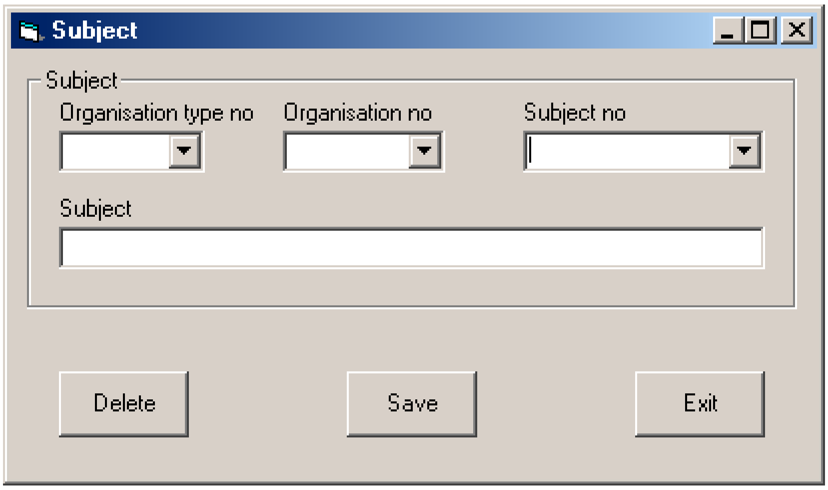
- The registry clerk marks the actual volume in the information field and then clicks on the button “return loan”. A message will come up with a warning question if you really want to delete the loan. In the Registry System it is not possible to search for every loan that an employee has done, because the information about previous loans are deleted in the database.

D.14 Close a Volume



- The registry clerk can choose the organisation type number, the organisation number and the subject number in the drop lists and then she clicks on the ”close volume”-button to close the volume. The volume is closed and a new volume opens automatically and the volume is numbered by an index. The information is showed in the information field.

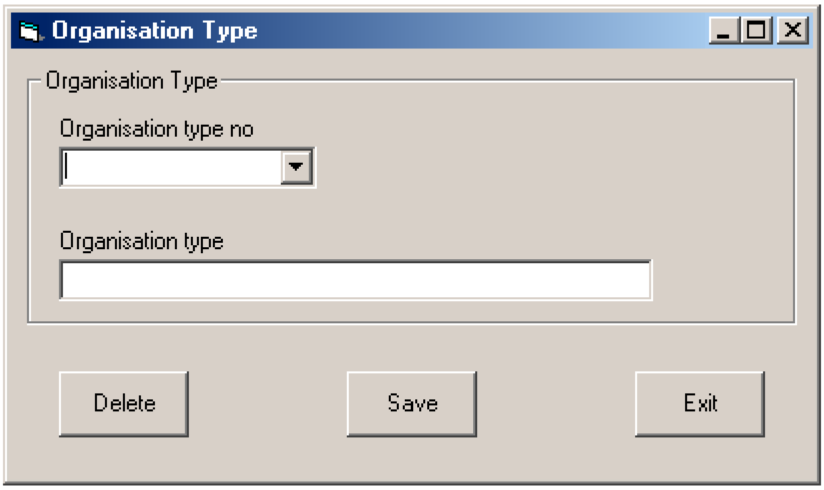
D.15 Add or Delete a Subject



- The registry clerk can write the organisation type number, the organisation number and the subject number or choose them in the drop lists and write the subject. Then she clicks on the ”save”-button to save the subject. The subject is thereafter saved in the database.

- If the subject must be deleted from the database, the organisation type number, the organisation number and the subject number are chosen in the drop lists. The subject is written and then the “delete”-button must be clicked on. Then the subject is disable to be chosen from the database when you file documents but you can still search for old documents with the deleted subject.

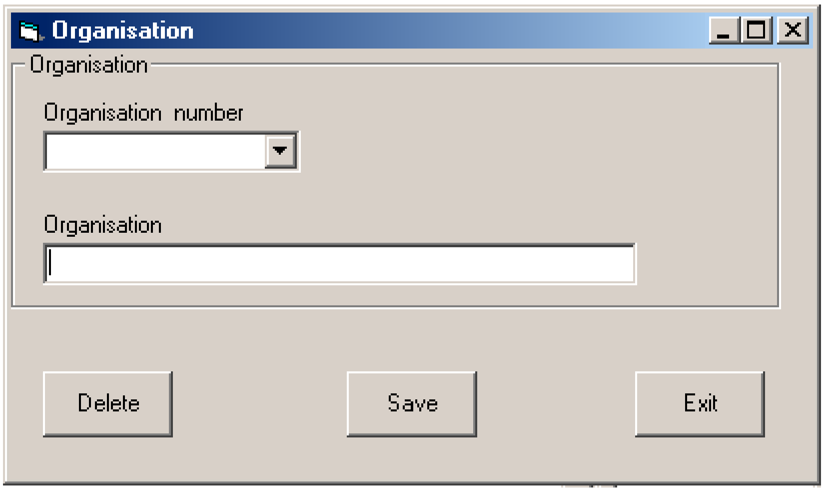
D.16 Add or Delete an Organisation Type



- The registry clerk writes the organisation type number and organisation type in the textbox and then clicks on the ”save”-button. The organisation type is saved in the database.

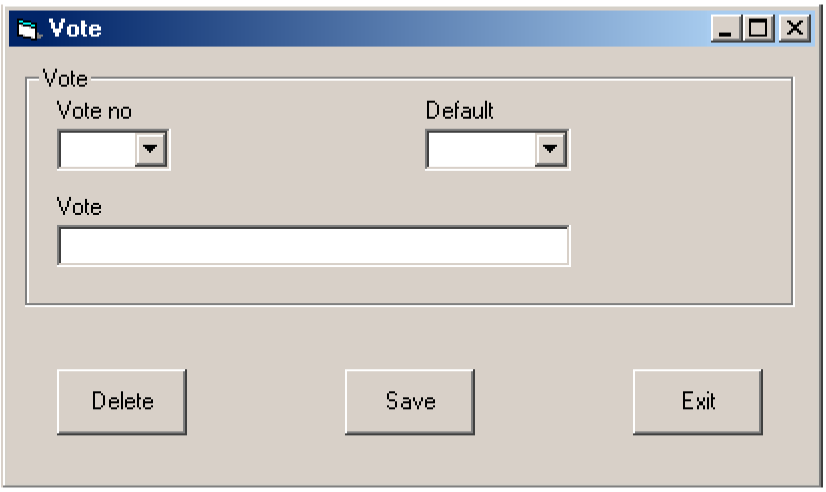
- If the organisation type must be deleted, the registry clerk choose the organisation type in the drop list and the writes the organisation type. Then she clicks on the “delete”-button. The organisation type will be deleted from the database.

D.17 Add or Delete an Organisation



- The registry clerk will do the same procedure with adding and deleting the organisation, as in the procedure in adding and deleting an organisation type.

D.18 Add or Delete a Vote



- The registry clerk writes the vote number and choose default no in the textboxes and writes the vote in the textbox. Then she clicks on the ”save”-button. The vote is saved in the database.

- If the vote must be deleted, the registry clerk choose the vote in the drop list and the writes the vote. Then she clicks on the “delete”-button. The vote will be deleted from the database.

D.19 About the OAG's Registry System