

Sanna Leppäjoki

Database Project

- Developing A Valencian Company's Database

Helsinki Metropolia University of Applied Sciences
Bachelor of Engineering
Industrial Management and Engineering
Thesis
22 November 2011

Author Title	Sanna Leppäjoki Database Project – Developing A Valencian Company’s Database
Number of Pages Date	46 pages 22 November 2011
Degree	Bachelor of Engineering
Degree Programme	Industrial Management and Engineering
Specialisation option	Logistics and Business
Instructor(s)	Leticia Gimeno, CEO Jarmo Toivanen, Principal Lecturer
<p>An international group of students formed a project team and were given an assignment, including different tasks by a Spanish family company. The theory and tools of management of such a project were studied from the defining and planning phase to executing and delivering the product to the customer.</p> <p>The thesis gives an insight into the customer, an innovative Valencian company, who had found their niche in the big vending markets of Spain with ambitions to expand to the rest of Europe. The thesis also presents how the theories and tools of project management were used in practice.</p> <p>The focus of the thesis was on one specific task: evaluation and development of Access database used for placing orders, controlling stock and invoicing. These kinds of evaluations demanded familiarization with the customer’s delivery process in order to be able to define the needs for a database. It was important to study deeply the structure and features of the original database to get an idea of what kind of development was needed. The main part of this thesis documents this familiarization and evaluation.</p> <p>Besides the studies of the original database, the results included also the description of the improvements made to the database structure. Different versions of the database were made, from which the company could proceed with the development. The thesis is also a documentation of the changes and further suggestions made, a tool for understanding the database further.</p> <p>Finally the process and the results were concluded from the customer’s and the team’s point of view. There are always challenges in diversified projects like this, but in the end the customer satisfaction is what counts.</p>	
Keywords	project life cycle, work breakdown structure, delivery process, ERP, relational database, primary key, foreign key

Tekijä Otsikko	Sanna Leppäjoki Tietokantaprojekti – valencialaisen yrityksen tietokannan kehittäminen
Sivumäärä Aika	46 sivua 22.11.2011
Tutkinto	insinööri (AMK)
Koulutusohjelma	tuotantotalous
Suuntautumisvaihtoehto	toimitusketjujen hallinta ja liiketoiminta
Ohjaaja(t)	toimitusjohtaja Leticia Gimeno lehtori Jarmo Toivanen
<p>Kansainvälinen ryhmä opiskelijoita muodosti projektiryhmän ja sai eri tehtäviä sisältävän toimeksiannon espanjalaiselta yritykseltä. Työ antaa kuvauksen Espanjan automaattikonemarkkinoilla toimivasta asiakkaasta, jonka tavoitteena oli laajeta Eurooppaan. Projektiryhmän tehtävänä oli auttaa yritystä näissä tavoitteissaan.</p> <p>Tässä opinnäytetyössä tutustuttiin projektiin soveltuvaan teoriaan ja projektin johtamisen työkaluihin, määrittely- ja suunnitteluvaiheesta lähtien, toteutukseen ja työn toimittamiseen asiakkaalle. Tekstissä kuvataan myös, kuinka teoriaa ja työkaluja hyödynnettiin käytännössä.</p> <p>Opinnäytetyössä keskityttiin tarkemmin yhteen annetuista tehtävistä: arviointi ja kehitystyö Access-tietokannan parissa, jota käytetään tilausten ja laskujen tekemiseen sekä varastonhallintaan. Tällaiset arvioinnit vaativat tutustumista asiakkaan tilaus-toimitusprosessiin, jotta oli mahdollista määrittellä tietokannalle tarvittavat ominaisuudet. Tilaus-toimitusprosessiin tutustuttiin yritysvierailulla, henkilökohtaisissa tapaamisissa, sähköpostitse ja internet-tietoihin perehtymällä. Alkuperäisen tietokannan rakenteeseen ja ominaisuuksiin perehtyminen on äärimmäisen tärkeä, jotta tiedetään, millaista kehitystä järjestelmä oikeastaan kaipaa. Se toteutettiin käymällä läpi relaatioita, taulukkoja ja niiden tietokenttien sisältöä. Tämän työn tärkein osuus oli tässä arvioinnissa ja perehtymisessä.</p> <p>Pohjautuen laadittuihin arvioineihin tietokantaan suunniteltiin parannuksia. Tietokannasta tehtiin eri versioita, joiden perusteella yritys voi jatkaa kehitystyötä. Tämä opinnäytetyö toimii yritykselle myös dokumentaationa jo tehdyistä muutoksista sekä jatkokehitysideoista; se on työkalu tietokannan ymmärtämiseen. Tehdyt muutokset ja dokumentointi nopeuttavat tietokannan käyttöönottoa ja helpottavat yrityksen tilaus-toimitusprosessia.</p> <p>Lopuksi katsastellaan prosessin loppuun viemistä ja tuloksia asiakkaan ja tiimin näkökulmista. Asiakas oli tyytyväinen tuloksiin ja koki että pystyy hyödyntymään työn tuloksia.</p>	
Avainsanat	projektin elinkaari, työnositus, tilaus-toimitusprosessi, ERP, relaatiotietokanta, perusavain, viiteavain

Contents

Abstract
Tiivistelmä

1	Introduction	1
1.1	Evaluating the supply of projects	1
1.2	Prioritizing the tasks	2
1.3	Work in progress	3
2	Project management	6
2.1	Project life cycle	7
2.1.1	Definition	8
2.1.2	Planning	9
2.1.3	Execution	11
2.1.4	Delivery	11
2.2	Aspects of a software project	12
2.3	Aspects of an international project	13
3	Meet the company Ecoventing Llevant	15
3.1	Delivery process	16
3.2	Defining the assignment	18
4	The kick-off of the project team Eco-Aid	19
4.1	Sharing responsibility	19
4.2	Dividing tasks	21
5	Development of ERP by using Access	23
5.1	Delivery process as a basis for the database	23
5.2	Evaluating and developing the database	25
5.3	Tables, primary keys and relations	26
5.3.1	Customers and Suppliers tables	30
5.3.2	Orders	33
5.3.3	Inventory transaction	34
5.3.4	Invoices	34
5.4	More about relationships of the tables	36
5.4.1	Purchase flow	36
5.4.2	Sales flow	37
5.4.3	Changes made to relationships	38
5.5	Forms	41
5.6	Queries	42
5.7	Reports	42
5.8	Documentation and managing the changes	42
6	Conclusion	44
	References	46

Table of figures

Figure 1 Meeting the project group	4
Figure 2 Dimensions of the project management process (Gray & Larson 2008.).....	6
Figure 3 Project life cycle (Gray & Larson 2008.)	7
Figure 4 Project management trade-offs (Gray & Larson 2008.).....	8
Figure 5 Cost effect of defect in different phases (McConnell 1998.).....	12
Figure 6 Products - before and after repairing	16
Figure 7 Delivery process	17
Figure 8 Project organization	20
Figure 9 Work breakdown structure (general)	20
Figure 10 Work breakdown structure (more detailed)	21
Figure 11 Gantt chart.....	22
Figure 12 The first version of information flow	24
Figure 13 Work breakdown structure (ERP).....	24
Figure 14 Simplifying the model.....	25
Figure 15 The interest groups in the model.....	26
Figure 16 A primary key, foreign key and relation.....	28
Figure 17 Navigation pane.....	29
Figure 18 View of relationships	30
Figure 19 Suggestion for combining contact details.....	31
Figure 20 Adding supporting tables	32
Figure 21 Orders	33
Figure 22 Comparing purchase and sales invoices.....	35
Figure 23 Combining invoices	35
Figure 24 Purchase flow for evaluation in the database.....	37
Figure 25 Sales flow evaluation in the database	38
Figure 26 Tables and relationships (Structure1).....	39
Figure 27 Tables and relationships (Structure2).....	40

1 Introduction

An international group of students worked for a project of a Spanish company. This thesis describes the process of that project. The purpose of the project was to help the company to expand its business. The personal aim was to present and use in practice the skills and know-how obtained in the studies of Industrial and Management Engineering, and gain more experience. The first chapter gives some background to the project. The theory of the project management is described in chapter two. The third chapter tells how the project started and how the team functioned and in which environment. The company is presented in the chapter four. The fifth chapter focuses on one of the main task and the results of the project, development of Enterprise Resource Planning (ERP) by using Access. In the final chapter the outcome of the project is evaluated and further recommendations given.

1.1 Evaluating the supply of projects

Carrying out the final thesis abroad seemed the most effective way of attending an exchange period which I felt was an interesting experience both for study and culture. I chose to apply for an exchange program to Universidad Politécnica de Valencia (UPV) because they had courses in English and I also wanted to boost up my Spanish skills.

An exchange program European Project Semester (EPS), Valencia started on 6 September 2010. It offered several different projects. The students got preliminary information of the topics a few weeks before the project semester started. In addition within the first two weeks they attended several lectures where a bit more detailed information was given. The projects reflected very different aspects of work life: from innovative brainstorming to very strictly instructed projects, from public work to business world, from designing and engineering to administration. The examples of the most innovative projects were designing a product for public use with cradle to cradle concept by the community of Valencia and innovating science toys for the company Gigo. Project relating to the EU Water Framework Directive was naturally very strictly defined. Programming educational UAV and developing of a 3D-scanner were very much focused on mechanical and electronic engineering plus programming of course.

Most business orientated projects related to developing a business plan for a bioinformatic company and tools of expanding for a vending company.

Based on the information given, all students made a SWOT analysis i.e. analyzed strengths, weaknesses, opportunities and threats of each topic, to evaluate each project. Analyzing of the assignments was an interesting approach also considering work life. Certainly there is not always an opportunity of choosing one's project, but if there is, it is good to consider what are the strengths and weaknesses of the project and of oneself and what opportunities and threats there might lie ahead relating to each project. This is a good tool in helping the decision making which is the most beneficial project from the point of view of the client and oneself as a supplier of a service. Although the projects were very different and required very different kinds of skills, the decision making process was not easy as the projects offered also various opportunities for the learning experience.

1.2 Prioritizing the tasks

Ecovending Llevant, a small family company was one of the principals. It is a new company doing business in recycling vending machines. At the moment Eco vending Llevant acted locally in the city of Valencia. However they were striving for expanding their business not only into Spain but the whole Europe. That applied to both sales and purchases. As they were new in the field they were still developing their processes. In order to have tools for expanding, Eco vending Llevant needed more resources, and this is where a team of students could help conveniently.

The preliminary information received before the start-up of EPS relating to this assignment included the following topics:

- Market studies within the vending sector
- Improvement of the company management
- Programming electronic cards
- Development of software for electronic cards
- Administration and financial management
- Website design
- Commercial skills

- Human resources.

In the first lecture of Ecoventing Llevant on 7 September 2010 the topics had already been defined to fewer ones:

- Research and development (R&D) of the actual vending systems for being adapted to the supply of industrial materials.
- Development of a web page using PHP programming language for creating a virtual warehouse.
- Development of a database in Microsoft Access for creating an ERP system for orders registration and invoicing.
- Study of international markets, related to vending business.
- Improvement of the current web page.

The lists are a good example how the client has to consider different projects and consider what is really wanted and needed because usually time and money constraints do not allow having everything done at once. It is also the supplier's responsibility to interview the client thoroughly and both to help the client in prioritizing and decision making and to find out what the task truly withholds.

Nevertheless, this project seemed the most interesting. It seemed to relate in the most concrete way to the real business world. It offered a possibility to work with a real company and to learn from the process. Regarding the thesis, the development of an ERP for the company seemed the most suitable task. It was closely related to studies of Industrial Management and Engineering, so I could put the skills learned during my studies into practice. Also this field was interesting from the point of view of my future ambitions and career.

1.3 Work in progress

After one week of intensive presentations and lectures of all the different options, it was time for the students to announce the final choice of the project, and the teams were formed. From that moment, the project team Eco-Aid started the work for Ecoventing Llevant, forming the project group (Figure 1).



Figure 1 Meeting the project group

From left to right: Matthieu Malard, Leticia Gimeno, Jose Gimeno, Bram Kruijt, Sanna Leppäjoki, Niels Banus, Bettina Friedl

Several meetings were held in different forms. In the beginning, Eco-Aid and Ecoventing Llevant met several times in order to get a clear picture of the targets and the roles of Eco-Aid as a supplier and Ecoventing as a client. Otherwise the correspondence was carried out mainly via e-mail.

The whole team met once a week at the UPV. The purpose of these weekly meetings was to keep all members of the team up-dated about the project and how its different tasks progressed. In case somebody had fallen behind with the timetable or faced difficulties, the situation could have been re-evaluated and corrective measures taken in the form of re-allocating resources, for example.

The members responsible for ERP met more frequently in the beginning because working with the database needed more brainstorming and sharing of ideas and know-how. After brainstorming it was time for individual work.

The project team Eco-Aid worked mainly with their own laptops in their homes. The communication within the team and to the company was done by using the internet or e-mail. It was decided that the documents would be shared also via files in the cloud server, and also the work could be done there.

Eco-Aid had three months to carry out the project. One milestone for the project was the mid-term report given on the 9 November 2010. The deadline to finish the project and write the final reports was 22 December 2010.

The theoretical part of the thesis includes process and management of the project. The concrete steps are described separately including the necessary information obtained of the company and its delivery process to understand the needs of the company. The main part concentrates on development of an ERP by Access. Also further familiarization of Access and VBA was needed in order to be able to analyze the current status of the database and needs for development. The changes and new features were done and tested within the time limit. The results of other task are reviewed only shortly and concentration is on giving further development recommendations regarding database.

2 Project management

First one should understand what a project is. It should not be confused with repetitive, daily work. A project is non-routine. There might be several professionals working for a project. It has a budget, an objective, a defined beginning and an end. A program is a group of projects heading to a common goal. (Gray & Larson 2008.)

The project management is needed to manage the change. The project manager should be proactive to change and manage all aspects of the project. (Lester 2007.)

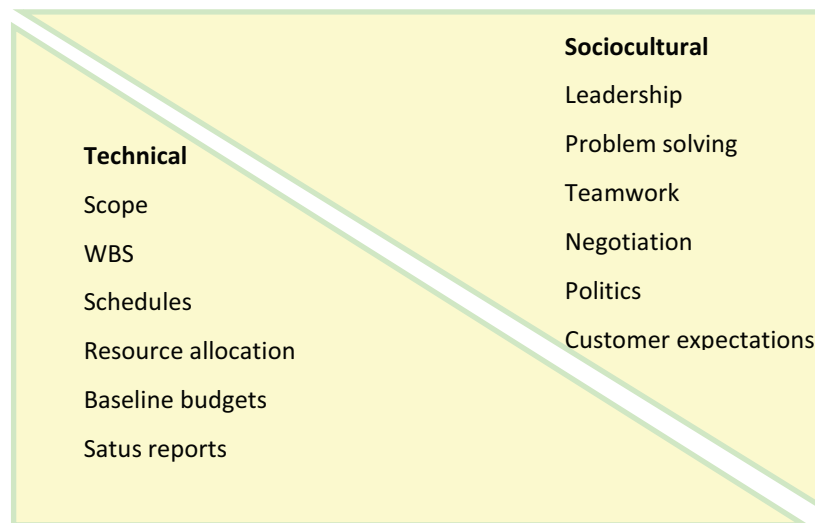


Figure 2 Dimensions of the project management process (adapted from Gray & Larson 2008.)

Gray and Larson (2008) divide the dimensions of the project management in two: technical and sociocultural (Figure 1). The technical dimension is a formal one including planning, scheduling and controlling, and tools and software used for managing these steps. The sociocultural side includes forming a project culture that enables a good working environment and a fast problem solving ability. This dimension also involves cooperation within the project team, with managers and the customer. In a similar way Lester (2007) mentions hard and soft skills needed in project management, the latter one being more or less necessary for any type of management. Nevertheless, the both sides are equally important for a successful project.

2.1 Project life cycle

Project's life cycle can be defined in various ways depending on project or industry. Figure 1 illustrates generic model including four steps: defining, planning, executing and delivering.

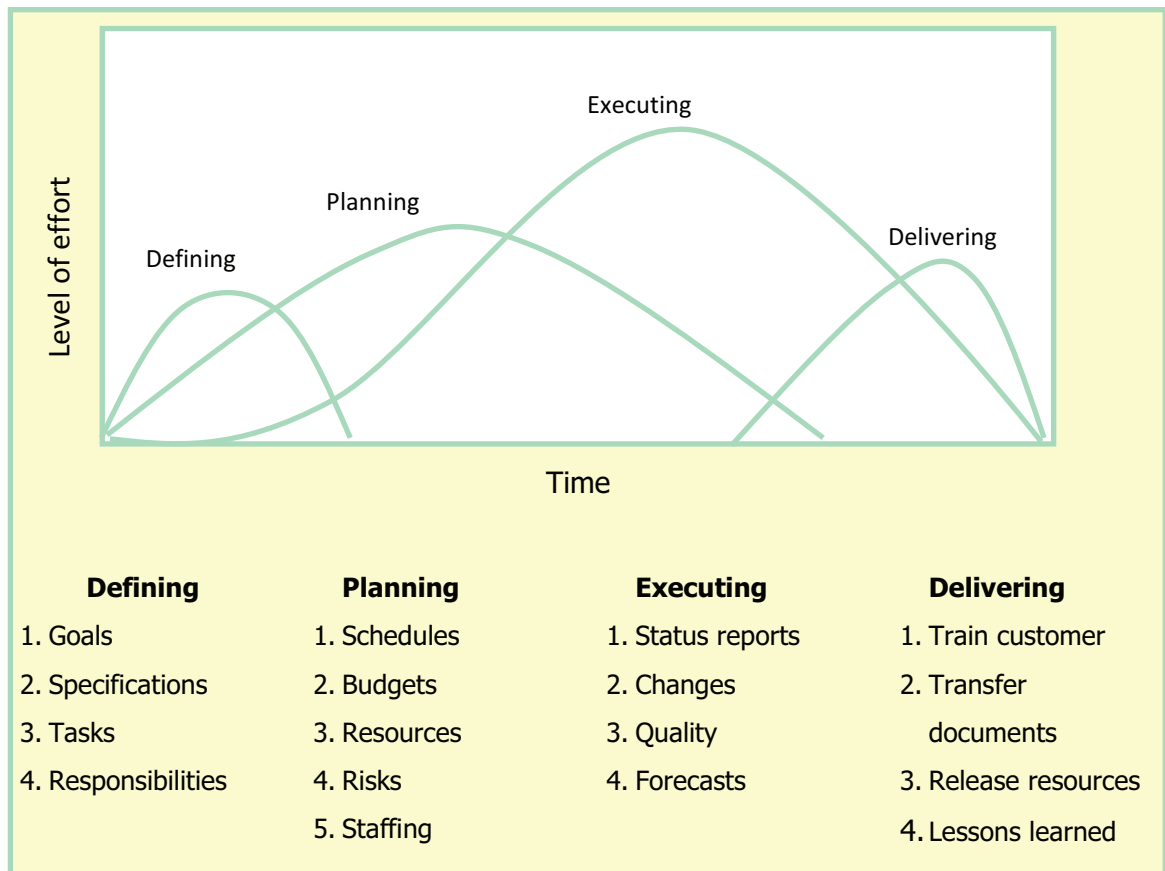


Figure 3 Project life cycle (adapted from Gray & Larson 2008.)

In the first step, project goals, specifications, tasks and major responsibilities are defined. In the planning stage schedules and budgets are determined, the staff and other resources allocated and risks evaluated. The third step is seen as the major portion of the project, as the actual work takes place including producing of the product. Status reports are done to control that the project stays in its schedule, budget and specifications. If needed, changes are made. In the final step the product is delivered to the customer including project documentation and training when needed. Finally, the project resources are released. (Gray & Larson 2008.)

2.1.1 Definition

Although in Figure 3 of the project life cycle defining the project does not get a big portion, its importance should not be underestimated. Defining the project scope, a document of a couple of pages in small projects, is a tool for this, and it can be used by the project participants. Again, different projects, industries and companies have their own needs but for example the following points can be used as a checklist:

1. The project objective defines the overall objective, what is delivered, within which time frame and on what cost.
2. Deliverables describe the major outputs of the project such as specifications, manuals, prototypes, final test and eventually approved product.
3. Milestones are significant event at a certain time, like the ending of one phase of the project and starting of the second.
4. Technical requirements to ensure proper performance of the product should be listed.
5. Limits and exclusions should be defined i.e. what the focus is and what is not included.
6. Reviews with customer are held to understand and agree on expectations. Clear communication is important as the project moves on. (Gray & Larson 2008.)

With a clear project scope it is more feasible to manage the project trade-offs, which can be seen in Figure 4, to prevent the project from expanding uncontrollably and thus to control the costs and the time used. However, sometimes it can be desirable to reduce time with the expense of cost or vice versa. (Gray & Larson 2008.)

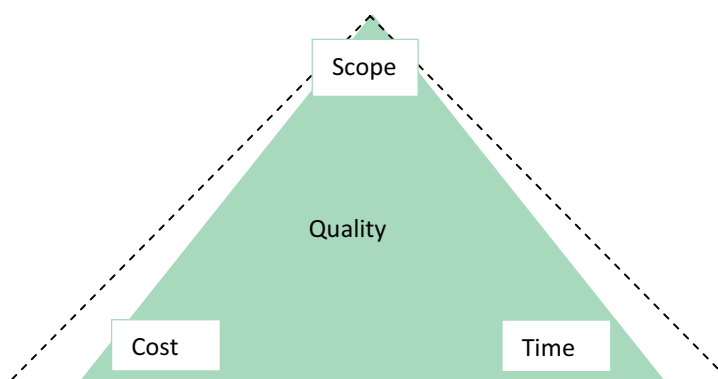


Figure 4 Project management trade-offs (adapted from Gray & Larson 2008.)

The work breakdown structure (WBS) is a tool used by project management to define work elements. The elements are presented in a hierarchical framework, broken down to smaller units. The structure shows the work and responsibilities. It can show the links and thus help coordination and communication within the project. (Gray & Larson 2008.)

The organisation breakdown structure (OBS) describes how responsibilities are organized. The work responsibilities are also presented in a hierarchical form. The organisation breakdown structure can be linked to the work breakdown structure and used to monitor both the product and organization. (Gray & Larson 2008.)

Table 1 Responsibility matrix (RM) (adapted from Gray & Larson 2008.)

Task	Mr X	Ms Y	Mr W	Ms Z
Task A	R	S	S	
Task B	S	R		S

For smaller projects or subprojects, a responsibility matrix (RM) is a clear and useful tool. In it the tasks are listed in rows and the people responsible in columns as in Table 1. R is used to identify a person who is responsible for coordinating the recourses and making sure the task is completed and S for person(s) who support and/or assist in the task. (Gray & Larson 2008.)

2.1.2 Planning

At the planning stage the details of the project like schedule, risks, budgets, resources and staffing are made more specific. Estimates are important as a support for good decisions, for scheduling work, for determining project time, costs and worthiness. They are needed for defining cash flows and budgeting. Project status reports depend on reliable estimates. Past experience estimates can be used as a starting point but must be up-dated with up-to-date information. Estimates should be done by experts of the specific activity or task. (Gray & Larson 2008.)

Typical costs found in a project are direct costs including labor, materials and equipment, project overhead costs and general and administrative overhead costs.

Depending on project conditions and intention of use, different types of cost estimates and level of details are suitable. Top-down approaches include consensus, ratio, apportion and function point methods; bottom-up approaches template methods, parametric procedures applied to specific tasks, detailed estimates for the WBS work packages and phase estimating. (Gray & Larson 2008.)

Based on WBS, a visual, graphic flow chart should be made illustrating the activities and their duration, timing and independencies in logical sequences. Earliest and latest time as well as float times should be defined. A critical path is the longest duration through project. Project management software can be a tremendous help in calculations and illustrations but still it is important to understand the meaning of these concepts. (Gray & Larson 2008.)

Risks can be listed with the help of the risk breakdown structure which is similar to WBS but concentrating on risks. It covers four main risk categories: technical, external, organisational and project management. Another useful tool is a risk profile, a list of questions relating to a more specific area of the project. The questions are done based on earlier, similar projects. After getting the list of risks, using the mentioned tools for example, they can be assessed. They can be reflected to the project trade-offs mentioned in previous section (2.1.1 Defini) by appropriate scale. Some type of risk assessment matrix can be done by scaling likelihood, impact and detection difficulty for example. The point of risk assessment is to decide a suitable response. With careful preparation the likelihood and/or impact of risks can be reduced or even avoided. Transferring or sharing the risk can be one option, and some risks just need to be accepted. (Gray & Larson 2008.)

Labor, materials and equipment, mentioned earlier as costs, are also resources. To schedule the resources the projects usually need to be classified time or resource constrained. Based on this decision, if the project faces a scheduling problem it can be defined which project trade-off gives in. Scheduling the project is necessary because a failure to schedule limited resources can lead to serious problems. (Gray & Larson 2008.)

2.1.3 Execution

For evaluation and control of project progress, an information system is needed at least in bigger projects. It is important to determine to whom and what kind of reports are needed for effective follow-up of cost, schedule and specifications. Then it is possible to define which data is needed. It has to be also clear who collects the information, and when and how it is done. (Gray & Larson 2008.)

In previous sections 2.1.1 and 2.1.2 defining and planning the project were explained. The tools and estimates in these steps can be used when monitoring the project on a regular basis. When comparing the plans and the actual situation the changes can be detected. Depending on deviations, a corrective action can be taken and new forecasts done. (Gray & Larson 2008.)

2.1.4 Delivery

Eventually all the projects come to an end. A perpetual project seems to be never ending. In this case it needs to be controlled that there are no "add-ons", i.e. at some point the project scope and design needs to be fixed, carried to an end and finished. A Project can also fail sometimes. A closure can be also premature with some parts excluded, but usually it is normal of a completed project.

At the final stage the project outcome and documents are transferred to a customer. Customer training might be needed. It is important to get delivery acceptance from the customer, close accounts and see that all the bills are paid for. The project resources are released, i.e. people and equipment are directed to other activities or projects.

Each project is also a learning process and a possibility to a continuous improvement. One tool for learning is project audit. Its meaning is to assess not only what went wrong, what not to do, but more preferably also which were the success factors and good practices, i.e. what should be done also in the future. Audit depth depends on organization size, project importance, type, risk, size and problems. There can be in-process and/or postproject audits. It should be planned and part of the normal process

including well-thought planning and staffing, data collection and analysis and finally reporting with recommendations and lessons learned. (Gray & Larson 2008.)

Auditing includes performance evaluations such as 360-degree evaluation, in which the same form is completed by the individual himself, superiors, fellow team members and sometimes also the client. The feedback is given by human resources or consultant. The point is to compare self-evaluation to other feedback in order to give a more realistic view of the strengths and weaknesses and to identify areas for improvement. (Gray & Larson 2008.)

2.2 Aspects of a software project

Compared to a generic model of the project's life cycle, a new software development project may consist of five phases: definition, design, code, integration/test and maintenance. (Gray & Larson 2008.) Furthermore McConnell (1998) mentioned five phases of a software project: requirements, architecture, detailed design, construction and maintenance. He also pointed out the importance of the first step as the groundwork of the project.

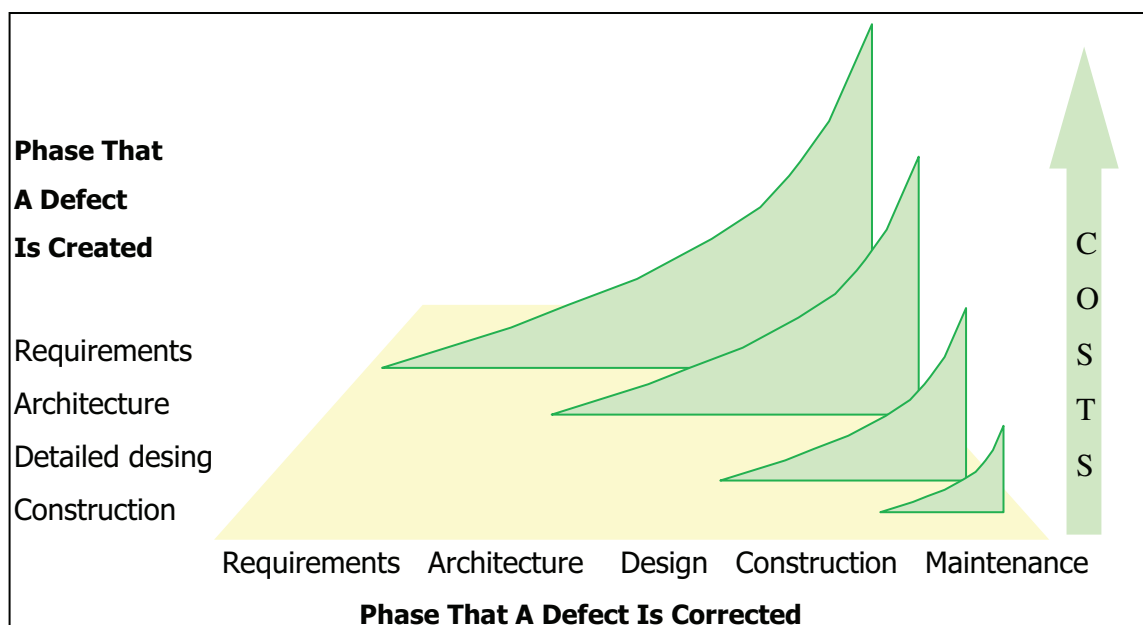


Figure 5 Cost effect of defect in different phases (adapted from McConnell 1998.)

McConnell (1998) presented a figure illustrating the cost effect of a mistake made in different phases in relation to the phase in which it is corrected. Based on this it is

clear that the earlier the error is made and the longer the time that passes before correcting it, the greater is the effect: re-defining, correcting the more lines of the code, re-testing, re-documentation, re-training, and so on. Thus, in my opinion, the first two steps of a project (defining and planning or definition and design) become more important also in Gray's and Larson's model than the

Figure 3 may show. Although in the case of this project the cost effect would not had realized, just the additional work.

When developing a software, the final product comes from series of steps (rather than product parts), each of which affect the next step. Thus a process breakdown structure (PBS) can be more useful than the classic work breakdown structure. In the process breakdown structure the project is organized around major steps, which are broken down into more specific work phases. (Gray & Larson 2008.)

2.3 Aspects of an international project

Projects can be classified according to the international aspect. A domestic project is performed in its native country, an overseas project in a foreign country for a native firm, a foreign project in a foreign country for the firm of that country, and a global project globally. (Gray & Larson 2008.)

All projects are influenced by internal and external factors. The latter ones can be encapsulated by the acronym PESTLE i.e. political, economic, social, technical, legal and environmental. (Lester 2007.) Furthermore Gray and Larson (2008) have, to some extent overlapping, list of environmental factors that need to be kept in mind in international projects. In addition to some factors mentioned by Lester this list continues also with geographical, security or infrastructure related and cultural factors. Of the two latter ones, infrastructure refers to communication, technology and education systems and culture to the customs, values and social standards, for example. The people can come from different countries and often this kind of multicultural work environment can be the greatest challenge of all. (Gray & Larson 2008.)

Variations in value orientations by Kluckhohn and Strodtbeck can be used for understanding of cultural differences. Cross-cultural considerations can be reflected also by using Hofstede's dimensions for examining culture. Power distance identifies the degree to which a culture accepts status and power differences among its members. Individualism describes whether a culture holds individuals responsible for each member's welfare (vs. group in collectivism). Masculinity refers to the degree to which the culture emphasises competitive and achievement-orientated behavior. Uncertainty avoidance identifies a culture's willingness to accept uncertainty. (Gray & Larson 2008; Geert Hofstede 2011.)

Table 2 Examples of Hofstede's dimensions (gathered from Geert Hofstede 2011.)

country	power			uncertainty	
	distance	individualism	masculinity	avoidance	
Austria	11	55	79	70	
Finland	33	63	26	59	
France	68	71	43	86	
Netherlands	38	80	14	53	
Spain	57	51	42	86	

In Table 2, for example, can be seen the differences between Austrian, Finnish, French, Dutch and Spanish nationalities, which were present also in this EPS project. Although there were representatives from quite different cultures based on Hofstede's dimensions, the team did not face any cultural clashes and also there were not language barriers within the group as everybody communicated fluently enough in English. At some point the teamwork suffered a little but that was more due to personal interests of some group members than cultural aspects.

3 Meet the company EcoVending Llevant

Ecovending Llevant is a small family enterprise situated in Valencia, Spain. The company was established only two years ago, at the beginning of 2009, actually as a result of an earlier EPS project. As written earlier in section 1.5, EcoVending currently operates locally but they strived for expanding their business to region of Valencia, in Spain nationwide and later on perhaps also in the whole Europe. (Gimeno 2010.)

The company consists of two employees. Ms Leticia Gimeno is the company manager. She takes care of all the administrative tasks including sales, purchase, invoicing, budgeting and accounting. Leticia's father Jose Gimeno works in the repairs. Voluntary IT support is obtained from Jose Ignacio. (Gimeno 2010.)

The company concentrates on recycling all types of vending machines for products including coffee, soft drinks, snacks and tobacco. They offer their clients evaluation and cost-estimates of damaged machines, repairing services, designing the labels and sourcing and sales of recycled vending machines. (EcoVending Llevant 2010; Gimeno 2010.)

Ecovending Llevant sees that due to the economical crisis they have a good niche for expanding their business. The vending machines are quite expensive and thus naturally tie a big amount of capital. When vending companies seek ways to reduce expenses recycled machines with half a price are a very attractive option. In addition to just selling the recycled vending machines, EcoVending Llevant provides additional services: they repair vending machines thoroughly before selling them and provide warranty. After sales maintenance provides additional value for many vending companies. (EcoVending Llevant 2010; Gimeno 2010.)



Figure 6 Products - before and after repairing

Ecovending Llevant is thinking in a renewable and green way. Instead of all the machines ending up to a junk yard and creating piles of waste, they get a new life, as can be seen in

Figure 6. This thinking could be used not only by EcoVending Llevant but also by their clients for creating more environmentally friendly image. (EcoVending Llevant 2010; Gimeno 2010.)

3.1 Delivery process

Figure 7 shows the delivery process of EcoVending Llevant. It starts with finding and contacting suppliers of used vending machines and spare parts. Usually EcoVending buys used vending machines which are not repaired as the price is naturally lower. Buying of the repaired machines would not reduce work either, as they would need to be checked thoroughly anyway. (Gimeno 2010.)

When starting the project EcoVending Llevant had one supplier. Because there are threats in relying on only one supplier, EcoVending Llevant was seeking for more. Another reason was that the more suppliers a company has, the more product variety and better position it has when it comes to comparing or negotiating prices. (Gimeno 2010.)

The part of finding suppliers and used machines is also one of the most challenging in the process. There is big competition in the vending market. Thus at least some bigger players have chosen to send their used machines to a trunk yard with an order of destruction in order to keep the smaller players away from their backyard and not to give them advantage of used and cheaper machines. (Gimeno 2010.)

Thus Eco vending was interested in sourcing used machines also from other countries in Europe such as Austria. Even North Africa could be taken into consideration. The condition of the machines, price, transportation and freight charges mainly determine the feasibility. (Gimeno 2010.)

In the delivery process, after finding an appropriate supplier, the purchase agreements, delivery and payment are made.

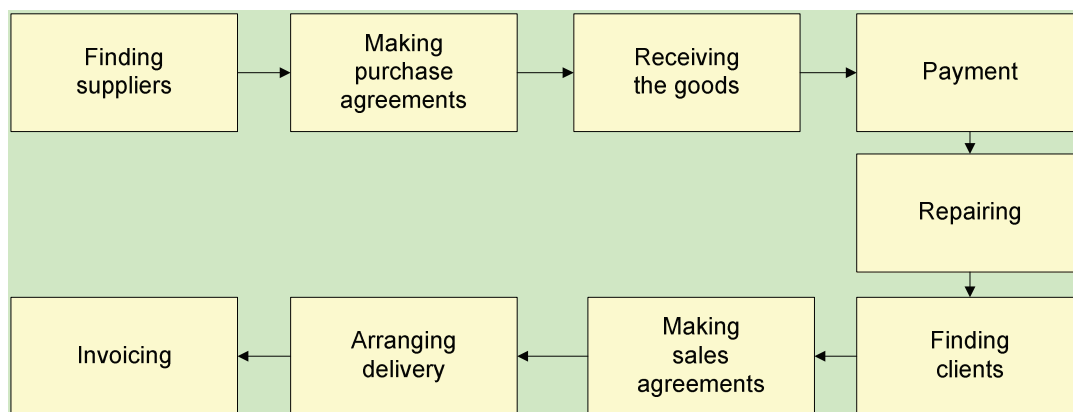


Figure 7 Delivery process

Finding clients is simpler than finding suppliers. Sometimes a client can also be ready awaiting for the machine ordered. After all the materials have been received, the vending machine is opened and all the necessary parts are repaired or replaced. Then the machine is ready to be delivered to the new owner, again according to delivery and payment agreements. At the final step the invoice is formed according to the delivery and sent to the client. (Gimeno 2010.)

3.2 Defining the assignment

The whole project group met for the first time in Eco vending Llevant's premises in Valencia. It turned out that the company website improvement was almost done so the tasks narrowed down to four points listed below.

1. Industrial vending: The aim was to find a supplier with an appropriate device to be attached to industrial vending machines. This would make machines more user-friendly, efficient and up-to-date, and thus more appealing to clients.
2. Development of an ERP by using Microsoft Access databases. The main task was to form a delivery order and link it to an invoice.
3. A study of the international market related to vending business: a similar study had been made already a couple of years ago for setting up the company but it was time to up-date and broaden the information about suppliers, competitors and clients.
4. Development of a web page in PHP-language for creating virtual warehouses. Due to the time constraint, this point was optional.

The team already had an image of how to divide responsibilities and a preliminary timetable was made in the form of a GANTT-chart. After getting a better understanding of the assignments and having the fifth member to the team, it was clear that also the timetable and the chart needed to be adjusted according to new information obtained.

4 The kick-off of the project team Eco-Aid

Originally four students chose to work with Ecoventing Llevant's project. The international project team consisted of Matthieu Malard from France, Sanna Leppäjoki from Finland, and Bram Kruijt and Niels Banus from the Netherlands. A few days after the establishment, the team received an additional resource as Bettina Friedl from Austria joined in.

The first task was to form a name for the team. As all the projects related to green issues and the team's main task was to optimize the company, the team wanted these themes to be reflected in the name of the team. Thus the name Eco-Aid was invented.

Eco-Aid determined that their mission as a young and dynamic team was to draw on different experiences in the diverse fields of knowledge. As a team they could boost and increase each others' ability to work and gain new know-how from which the team members could profit in their future careers. Team's aim was also to provide maximum effort and high performance by using all accessible resources in order to support their client.

4.1 Sharing responsibility

Figure 8 illustrates the organization of all the related parties in the project. The whole organization or the project group consisted of the client and the supplier. The client was Ecoventing Llevant and the company manager Leticia Gimeno was also their project manager. In addition there was an outside resource also from the client's side, Jose Ignacio who had started forming the database and could answer questions related to it. Pedro Fuentes, the professor of UPV evaluated the project from the supplier's side. The project team itself, consisting of five international students, was already introduced earlier in the section 1.3.

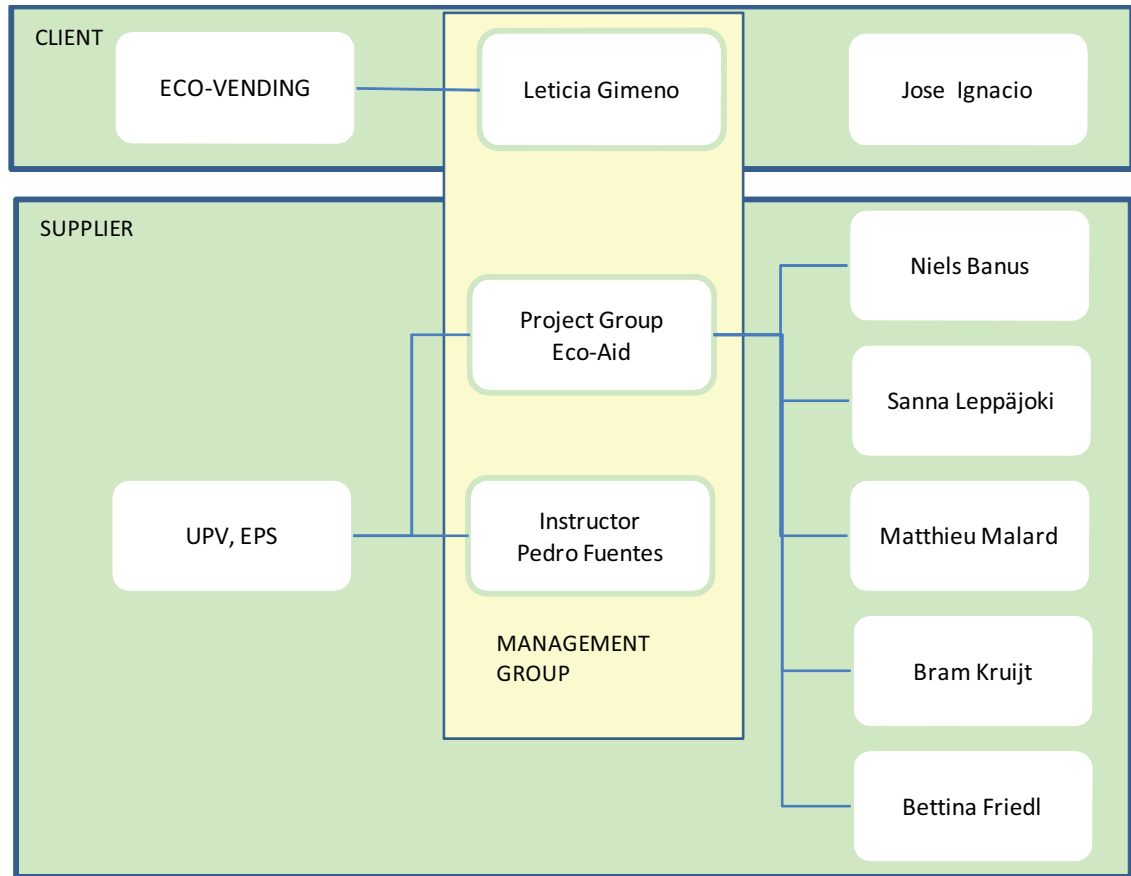


Figure 8 Project organization

The work breakdown structure (WBS) is a tool used by project management to define work elements. Already after choosing the assignment, a preliminary work breakdown structure was made according to the tasks. However, as after the first meeting of the whole project organization the tasks were clarified to three main points and one optional, the work breakdown were re-structured accordingly as illustrated in Figure 9.

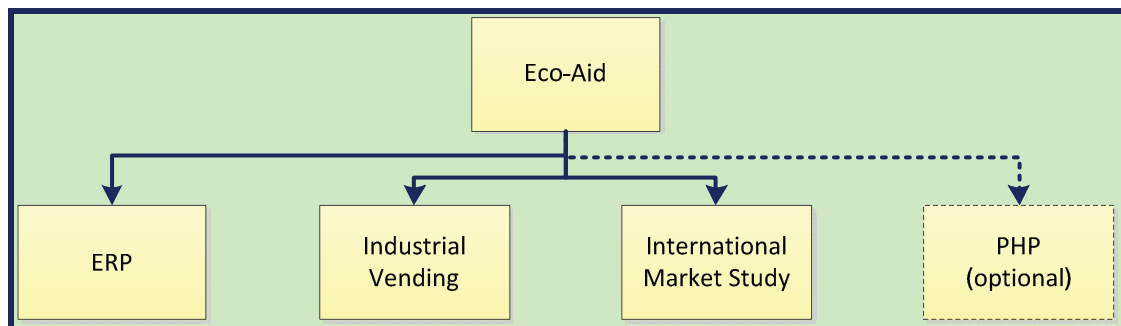


Figure 9 Work breakdown structure (general)

The team broke the tasks down to further work elements. As an example, in Figure 10 more detailed WBS is shown relating to international market study.

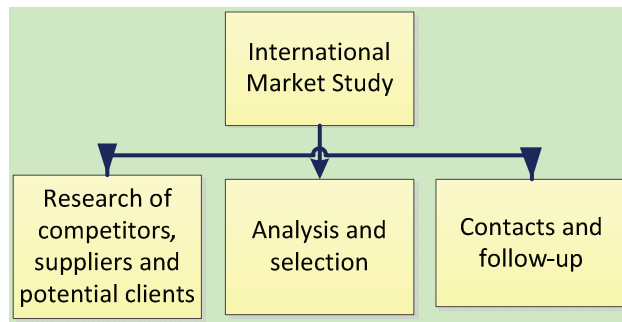


Figure 10 Work breakdown structure (more detailed)

4.2 Dividing tasks

Gantt chart is another tool, used for scheduling projects. It presents the duration of tasks including start and end dates and milestones. It can also show dependencies. To form a Gantt chart, Excel can be used but the team chose to do it with Microsoft Project. The team used WBS as a basis for the Gantt chart.

Again a few versions of the Gantt chart were made as the work elements clarified from preliminary information to the final assignment. It became clear and was also recommended by Jose Ignacio (2010) that ERP requires more time and the full resources of three students. As Bettina had joined in after creating preliminary chart and the designing the company webpage was left out from the list of the tasks, there was room for adjusting responsibilities and timetable.

The final Gantt chart formed can be seen in Figure 11. In it the milestones, i.e. the mid-term and the final reports and the presentations, can be seen, and the time reserved for preparations. The team evaluated the time needed for the tasks and the sub-tasks. There were no dependencies between the tasks but in sub-tasks they were marked.

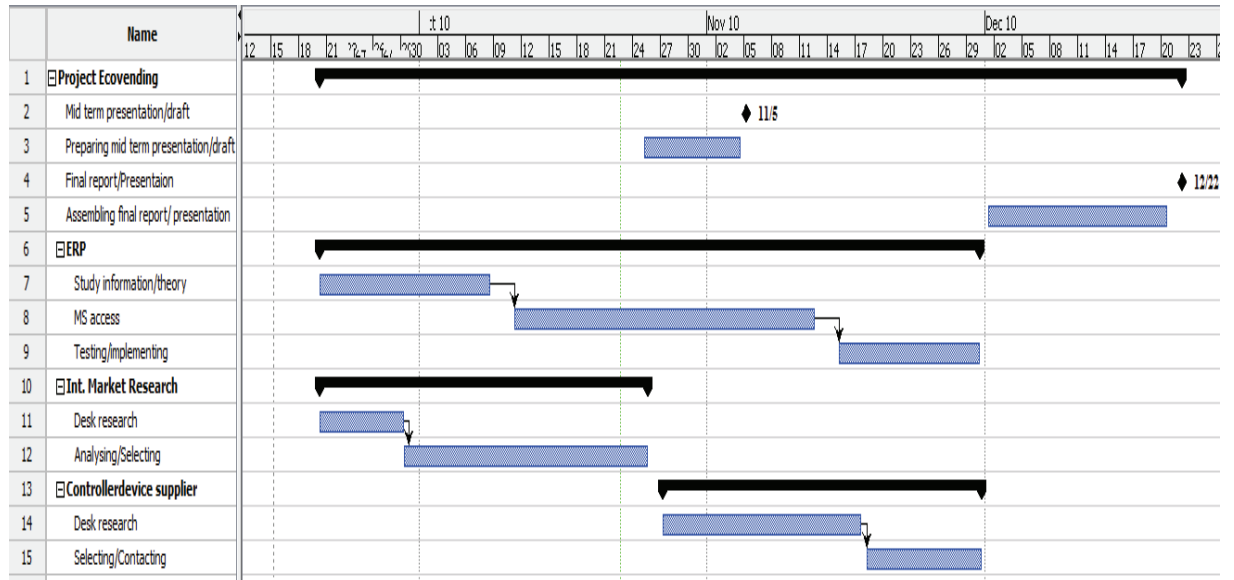


Figure 11 Gantt chart

The project team decided to divide the tasks so that Matthieu and Bettina studied international markets and industrial vending. Sanna, Bram and Niels concentrated on ERP.

5 Development of ERP by using Access

Enterprise Resource Planning (ERP) is an integrated computer-based system used to manage internal and external resources. It enables the flow of information between all business functions. (Murthy 2008) Well-known enterprises offering ERPs are SAP, Oracle and Microsoft. They offer also a possibility to take only some parts of the systems in use and tailored features.

Commercial ERPs can be too expensive for a small, incipient company. However, good Excel or Access skills can be enough in creating a basic ERP system. This is worthwhile in order to maintain supplier, client and product information, to avoid extra typing and typing errors when forming orders/invoices and it can be used in monitoring stock inventory. When competing in a hectic world tuning these kinds of procedures can give a small company a competitive advantage.

5.1 Delivery process as a basis for the database

When working with the relations databases, the most important point is to clarify the purpose of the database. One needs to decide which information is needed, how it should be structured and what the relations are. The point of a relations database is that no information should be entered twice. (Andersen 2007.)

The structure of the database can be formed according to the delivery process. A simplified flow can be seen in Figure 12. The delivery process is presented with white rectangles. From delivery process it can usually be seen what is needed from the ERP. It gives a visual image how different steps are related. Based on it can also be concluded what documents are needed, and furthermore what information the documents should contain. In the figure, yellow shapes present the related data or document. Delivery Note and Sales Orders are emphasized with red borders as originally these were the ones the company expected the team to form.

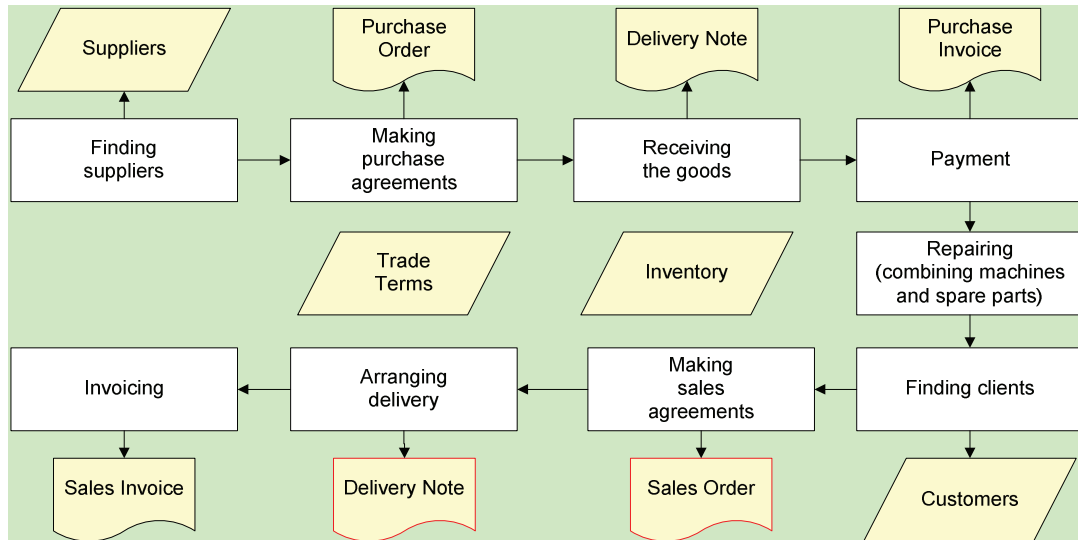


Figure 12 The first version of information flow

Before EcoAid team started, José Ignacio (2010) had already started creating the ERP in Access. Thus the first assignment was to analyze and develop the work with Access. The team members responsible for ERP had a look at what had been done so far together with José and a copy of this first version of ERP was provided to the team.

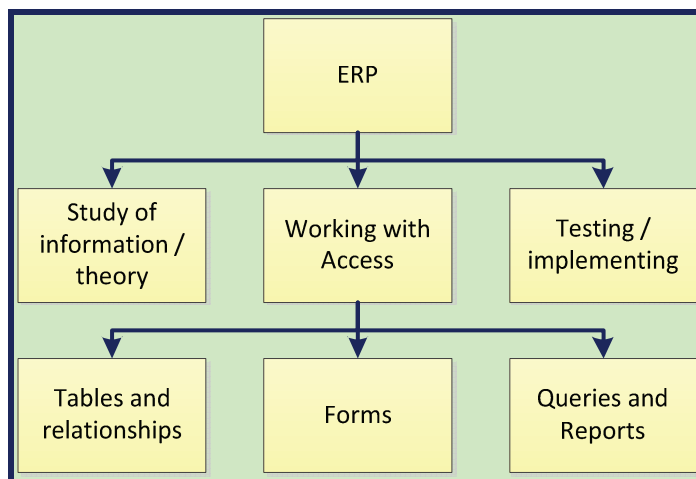


Figure 13 Work breakdown structure (ERP)

The team had already structured the work with ERP in three parts according to the tasks (Figure 13). It became obvious that there was a need to refresh the knowledge of Access as already some time had passed since studies of Access and meanwhile also version of Access had changed. Finding books on Access 2007 in English in both the town libraries and UPV libraries turned out to be impossible; there was none,

everything was in Spanish. However, e-libraries of team members' home institutions provided suitable material. Studying with electronic material of course limited the work to be done only on computers within an internet access. The internet connection should have been also fast enough. After studying Access 2007 manuals and the original database, the structuring of the database started.

5.2 Evaluating and developing the database

Regarding the delivery process, the team thought that it could have been presented with a simplified approach, which can be seen in Figure 14.

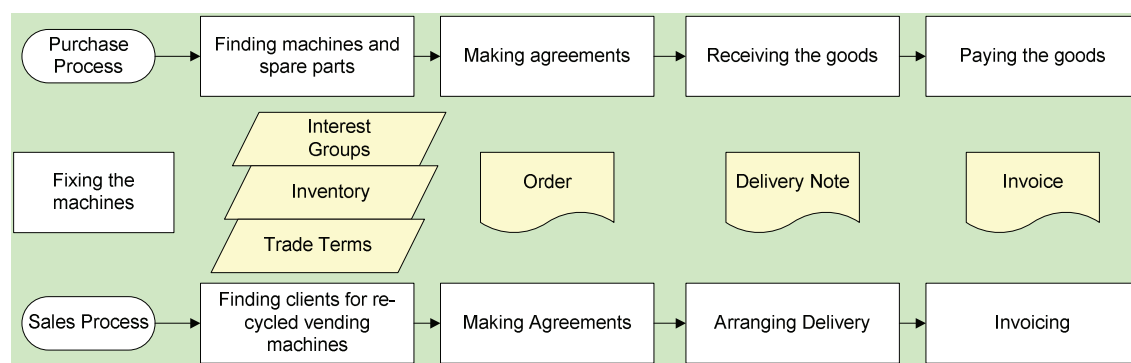


Figure 14 Simplifying the model

Simplification can be done easily by viewing purchase and sales processes side by side instead of a long delivery process. Then the similarities in the processes and in the fields of the database can be detected. Trade terms and inventory are the same for both as was implemented in the original database. Clients and suppliers are also all interest groups just with different roles from whom usually similar data is wanted to restore (name, address, phone number etc). Processes include the same steps of making agreements, delivery and money transactions with the documentation containing the same information. The main difference is whether goods and money are coming in or out, whether it is a debit or a credit transaction.

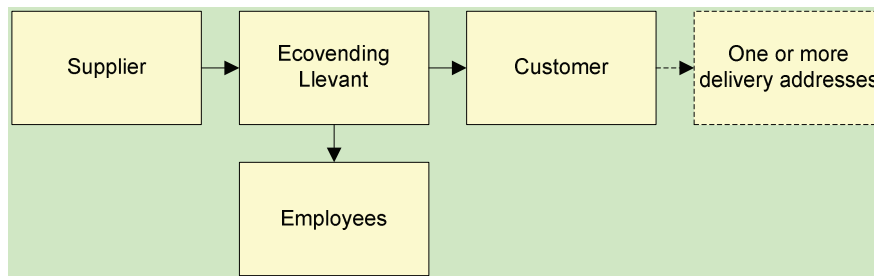


Figure 15 The interest groups in the model

To clarify the relation of the different parties in the process, it might be useful just to have a look at the interest groups separately as is done in Figure 15. So the process starts when the supplier delivers a used vending machine to Ecoventing Llevant. After fixing the machine, Ecoventing delivers it further to the customer or to their delivery address.

After defining the information structure the team familiarized with Access. The main features of Access are tables, queries, forms, reports and macros. Tables are the basis of the database containing all the data. Queries are used to obtain information from tables, or other queries, and to maintain information in the tables. Forms can be created for the end-user, in order to make it easier to enter the information to the tables. Reports are used to collect the information from tables and to have them in a nice display or in printable form. (Cronan 2007.)

5.3 Tables, primary keys and relations

As the tables are the basis of the database, the most important point before even starting work with tables is to clarify the information needed in them and in which order it should be i.e. which tables are needed, what information they should contain (records such as customers) and what kind of fields (e.g. address). The point of tables in relational database is that no information should be entered twice but they are carried from table to another by creating relations. (Cronan 2007.) As mentioned in earlier section 5.1 the team carried out this task by analyzing the delivery process of Ecoventing Llevant.

In the datasheet view, one can see the data and enter the information into records. However, the tables should be made in a design view, in which data type (e.g.

number, date or text) and other features of the field are set. Setting the features such as field size has a big impact on the size of a database. Setting data type ensures that the information is inserted in the right form. It is also possible to set further limitations what kind of information can be inserted and how it can be done, for example that a birthday of a contact person can't be in the future or whether the field is compulsory. In the description column you may write further instructions what should be inserted to the field in question, and the instructions are visible in the datasheet view to assist the end-user. All these features help the end-user to enter information in the correct form into the tables. As the number of null values and incorrect values is this way minimized this data integrity on the other hand guarantees that the information retrieved in other features of Access are correct. (Cronan 2007.)

The tables include also another crucial feature, the primary key. The primary key is the identification number of the information in the table. It is a compulsory, unique value to data within a specific table. Access can set it automatically or the user can do it. The primary keys from other table are known as foreign keys. Creating relationships with the help of primary keys is crucial also for forming queries and reports from the tables. (Cronan 2007.) Some examples of primary and foreign keys are described in paragraph below.

For example, in a table that contains product information, a product code can be a primary key that the user himself sets; for suppliers it might be easier to let Access create a primary key, which can be running from number one up, for example. An order table, having its own primary key such as order number, contains information of suppliers and products. However, instead of writing the information all over again, it is only linked to orders by the product code and the supplier code. Thus in the orders table the supplier and product codes are foreign keys. This is illustrated also in Figure 16 in which suppliers and purchase orders tables are shown. Both tables have their own primary key, which is marked in the database with a yellow key symbol next to the relating field. A black line is linking suppliers and purchase orders table. The link is made by the supplier ID. Thus the supplier ID is the primary key in its own supplier table and at the same time also a foreign key for the purchase order table.

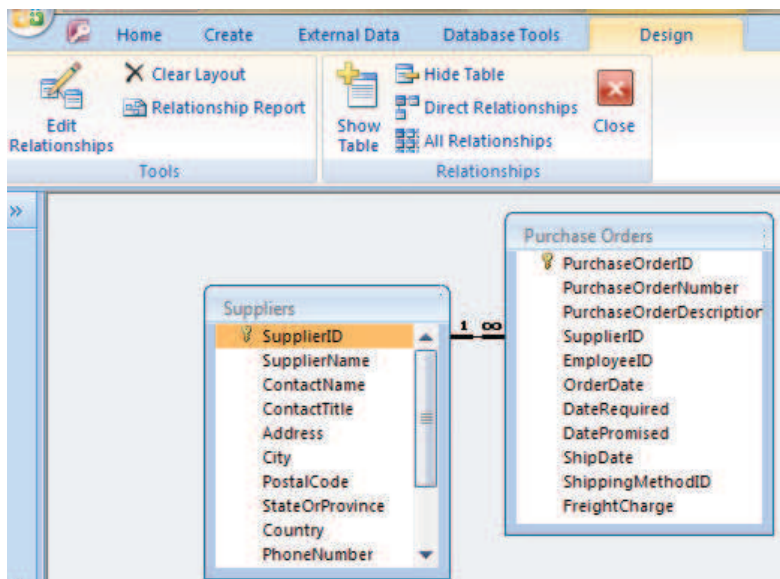


Figure 16 A primary key, foreign key and relation

In the paragraph above, the relations between tables were already mentioned. The relations of Ecovending Llevant's database are analyzed later in 5.4 but as the theory is strongly connected to tables and primary keys, it is explained here. Access is a relational database. Relations between tables give the power to the further database functions: the clearer the relationships, the easier it is to make queries, for example. To define relationships, the common information needs to be specified. Figure 16 shows the relation between two tables. In this case it is one (1) to many (∞), i.e. for one supplier there can be more purchase orders but in one purchase order there can be only one supplier. (Cronan 2007.)

A rare relation is one-to-one which means that the first table has only one corresponding record with the second table and vice versa. In practice, this is an unusual type because in this case the information could be in the same table. However sometimes it can be used for security reasons or to avoid null values. (Cronan 2007.)

The third type is a many-to-many relationship. An example of the former one is again a purchase order which can have many products on it, but also one product can be related to many purchase orders. From the Access point of view this is complicated type, and if built as such it would cause problems in later steps when forming queries and reports. This type of relationship should always be broken with an additional table. (Cooper 2008.)

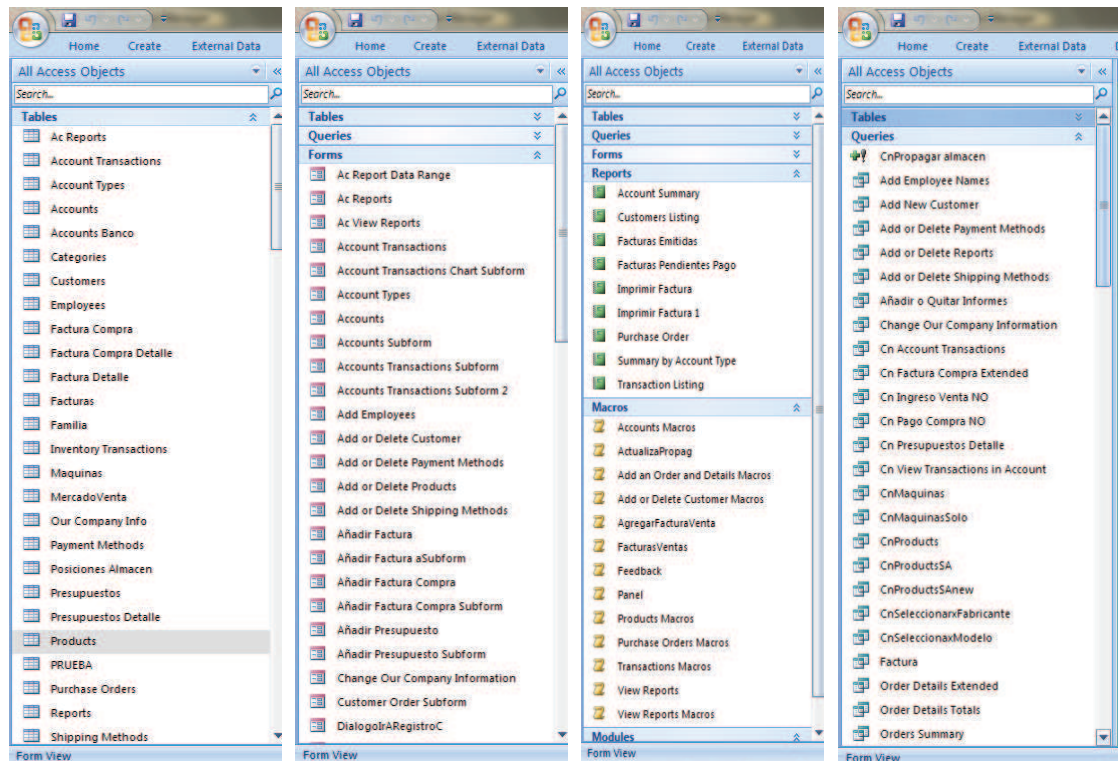


Figure 17 Navigation pane

To familiarize with the structure of the first version of Ecoventing Llevant's database, it was worthwhile to activate the navigation panel of Access -> Options. It was easier to view all the tables, queries, forms, reports and macros that were already done. (Figure 17). Before going to a design view, it was also useful to have a look at the relationship table. In this view it is possible to have an overview of the tables and their relations.

The database now in question was somewhat bigger and more complex than done in school courses. It is also more challenging to step into somebody else's work than to start from scratch. The main challenge was to know how the relations work and which change affects to what. It turned out it took some more time than expected just to familiarize oneself with the database.

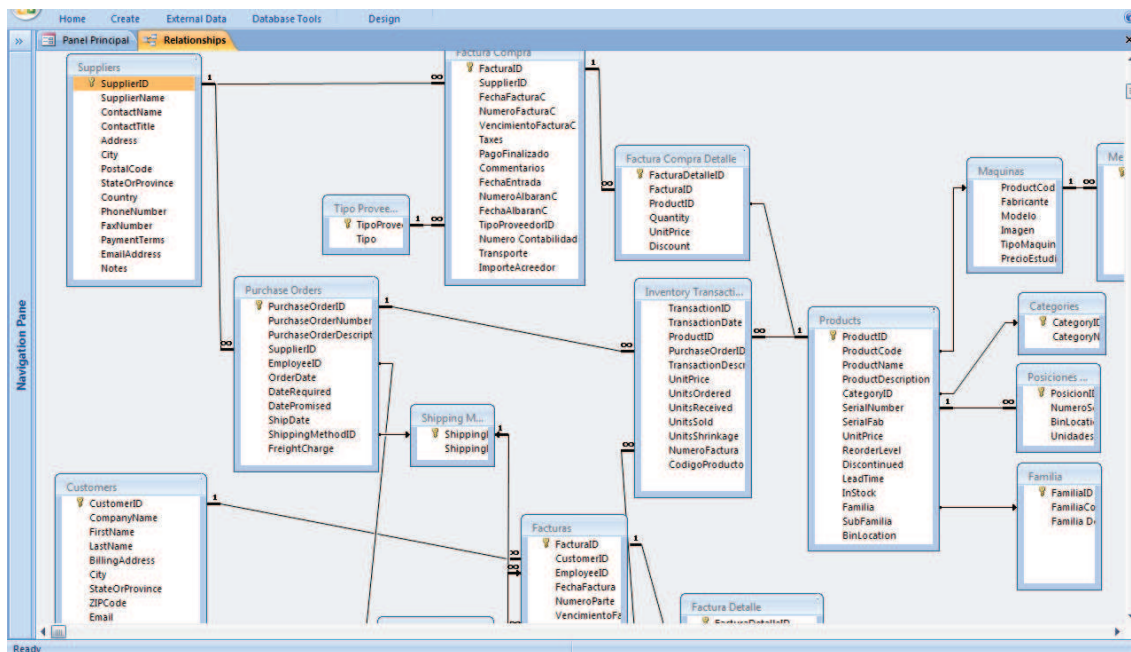


Figure 18 View of relationships

In general, in Ecoventing Llevant's database the tables had been formed clearly suiting the purpose, such as shipping method, employees, orders and invoices. The features of the design view were used efficiently to avoid wrong inputs. When going through the tables one by one, the team could not find any errors in them. The description field was not used though it could give some instructions for the user. However, some remarks relating to the structure of the tables of customers, suppliers, orders, invoices and relationships are described in following sections (5.3.1., 5.3.2, 5.3.3, 5.3.4 and 5.4)

5.3.1 Customers and Suppliers tables

There were two separate tables for customers and suppliers including the information fields that can be seen in Figure 19 in the yellow box. The ID number was the primary key (PK) in both tables. Many of the information fields were the same (e.g. name, address and phone) and the data types were the same.

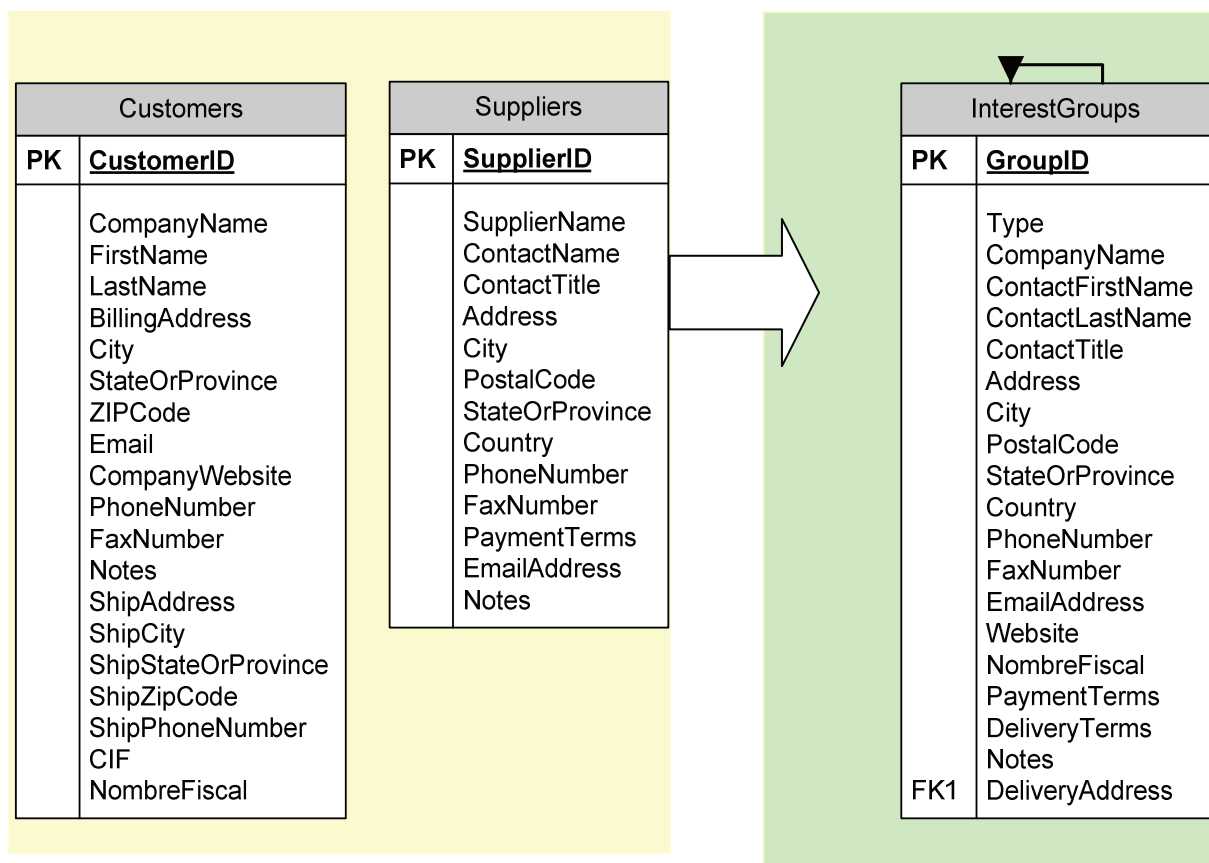


Figure 19 Suggestion for combining contact details

Website information (address) was missing from Suppliers table although nowadays it can be seen as crucial information. These types of little additions were made to the tables. On the other hand, in the Customer table there was no Payment terms field, which is naturally one of the most relevant details for the business. Another important detail is the delivery term. These are usually standard terms such as with former advance payment, 14 or 30 days net and with latter Incoterms 2000 like FOB or CIP. Thus it was considered that separate tables should be added for these terms and related to the Customer and Suppliers tables.

The Customers table had details of one shipment address. If a customer had no shipment address the fields would be left empty, i.e. there would be null values, which would endanger data integrity. On the other hand, if the same customer's address would be inserted again to the shipment address it would mean inserting the same information twice, which would be against principles of creating database. A challenge occurs also if a client, a cafeteria for example, has more than one delivery address in a

different location than the invoicing address. Especially when expanding, it can easily happen that some clients have several branches. As the information in Suppliers and Customers tables are basically the same and regarding the challenge with shipment addresses, it would have been recommendable to form only one table for interest groups (see Figure 19). Just an additional CompanyRole-field could have separated them according to the transaction type such as sales, purchase and delivery. By using the recursive relation, a delivery address could have been a foreign key from delivery address' group ID. The relationship type could have been one-to-many allowing one customer to have more than one delivery address, but one delivery address having only one invoicing address. This could give more flexibility if the business gets new, more complex features when expanding.

TransactionType-table (Figure 20) was added for transactions, and as a temporary solution it was linked just as a field to the separate tables of customers and suppliers. TransactionType-table could naturally be used also with following tables, and the table was added also for the purpose of separating sales and purchase orders and invoices. Thus in the related reports, for example, the transaction type was seen a more informative word.

ID	Transaction	Company Role	Address
1	Sales	Customer	
2	Purchase	Supplier	
3	Delivery	Addressee	
*	(New)		

Figure 20 Adding supporting tables

The client's wish was to keep Customers and Suppliers separate. Thus Structure1 of the database includes this form. However, a database with Structure2 was also formed and delivered to the client. The decision of which database was taken into use and developed further after this project, was naturally left to the client.

5.3.2 Orders

The team had to create a sales order table as there was only a purchase order table. Instead of forming a separate table for sales, EcoAid decided to finally carry another option, i.e. modifying the purchase order table so that it can suit both purchase and sales. The information of the transaction type could be used to separate purchase and sales.

The team preferred this solution as more flexible. The database would be also simpler as one does not create more tables. At first, despite several attempts, the team was not able to create a suitable field to attain supplier OR customer information. The challenge was the query for the row source, which needed to be altered to detect both suppliers and customer's tables.

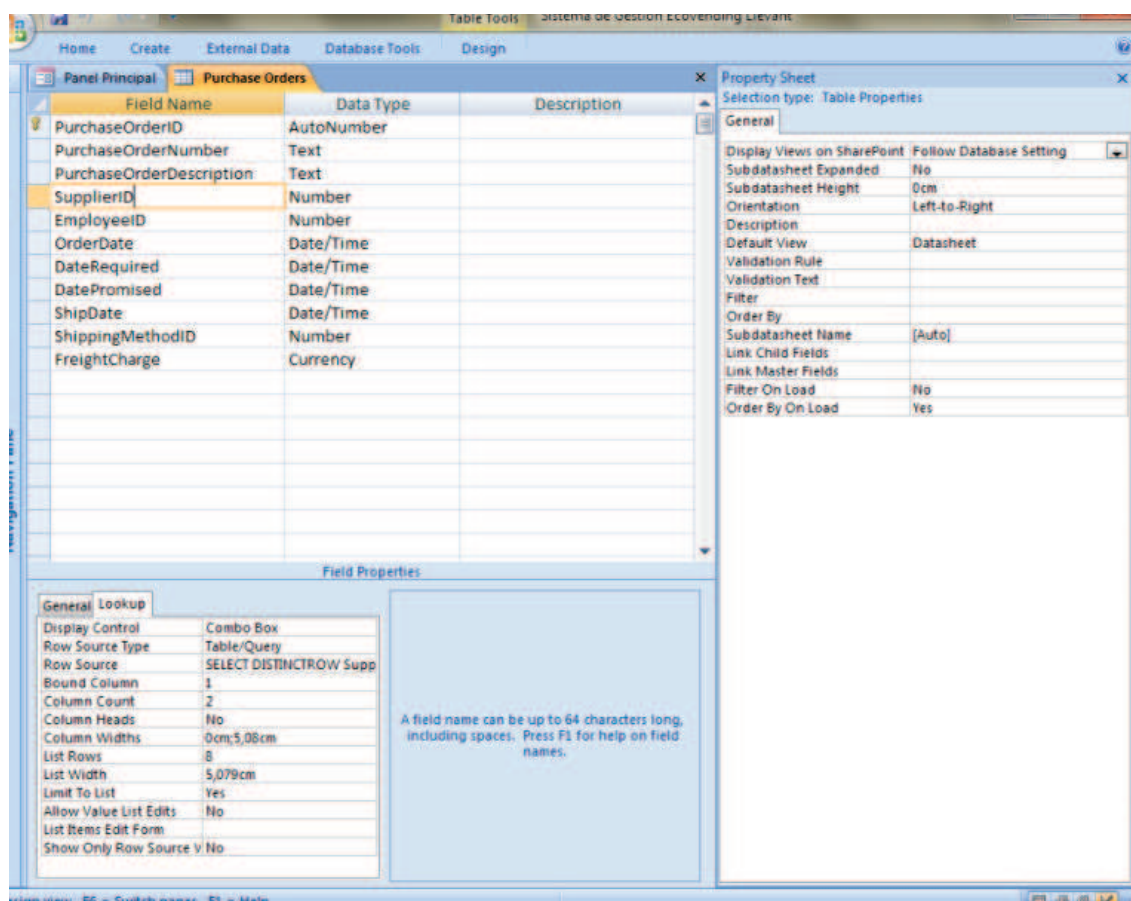


Figure 21 Orders

Due to the failure in modifying the purchase order table to suit both sales and purchase order, the team already formed one version with a separate sales order table. It was made with the same form as the purchase order table, and apart from the supplier/customer field also purchase order table was formed to suit both, so that in future projects the last modification could be done.

Then in the very last meters of the project the solution was found and the restructuring of the database was started all over again to its final version.

5.3.3 Inventory transaction

The Inventory transaction table is the link between orders and products. It presents the rows of an order. In one order there can be many rows but only one order per a row. The product details are brought from the Product table. To one product there can relate many transactions but to a transaction (a row) only one product. These are one-to-many relationships.

In practice, the user inserts what is going on in the warehouse: the bought, used vending machines and parts coming in, and the sold, fixed machines going out. With the help of queries it is possible to follow the stock situation.

The Inventory transaction is also a link between orders and invoices. There must be an order before goods are coming in or going out. After the transaction has taken place, the invoicing is possible. This structure also enables the fact that in one invoice there are rows from different orders (combined invoices) or rows of an order are invoiced separately (partial deliveries).

5.3.4 Invoices

When checking the invoice tables (purchase and sales, in Figure 22) the team noted the same things as with other tables. Data types were used accurately to suit the purpose. No relevant information seemed to be missing.

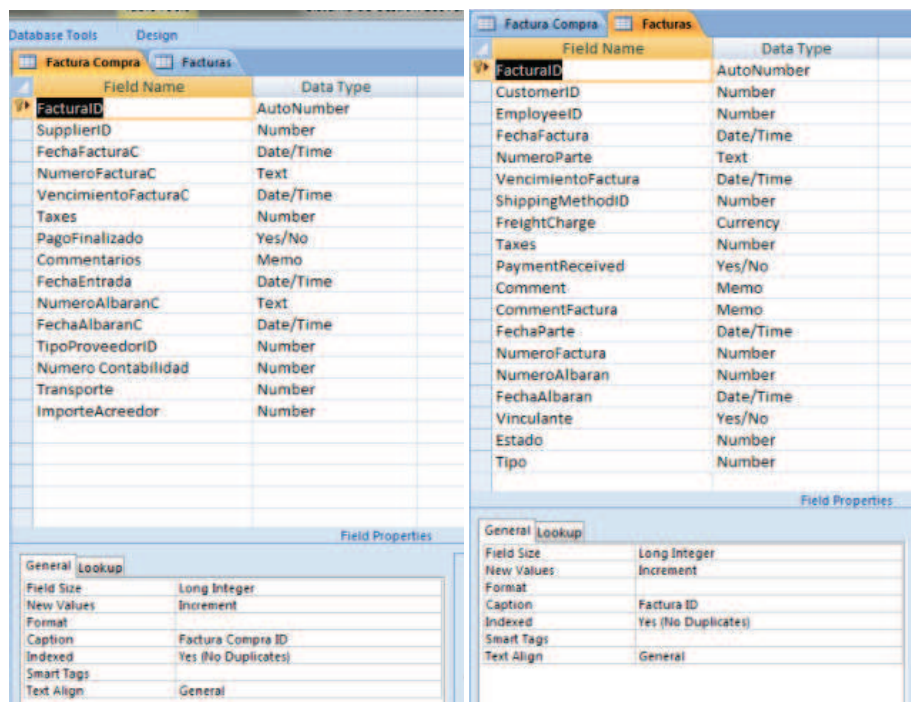


Figure 22 Comparing purchase and sales invoices

SupplierID on the purchase invoice was in a way duplicate information as it was already in the purchase order and could have been linked via inventory, in a way, because it had to be there due to missing relation between inventory and invoices. As originally there was no table for sales orders, the fields and relations of the sales table differed from this part (e.g. CustomerID and EmployeeID)

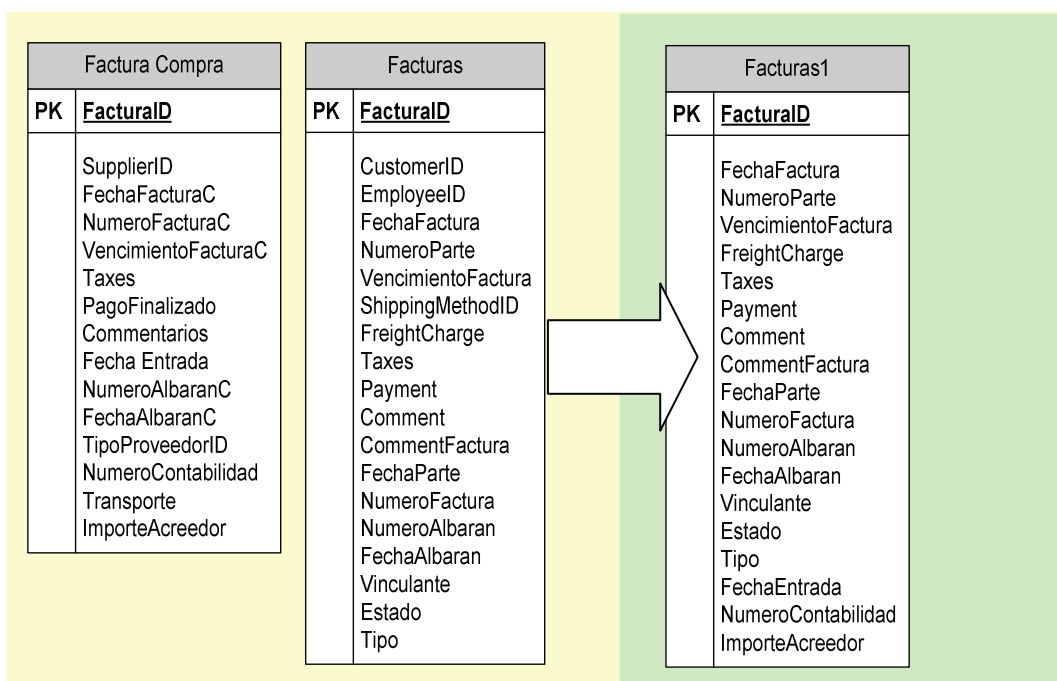


Figure 23 Combining invoices

Before finding a solution to the problem of combining sales and purchase into one order table, the relationships were created between both inventory and purchase invoice, and sales order, inventory and sales invoice. However, after combining orders, and as the fields of invoices were again corresponding, the team adjusted them to suit both sales and purchase and left only the other and modified relationship accordingly.

5.4 More about relationships of the tables

The theory of relationships was described already in previous section 5.3, but as the relations together with tables form a crucial base for the database and its further functions such as queries and reports combining two or more tables, the analysis of the relationships in Ecoventing Llevant's is handled separately under this heading.

5.4.1 Purchase flow

In Figure 24 the purchase flow in the database can be seen. From the Supplier table, the Supplier ID is related to Purchase order table. The relationship is one-to-many as one supplier can have many orders but in one order there can be only one supplier. From the Purchase order table, the order ID is related to the Inventory transaction table, again as one-to-many relation, as one purchase can include many products and deliveries. The Products table is related to Inventory transactions as well: one product can relate to several orders but under one transaction there is only one product. The Purchase invoice (Factura Compra in the figure) is related to the Suppliers table and the details of invoice (Factura Compra Detalle in the figure), i.e. item rows, which again are related to the Products table.

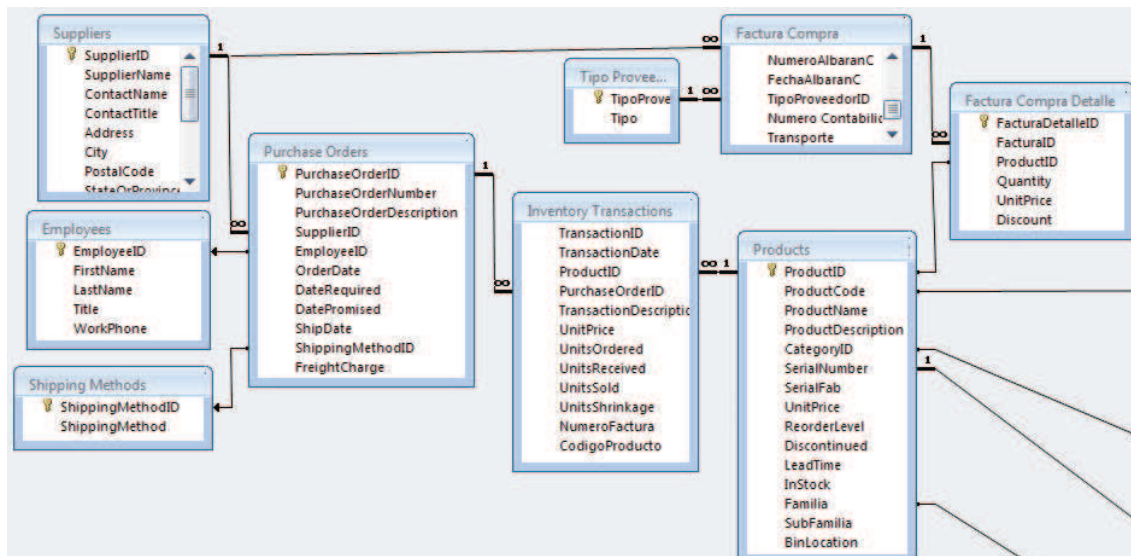


Figure 24 Purchase flow for evaluation in the database

The purchase invoice seemed like an isolated island without link to the purchase flow. In order to keep the flow intact, the invoice rows should come from inventory transaction with one-to-one relation. If the item rows were to be kept separate from inventory transactions, another choice would be to link the purchase order and purchase invoice. This relation should be many-to-many, as in the case of partial deliveries, many invoices might relate to one order, and in case of combined invoices many orders might relate to one invoice. These two choices present two different types of invoicing: order based or delivery based invoicing.

5.4.2 Sales flow

When analyzing the sales flow, some distinct differences could be noticed compared to the purchase flow. The obvious one was that there was no order table, as that was included in the original tasks. However, other facts could also be noted, which can be seen from Figure 25. As there is no order table, the relation from Customers table is straight to the invoice. Unlike with purchase, sales invoice is linked to inventory transactions with one-to-many relation. Invoice rows on the other hand do not have a link to products nor transactions.

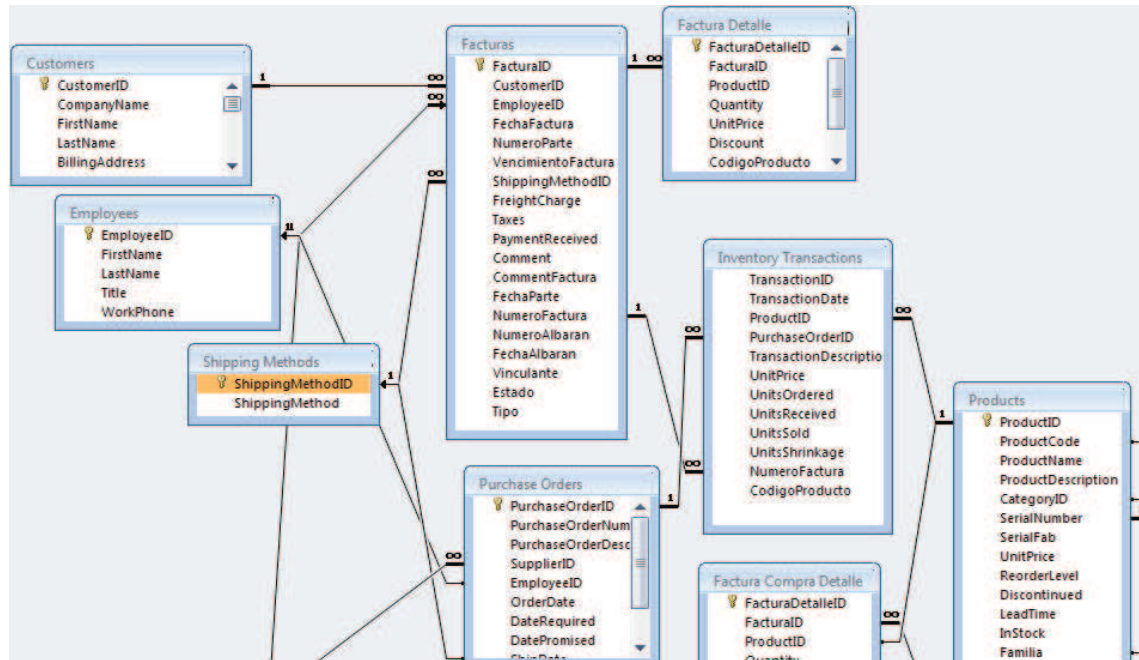


Figure 25 Sales flow evaluation in the database

After forming a sales order or modifying the purchase order to suit also sales flow, the relations should be modified accordingly, in a similar way as in the purchase flow.

5.4.3 Changes made to relationships

Not only were there two separate flows with purchasing and sales, but they also differed from each other remarkably. One of the goals was to simplify and clarify this. The result can be seen in Figure 26 illustrating the tables and relationships, and further explanation follows in the next paragraphs. Only the relationships related to the main steps of the delivery are included in the figures as they are the most crucial ones. The relations of tables including supporting data (such as delivery and payment terms) were not seen so important to illustrate and explain, but of course those tables and relations also had to be formed.

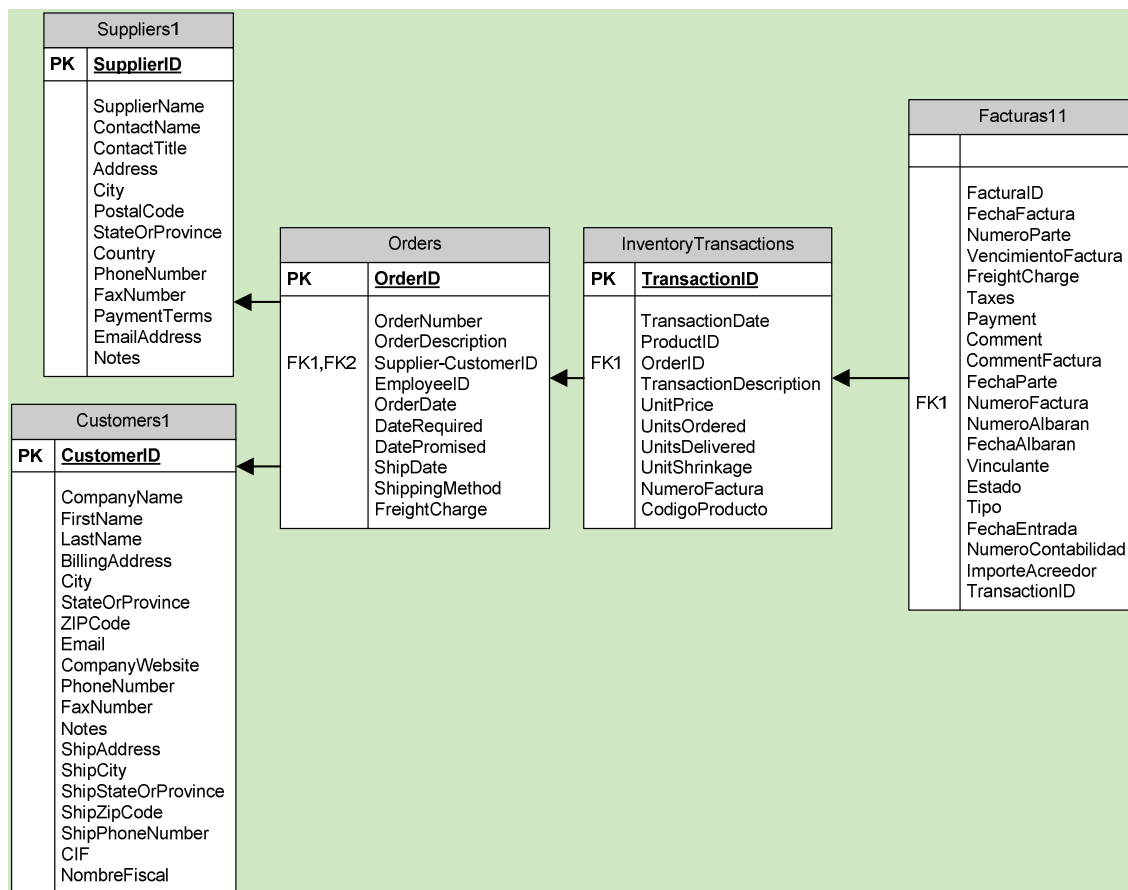


Figure 26 Tables and relationships (Structure1)

The first step was already used by the purchase process i.e. from Suppliers table, CompanyID is related to the order table. The same link was made from Customers table. The relationship is one-to-many as one company can have many orders but in one order there can be only one company.

Also the second relation was already established in the purchase process: from order table, the order ID is related to inventory transaction as one-to-many, as one order can have one or more rows of products and thus many transactions. After making the change mentioned in the previous paragraph, this relation applied automatically also to the sales process.

To relate the invoice to the flow, it was decided to use the model that was used in the sales flow of the original version i.e. a relation from the inventory table. There one invoice can have many transactions, but one transaction only one invoice. Inventory

transactions equal on invoice row. Following the original model the link was done by using the invoice number, which was not the ID, the primary key.

The team saw that one possibility could be to form a relation from the invoice details to inventory as a one-to-one relationship when the inventory row would be corresponding to the invoice row. Sometimes also delivery based invoicing is not possible, for example in case of advance payment. Then the link could be done also from order to invoice as a many-to-many relationship, as one order might include several invoices (partial payments) or one invoice might include several orders (combined payment). Due to complications with many-to-many relations (see section 5.3) this would have needed to be done via a separate table. At this point Ecoventing Llevant did not consider this a crucial point of view.

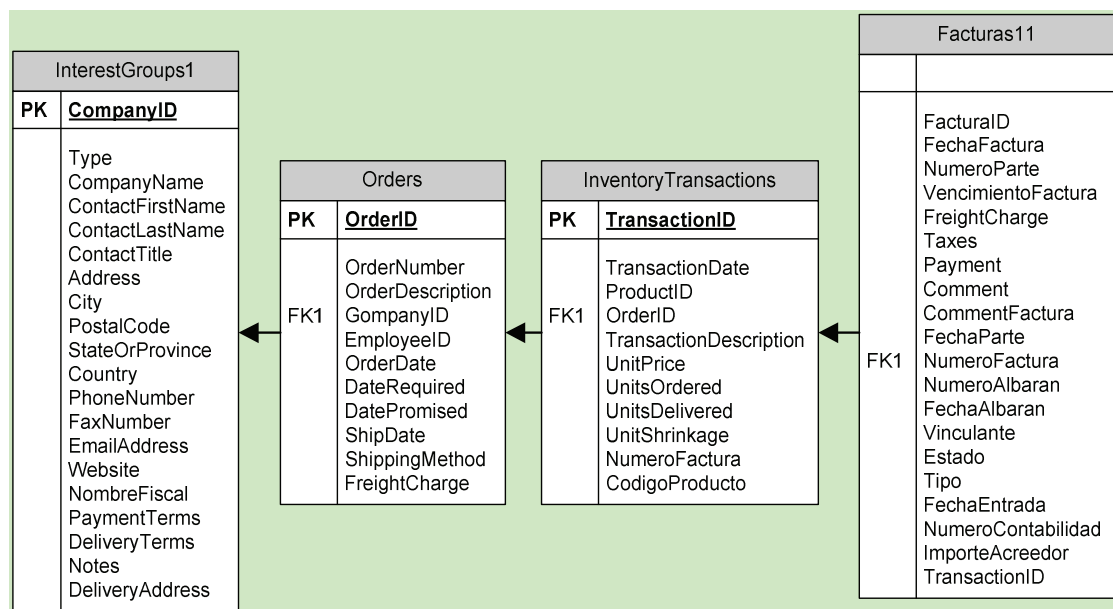


Figure 27 Tables and relationships (Structure2)

The Structure2 in Figure 27 differs in the first step where all the companies are in one table. This makes relations and the flow more straightforward. Through the relations the information of the transaction type (purchase or sales) is also connected to orders, inventory transaction and invoices, and in queries and reports the type can be retrieved.

5.5 Forms

The forms are based on tables as such or done via queries. They are used mainly for entering and viewing data. (Cronan 2007.) A form is the eventual view users work with. With the help of a form the user adds, changes or views data in the database. So in one form, one can edit information in one or more tables.

The first point when designing the form is to decide which table or query is the appropriate record source. Orders and filters used in the source table or query come also to the form. (Andersen 2007.)

Panel Principal Purchase Orders

Order Number:

Order ID: 1 Order Date: 14-12-2010
 Order Number: Shipping Method: UPS Ground
 Suppl./Cust.: Luis Rico Add Ship Date: 14-12-2010
 Employee: Gimeno, Leticia Add Date Required: 14-12-2010
 Description: Some bolts Date Promised: 21-12-2010

Products Ordered

Date	Product	Units Orde	Unit Price	Subtotal
14-12-2010	106	2	\$2,00	\$4,00
* #Name?				

Preview Order...

Record: 1 of 1 No Filter Search

Figure 16 The Order Table

Figure 16 shows how the order form looks like for Ecoventing Llevant. If one wants to make a purchase or sales order, one uses this form.

Every box within a form gives information or allows the user to enter information. When changing information in a box, one edits information in the related table

according to the type of relation. There are many ways in which tables can be changed according to their individual settings.

5.6 Queries

The queries are separate database objects used to retrieve information from the database. It is possible to easily sort, filter and print records in tables too but queries give more flexibility and enable working with multiple tables. It is recommendable to use query when you want to return to subset of records. (Andersen 2007.)

Besides Access wizards, queries can be made by using SQL, which is a Structured Query Language. The language includes following elements:

- Data Definition Language (DDL) with commands create, alter and drop.
- Data Manipulation Language (DML) with commands insert into ... values, update ... set and delete from
- SQL with commands "select ... from ... where"

SQL became useful when a query wizard was inadequate. It was used already when bringing information from the existing tables to the other ones.

5.7 Reports

The reports are used for printing documents such as orders or invoices sent to customers or even annual reports or other documents kept for files for revenue service/agency. Reports can be formed based on tables or queries. (Andersen 2007.)

5.8 Documentation and managing the changes

When more than one person is working with a project, documentation can already become challenging. In companies this problem is often moderated by using shared servers and clear instructions for document updates. Also EcoAid saw a cloud server as a useful tool. It provided everybody, including the team members and the principal, access to the latest versions of the documents and the system. The new versions were saved under a new name in order to keep the earlier work and solutions.

A continuous documentation was made. Screenshots were taken to help comparisons and analyses. Visio was used as a tool for creating optional process flows and charts of the database at the planning stage. When carrying out the actual changes, a list was formed including the date when the change was made, object type (table, form etc.), object name, field name and description of the changes, whether there was a need for testing and when the testing had been completed. A list with the summary of the changes was also provided to the principal. With the help of it the principal could be on the top of the status of the database, and it could be used to help further testing and developing.

6 Conclusion

The project was an interesting real life task from a small Valencian company for a team of students. The assignment included four totally different parts, one of which optional. By carrying out the tasks, the team could reach its goal to help the company to smoothen their processes and to expand their business. There were many barriers to the project success, but also success criteria.

In order to be able to work on the project the team had to divide the tasks. In defining stage the project tools such as organisations chart and WBS were used. The defining stage was familiar to all the members of the team and was carried out very smoothly and thoroughly.

At the planning stage the tasks were defined more detailed and scheduled on GANTT chart. It was realised that the project was challenging because it was both time and resource constrained. The exchange study period, i.e. 4 months was all the time that was given and there was no chance to prolong it. It also turned out that the assignment had been somewhat misleading on the ERP part and this created another challenge. It was obvious that the task would have required more background information from the team members. However, resources were given and limited, and there were no opportunities to influence this. It was good that this was realised and the project scope was made flexible on this part. Thus planning was good and the expectations realistic.

When carrying out the project there were some obstacles. A surprising and real bottle neck came in finding study material in English. As the team members were not so in-depth familiar with Access, this remarkably slowed down the study of the theory and working with the program. The influence was realised right away and reported to the customer and supervisor, and the situation was just accepted. Thus it was not possible to meet the original schedule and it was revised with the expense of scope, again. The project team met also other obstacles when a theft of one computer caused losing some material. Another laptop broke down just when preparing the final versions and presentation. In this case careful backup was crucial. These challenges probably were one reason for reduced commitment of some team members and caused unequal work

load to the others. This was also reported, and accepted. Thus it could be stated that also the project management and management interference was inadequate.

The follow-up and evaluation during and after the project were good. The team meetings were held on a regular basis and they were valuable occasions for status updates.

Also, although there were some clear weaknesses and threats realized, in the end the customer was very pleased with the results. The strengths came up for example in process description and documentation. These on the other brought new points of view to the company regarding their business, processes and the program.

Regarding the database, the work had to be finished prematurely. However, the careful analysis and documentation of the database already gave tools for the customer for further development. Also four optional versions were structured with the recommendation which could be the best one. Actually the customer also agreed to the recommendations although it was basically an "additional" version provided by team because the idea was rejected by the customer at the planning stage. The team gave further recommendations to test the database and to develop forms and reports further according to new structure.

In conclusion, the results of the database task were the description of the company's delivery process, analysis of database structure, revising database structure and forming four different versions of it, one of which was recommended for the client, further recommendations and documentations of all the parts and steps done. Also the two other tasks were accomplished successfully and lead to clear and complete analysis of the market for the company and new, international suppliers and customers.

References

- Andersen, Virginia. 2007. Microsoft Office Access 2007: The Complete Reference. [e-book] McGraw-Hill Professional Publishing. URL <http://www.ebrary.com> Accessed November 2010
- Cooper, Rob. 2008. Expert Access 2007 Programming. Wrox. [e-book] URL <http://www.ebrary.com> Accessed December 2010
- Cronan, John. 2007. Microsoft Office Access 2007: QuickSteps. McGraw-Hill Professional Publishing. [e-book] URL <http://www.ebrary.com> Accessed October 2010
- Ecovending Llevant, 2010: [online] Ecovending Llevant. URL <http://www.ecovendingllevant.es> Accessed 15.10.2010.
- Ecovending Llevant, 2010: [online] Ecovending Llevant. URL <http://www.ecovendingllevant.es/servicios.html> Accessed 15.10.2010.
- Ecovending Llevant, 2010: [online] Ecovending Llevant. URL http://www.ecovendingllevant.es/cat_caf_nec.html Accessed 15.10.2010.
- Geert Hofstede, 2011: [online] Geert Hofstede, Hofstede Dimension Data Matrix. URL <http://geerthofstede.nl/research--vsm/dimension-data-matrix.aspx> Accessed 10.03.2010
- Gimeno, Leticia. 2010. CEO, Ecovending Llevant, Valencia, Spain. Presentations 2010.
- Gimeno, Leticia. 2010. CEO, Ecovending Llevant, Valencia, Spain. Conversations 2010.
- Gimeno, Leticia. 2010. CEO, Ecovending Llevant, Valencia, Spain. E-mail correspondence 2010.
- Gray, Clifford F., Larson, Erik W. 2008. Project Management, The Managerial Process. McGraw-Hill Companies.
- Ignacio, Jose. 2010. Outside recourse of Ecovending Llevant, Valencia, Spain. Conversations 2010.
- Ignacio, Jose. 2010. Outside recourse of Ecovending Llevant, Valencia, Spain. E-mail correspondence 2010.
- Lester Albert. 2007. Project Management, Planning And Control.
- McConnell Steve. 1998. Software Project Survival Guide. Microsoft Press.
- Murthy C.S.V. 2007. Enterprise Resource Planning and Management Information Systems: Text and Case Studies. Global Media [e-book] URL <http://www.ebrary.com> Accessed October 2010