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FINAL THESIS REPORT

KNOWLEDGE, INFORMATION AND QUALITY IN ORGANIZATIONS

CASE: DEVELOPING AN INTEREST GROUP INFORMATION DATABASE FOR TAMPEREEN LOGISTIIKKA

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Abstract

The project of developing an interest group information database was initiated by the client, Tampereen Logistiikka, as they felt the need for a centralized interest group information and feedback management tool. The theoretical framework of the relationship between knowledge, information and quality in organizations was formed, as the issue became topical during the project.

The aim of the work was to design a database system and user interface for managing interest group information and sent and received feedback. The feedback system was also going to be implemented as a part of the quality management system of the client. The aim of the thesis was to show that knowledge, information and quality in organizations are interlinked with each other, and that database system development is related to the overall organizational information and knowledge practices.

The project starting point was outlined by researching contemporary literature and other written material in the field of database development. Several client interviews and group discussions were carried out throughout the project to define the scope and requirements. As the work progressed, material from the fields of knowledge, information and quality management was included to form the theoretical framework.

By the end of the project the pilot version of the database system was finalized and brought into production. Further development of the system is likely to take place in the future. As a result of the literature study, it can be concluded that good information and knowledge management practices are a requirement for high quality in organizations.

Keywords: database, information, knowledge, management, quality

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1 Introduction

The thesis studies the relationship of knowledge, information and quality in organizations and how database system development is related to the overall organizational information and knowledge practices. The thesis is formed of two parts: The first part looks at knowledge, information and quality in organizations from different perspectives. The second part presents the documentation of the practical development process of the interest group information database system at Tampereen Logistiikka, the client.

The theoretical perspective was taken to show that good information and knowledge management practices are a requirement for achieving and maintaining high quality in organizations. The aim was also to demonstrate that database system development is closely related to managing information and knowledge, and thus to the overall business processes, including quality.

The document is organized as follows: The chapter two describes the working methods used in the final thesis. The chapters from three to seven discuss the different aspects of knowledge, information and quality in organizations, the challenges they hold and solutions to overcome them. The chapter eight documents the database system development process that took place at the client and discusses the different characteristics that affected the design process and the outcomes. Finally, in chapter nine, the overall conclusions of the thesis are drawn.

2 Working Methods

The theoretical frame work of the thesis was formed with the support of literature and previous studies in the fields of knowledge, information and quality management. The theoretical discussion was elaborated with the experiences of the writer gained from working life and business studies.

Literature and other written sources were also used in the practical database system development work, firstly, to perceive the entire design process flow and, secondly, to answer specific technical questions. Also some consultant support was used toward the end of the project in technical matters that could not otherwise be solved.

Several interviews and group discussions were conducted to collect the requirements and define the scope of the database system. After all the participating stakeholders were interviewed, the findings were summed up and discussed again in groups. This process was repeated until all the participants agreed on the overall data and processing requirements for the system. Throughout the project the requirements were analyzed, changed and tuned until they were refined and finalized.

The actual implementation of the database system was conducted in close co-operation with the client. The contact persons at the client site were consulted with in numerous phases of the implementation process. The stakeholders also took part in testing the application during its development. Modifications were made to the application along the way, until the first pilot version was finalized.

3 The Knowledge Organization

To understand the concept and relationship of knowledge, information and quality in organizations the nature of an organization as a knowledge, or learning, organism needs to be looked at. The background of knowledge management (KM) and the concept of the *knowledge organization* lie in the economical and technological development of the society. Since the Second World War the society has strongly moved from the bureaucratic and hierarchical structure towards a knowledge economy. (Bennet & Bennet, 2001, 3.)

Up until the seventies the workplace was a bureaucratic institution that was lead from top down. The employees had little say in the decisions being made by the management. It was commonly thought that knowledge is power and, therefore it was not beneficial to share it with the employees. Slowly, due to the increased interest in management and organizational theory research, the management styles shifted from bureaucratic towards participative management, where the employees started to gain empowerment and responsibility at the work place. (Bennet & Bennet, 2001, 3.)

Due to the general economic growth and the development of information and communication technologies the expectations and mobility of employees started rapidly to increase by the 1990's. It was evident that the organizations could not go on as they had used to but they were more or less forced to change their thinking, or cease to exist. Information and knowledge organizations started to form. Through utilizing the computers and communications technology organizational networking, knowledge creation, sharing and application started to thrive. It was no longer enough for the workers to merely complete a given task at a give time; they wanted to be part of the decision making, to be respected and listened to. (Bennet & Bennet, 2001, 3.)

Currently, it is common for thriving knowledge organizations to aim at making their decisions at *the lowest qualified level*. In order to achieve this, an organization must provide their employees with empowerment, shared vision, clear values, strong organizational direction and purpose, not to forget open communication. In order to make good decisions, employees also need to have a good understanding of the entire context their decision has an effect on. (Bennet & Bennet, 2001, 6.) As will be

discussed in the later chapters, the challenges in achieving this are various and the efforts in turning a business into a knowledge organization often do not produce the desired results.

Common characteristics of a knowledge organization include the focus on flexibility and customer response, using the ideas and capabilities of employees to improve decision-making and effectiveness, utilizing technology to support and liberate employees, maximizing the added value by minimizing waste in processes, as well as emphasizing knowledge sharing and balanced decision-making in teams (Bennet & Bennet, 2001, 7).

3.1 Managing Knowledge

As organizations started to transform from their hierarchical, bureaucratic setting towards knowledge based culture, a new field of study, knowledge management, emerged in the 1990's. Along with the more complex markets and the globalised market place, which resulted largely from the rapid development of communications technology, stemmed the need to better understand knowledge organization, utilization and sharing. (Bennet & Bennet, 2001, 3.)

As knowledge management as a field of study became more widely recognized, different views of what it actually is and how it should be practiced emerged. Therefore, the definition varies somewhat from one researcher to another. Nevertheless, the common view is that knowledge management is the management of the organizational and individual knowledge resources.

According to Levinson (2010) the core of knowledge management is how knowledge can be used to generate value to the organization. On the other hand Edwards and Wolff (2008) see it a set of tools to transform tacit (soft) knowledge into explicit (hard) knowledge.

The Emerald Guide's Introduction to Knowledge Management (2005) is along the same lines with Levinson, as it defines knowledge management as the ability of an organization to capture and apply knowledge and to develop it at an organizational and

people level. It is not only about managing existing knowledge but also about creating new knowledge and sharing it. Effectively managing knowledge can lead to continuous organizational development and higher quality solutions. (Introduction to Knowledge Management, 2005.)

Bennet and Bennet (2001, 7) see knowledge management from a more human perspective: They see it as the awareness and appreciation of the employee knowledge as well as constant search for better ways to create, store, integrate, tailor, share and make available the right knowledge to right people at the right time. In the following chapters these views are elaborated from both process and human perspectives.

3.1.1 Information vs. Knowledge

To discuss the concept of knowledge it is necessary to discuss what knowledge is and how it is generated. There are, again, many views between authors about the essence of knowledge and how it differs from information. Here a few of them are discussed. They all approach the topic from a different angles but the core thinking remains the same.

Firestone and McElroy (2005, 197) see information as a non-random structure indicating interactive future potentialities. According to this view information does not require correspondence with its environment to exist. However, when evaluating whether the piece of information is true of false, the most important aspect of it is its correspondence with reality. (Firestone & McElroy, 2005, 197.)

The importance of the information itself can be evaluated by how it influences the behavior of its users. Only when information is evaluated and tested against its surrounding environment does it become knowledge. Therefore, knowledge is the tested and survived structure of information. (Firestone & McElroy, 2005, 197.) In short, knowledge can be created from information but information alone without any relationship to reality or context is irrelevant and cannot be turned into knowledge.

Bellinger (2004) describes knowledge creation as a continuum starting from data, which is purely a piece of data that has no relation to the surrounding world. The second layer is information, which consists of the pieces of data that have a relation with each other

and the context they are presented in. The third layer is where information has the potential to become knowledge: information forms patterns, which – if they are correctly perceived and understood – turn into knowledge. The patterns then create their own context: they are complete and consistent in themselves. (Bellinger, 2004.)

Turning data into information and information into knowledge is dependent on the person using it. If the user of the data does not understand the relationships between the pieces and their meaning in a wider context, information cannot be formed. And if the user cannot realize and understand the patters the information forms, knowledge cannot be created. Bellinger (2004) draws a conclusion that information relates to the description, definition or perspective (what, who, when and where). Knowledge, in turn, constitutes strategy, practice, method or approach, that is: how.

While the first theory of Firestone and McElroy (2005, 197) focuses on the true/false side of information and its evaluation against reality as a criterion for knowledge, Bellinger's theory (2004) does not distinguish between what is valid information and what is not. It rather sees that any information can turn into valid knowledge, if it is utilized correctly and its patterns in their context are realized and understood.

Grönroos (2004) has a more practical view: Where as information represents facts, numbers, reports and statistics, knowledge is considered an effective tool, which helps survive in today's unstable environment. To be useful, information must be transformed into knowledge, which can then be applied in different practical situations to potentially produce high quality results. (Grönroos, 2004, 84-86.) In other words, knowledge is created within an individual and is frequently considered actionable (Bennet & Bennet, 2001, 3-4).

These theories can also be derived to the environment of a database system: a database exists at the level of establishing relations between pieces of data, thus forming and storing data and information. It is only the end users who can turn this information into knowledge by utilizing it both at an individual level and through organizational practices and processes. The database is there to support the collections of data and information that have the potential to be turned into knowledge.

3.1.2 Explicit, Tacit and New Knowledge

In the field of knowledge management, knowledge is generally divided into three types: explicit, tacit and new knowledge. Explicit knowledge is something that can be understood without much further explanation. Tacit knowledge requires experience and insight to the topic. The word tacit means something that is hidden, or beneath the surface, and often is difficult to capture and transfer from one person to another. (Grönroos, 2004, 87.) New knowledge, on the other hand, can be either tacit or explicit.

Databases are often full of explicit knowledge that can be interpreted and used without much further guidance or elaboration. In a way this is true: everybody can understand from a customer record that the customer's telephone number is such and such or that they were contacted on a certain day and a certain topic was discussed. This is explicit knowledge; an outsider with elementary understanding of information systems and organizational operations can understand this.

On the other hand, an experienced user or a member of an organization can interpret substantially more from the same customer record. For example, he or she can find a deeper meaning in the fact that there *had* been contact with this particular client during a particular time. The information can for instance be used in future contract negotiations, or in the upcoming marketing initiatives. On the other hand, an entirely missing record can mean that something should be improved. This is where the explicit knowledge has the potential to turn into tacit.

The main reason for seeking new knowledge is to prevent an organization from getting caught with the old ways of operating. If an organization operates on the basis of old, outdated knowledge, it may be very difficult to remain innovative and keep continually improving, which is important in the competitive environment today's businesses face. It is said that the main reasons for not seeking, or even actively resisting, new knowledge and new ways of operating are the fear of failure and the fact that the new knowledge may go against the beliefs or values of the decision makers. (Desouza & Awazu, 2005, 28.)

3.2 What is there to be gained?

According to Bellinger (2004) knowledge management efforts can enhance the ability and capacity to deal with what the organization is trying to achieve, how it responds to competition, what the quality of the results is and how it manages change. Higher level of innovativeness can be achieved, as the employees have been authorized to make independent decisions and modify their working patterns as necessary. This can lead to better, leaner processes and better customer orientation, as the workforce is able to focus on the task at hand and adapt as the situation requires.

The value of knowledge management can be measured by the effectiveness with which the members of the organization are enabled to deal with situations today and envision those of tomorrow (Bellinger, 2004). In addition, a robust knowledge management practice can help the organization to capture the knowledge "*before it walks out the door*" (Edwards & Wolff, 2008), that is, before the resourceful, experienced employees leave for the organization.

To give a clearer image of the bottom-line benefits of knowledge management initiatives, they can be presented in a tree form showing them at different organizational levels. Skyrme (2009) has synthesized the tree below of three separate situations to highlight some commonly found benefits (Figure 1).

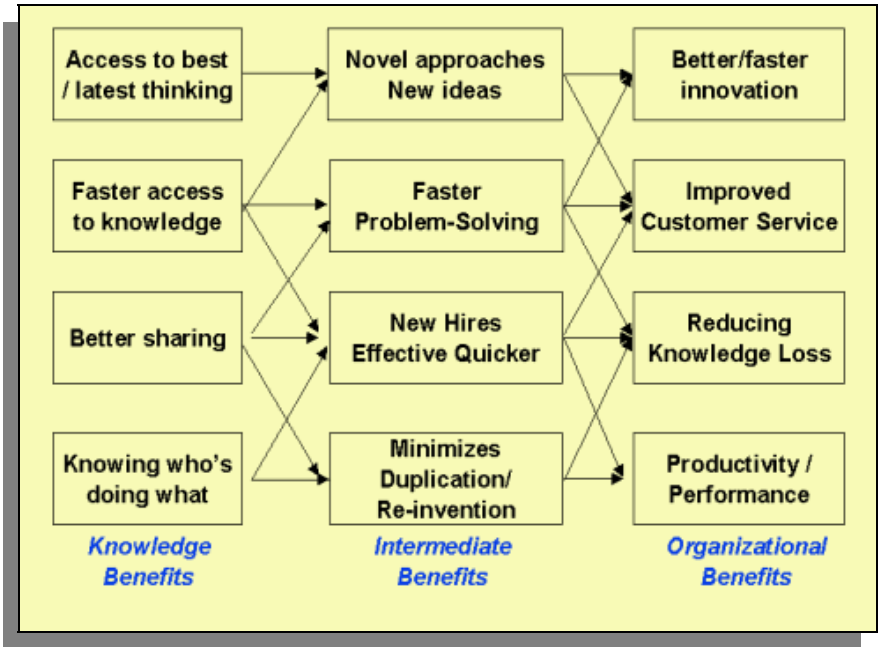

Figure 1: An example of a benefits tree (Skyrme, 2009)

The arrows of the tree indicate the relationships between different benefits. The benefits on the left hand side are the most visible or quantifiable. Those on the right are a combination of different factors and may include benefits gained from factors other than knowledge management alone. In general, the *Knowledge Benefits* in the figure result from more efficient processing of information and knowledge, such as eliminating duplicate effort. The *Intermediate Benefits* represent the ones expressing efficiency or effectiveness resulting from improved processes, for example. The *Organizational Benefits* have an impact on the overall organizational goals, such as a better level of customer service. (Skyrme, 2009.)

Measuring the exact value of a knowledge management initiative can be difficult, as it can often be a project where the cost is visible but the benefits are scattered between different organizational units (Skyrme, 2009). A successful knowledge management initiative can facilitate an empowered work force, good level of communication and innovative processes. This in turn helps reach an overall agile organization that is able to face the demands of the highly competitive, globalized market place and deliver more value to its customers.

3.3 The Significance of Intellectual Capital

It is said that intellectual capital is far more significant to an organization's future prospects than are its financial assets (Grönroos, 2004, 33). Grönroos (2004, 33)[1] presents a division of intellectual capital into six different dimensions: the *human, structural, customer, organizational, process* and *innovation capital*. In addition to these, an organization has its financial capital. Together these form the organization's market value.

Human capital comprises of the education the organization's employees possess, their personal skills and individual characteristics (Grönroos, 2004, 34). In essence it can be said that the human capital equals the human resources of an organization. Human capital is intangible in every sense: it cannot be owned by the organization. And as soon as the employee leaves, the knowledge they carry with them will leave too (Grönroos, 2004) unless it has been turned into explicit knowledge by capturing it in a tangible

[1] Original source: Leif Edvinsson

knowledge base. The human capital forms the corporate or organizational culture as well as its philosophy and values. Even though the management has a crucial role as a facilitator in building and supporting an organizational culture, according to Grönroos (2004, 35) it is in the hands of the employees to either support or extinguish it.

Structural capital refers to the hardware, software, databases, organization structure and intellectual property rights resulting from effective use of the human capital (Grönroos, 2004, 35-36). For example, databases can be collected using the information employees possess and produce in their daily work. As Grönroos (2004, 36) points out, these databases can become crucial to the operations of the organization containing information on the customers, processes, and production statistics and so forth. Again, these databases full of information can be used to create knowledge with which to handle day-to-day situations and prepare for the future ones.

Customer capital consists of clients and their buying habits. According to Grönroos (2004, 37) it is six times more expensive to get a new customer than keep an existing one. This explains rather clearly why maintaining the existing customer base is so important to organizations. Especially in today's environment it may not be wise to rely on a few key accounts but rather have a wide network of clientele (Grönroos, 2004, 37).

Organizational capital entails the internal sources of competitiveness. Thus the management needs to have the capacity to steer the organization towards continually renewing business processes, so it can achieve innovative results (Grönroos, 2004, 38). This notion is not far from the quality management term *continuous improvement*, which aims at the company being on the move towards better quality at all times. Grönroos (2004, 38) uses the work *stagnated* to describe an organization that is not renewing, and thus not an interesting option to the investors in the market. Stagnated can also be used to describe an organization that has given up or in no way even realized ways to promote continual improvement.

Process capital is closely related to the organizational capital but is more precisely described as the *effectiveness of internal procedures*, which all have a great impact on the competitiveness of the organization (Grönroos, 2004, 40). Here, the emphasis is on the importance of value producing processes, where the customer perspective is always

present. It can be seen that the management of process capital and quality go hand in hand: If the process capital is high and the processes are innovative and value producing, it can be assumed that the end result of that process is of high quality too. Despite its apparent benefits to an organization, too effective processes can have serious drawbacks that include out rooting individual brainwork from the daily procedures. When carried to the extremities, this will have a negative impact on the motivation and innovativeness of the employees. (Grönroos, 2004, 42.)

Innovation capital refers to the system's ability to renew itself. According to a research conducted by Booz-Allen & Hamilton (Grönroos, 2004, 42), it was discovered that the most successful companies in the long run were the ones that were able to commit themselves to being the absolute best, make rapid improvements as necessary, and had a motivated workforce and proactively looked for growth. One of the main challenges in achieving these goals is said to be the fact that knowledge itself cannot be managed; only the systems and processes that contain it (Grönroos, 2004, 45)[2].

Together these forms of intellectual capital constitute the organization's ability to remain agile in the demanding global conditions and respond to competition. It may also be seen that if an organization utilizes a high volume of intellectual capital in their daily operations, they are already producing and working with high quality solutions, which is one of the central purposes of knowledge management.

[2] Original source: Josef Hofer-Alfeis, Siemens Corporation

4 Knowledge Management Challenges

Donna Edwards and Jim Wolff (2008) conducted a research that identified some of the most common issues with knowledge management programs and implementation. The results of the study and some other usual knowledge management challenges are discussed in the following paragraphs. The common challenges include people issues, managing information, information overload, collaboration and knowledge sharing, documenting critical processes, exploiting new opportunities, decision making, as well as managerial engagement. In essence, these issues are common and relevant to organizations even if they were not actively engaging knowledge management activities.

Addressing people issues

Since knowledge is within people, addressing people issues is crucial for successful knowledge management initiatives. This is especially true what comes to managing tacit knowledge. The issue can be broadly divided into three aspects, the assimilation, development and retention of employees. (Edwards & Wolff, 2008.)

At the assimilation phase, when an employee has just started with the organization, it is important to ensure that the orientation runs smoothly and that the new recruit has an access to and is encouraged to use the knowledge and information resources available. These can include knowledge bases, knowledge-exchange session, tutoring or other methods of knowledge sharing. (Edwards & Wolff, 2008.)

As employees usually expect a level of development during their careers, it is important that it is facilitated, as their skills, abilities and responsibilities increase. According to Edwards and Wolff (2008) proactive and sustained development of employees will help ensure that their intellectual power is used and that it keeps providing value to the organization. This can be facilitated, for example, with long-term development plans and opportunities, which helps both develop and retain employees. (Edwards & Wolff, 2008.)

Information management and overload

According to Edwards and Wolff (2008) the main information management challenge is the array of different information formats that the users need to access in their work. While this is true, another common issue is that the information needed simply is not available to be retrieved. Both sides of the issue stem from the processes and tools used in organizations. The challenge can be aided by effective information and records-management systems, which can also ease information transfer and knowledge capture, providing that there is a broad management commitment to collaboration and knowledge sharing in place. (Edwards & Wolff, 2008.)

The risk of information overload is topical in today's environment, since information is everywhere. The information and communication technologies provide the means to access virtually any amount of information in a matter of seconds. It is evident that this can cut both ways: too much information can cloud the potential knowledge that could be formed of the information was it put the right context (Edwards & Wolff, 2008). Therefore, it is central to distinguish the meaningful and useful information and present only the necessary to the users.

Collaboration and knowledge sharing

Fostering collaboration and encouraging knowledge sharing are some of the most central challenges that knowledge management practitioners must face (Edwards & Wolff, 2008; Grönroos, 2004). These issues are closely related to the concept of intellectual capital of the organization and the people issues that were addressed earlier in the document.

According to Edwards and Wolff (2008) attempts to build a knowledge sharing culture are often impeded by challenges from within the workforce. This may stem from the lack of willingness to share knowledge that has been acquired possibly through years of experience. It may also be that employees resist change and sharing their tacit knowledge in the fear of possible process changes, production speed ups or even job eliminations (Summers, 2009, 186).[3] There may also be organizational inflexibility,

[3] Timothy Aeppel, "On the Factory Floors, Top Workers Hide Secrets to Success," The Wall Street Journal, July 3, 2003.

which affects negatively on the forming of a knowledge sharing culture. In order to successfully create a learning organization it is necessary to show the employees how knowledge sharing can benefit them so that it does not turn into another time consuming chore. (Edwards & Wolff, 2008.)

There are many software tools in the market to facilitate knowledge sharing. Therefore, there is a risk that the practices are reduced to merely delivering the right information to the right people by using software tools (Firestone & McElroy, 2005, 197) instead of focusing on the people, who possess the knowledge. Edwards and Wolff (2008) see that people are the most important knowledge asset an organization can have, and therefore that should be the driving force when systems, processes and tools are developed, and not other way around.

Documenting critical processes

Documenting the critical and other processes in organizations is essential to the operations, especially when unexpected situations take place. It is usual that only a few people within an organization know how a certain process should run and how it is executed. Problems may occur in situations, where those people are unavailable to conduct their usual tasks. This is where documentation, such as process descriptions and guidelines, becomes crucial. The more critical the process or task is, the more carefully it should be documented. (Edwards & Wolff, 2008.)

The common issue with documenting the critical processes is that it requires a lot of input and experience in the given process to be able to produce documentation that is both reliable and cost efficient. This is where different software tools can become very useful as central repositories of information that is accessible to the employees and that are easy to maintain, as necessary. (Edwards & Wolff, 2008.)

Exploiting new opportunities

In their document Edwards and Wolf (2008) discuss exploiting *global* opportunities but the matter can be derived to the *local* setting as well. In this case it seems to be more appropriate to view the issue from the local perspective rather than from a global one.

It is said that knowledge management can enable organizations to exploit business opportunities in new territories and to adapt the skills base according to the needs of different regions (Edwards & Wolff, 2008). This is also true nationally, for example, when an organization is looking to strengthen their market position in new business sectors or national regions. Again, this goes back to the innovativeness and high quality processes of a learning organization. Looking for new knowledge is important, as without it, it is difficult for an organization to grow and flourish, as was discussed earlier in the document.

Supporting decision making

In order to enable and empower employees to make good and informed decisions an organization needs to ensure that reliable information is rapidly accessible, when necessary. A resourceful employee can then fast turn this information into knowledge and act on the situation with the best of his or her abilities. By enabling good and fast decision making new opportunities can be exploited and innovativeness can increase. Here different information systems, such ERP (Enterprise Resource Planning) and KM tools can be used to facilitate information transfer as well as reduce cycle times. (Edwards & Wolff, 2008.)

Managerial engagement

As with any organizational project, one of the key success factors in knowledge management initiatives is management support and engagement. Without the support of the management the project often lacks leadership, planning and direction (Edwards & Wolff, 2008). This is especially true what comes to projects, where change is present and thus often applies to knowledge management efforts too.

The more change is involved in a project the more important it is to ensure that leadership is engaged throughout it. The lack of managerial engagement and sponsorship are one of the common reasons for business project failures and it can show in many ways, including:

- Lack of clear links between the project and the organization’s key strategic priorities

- Lack of skill and proven approach to project and risk management
- Lack of clear communication and understanding between stakeholders (Lever, 2008)

Change management is an important part of the overall managerial engagement. The Prosci Change Management Learning Centre conducted a study with over 900 companies and concluded that change management is a necessary component for any organizational improvement project that includes change in the processes, technology or the organization itself. (Change management..., 2010.)

Change management is a set of processes and tools to manage *the people side* of the change. A major reason for applying a change management program in a project is to manage resistance among employees and managers, which in itself is a normal reaction but when persistent can form a threat to the entire project. Therefore, the change management team needs to identify, understand and manage change throughout the organization. (Change management..., 2010.)

5 The Relationship of Knowledge and Quality

Quality is often defined from the customer perspective, for example, as *customer performance requirements*. Some quality management professionals see quality as *conformance to requirements* or *fitness for use.* Others find that quality itself is *defined by customers*: what customers see as quality is quality. According to the quality advocate Philip Crosby (1926-2001) effective organizations understand the importance of determining customer requirements as clearly as possible, and then offering products or services that conform to the requirements, as determined by the customer. (Summers, 2009, 43.)

The topic of how knowledge and quality affect each other can be approached from the performance gap perspective: A performance gap exists, if there is a difference between where the organization currently is in relation to its performance objectives and where it wants to be (Oliver, 2008). According to Oliver (2008) this gap can only be closed through better understanding of processes and new knowledge acquisition, which can then be used to make more informed decisions and promote improvement and change.

Keeping this in mind, the following paragraphs look at the relationship of knowledge and quality from two perspectives: Firstly, the results of a study researching knowledge management practices in ISO certified, quality focused organizations are discussed. Secondly, how customer knowledge can be leveraged in order to improve quality is examined.

5.1 Knowledge Management in Quality Focused Organizations

A study was conducted by Judy Oliver (2008) researching the knowledge management practices in quality-focused organizations to support continuous improvement. The research was conducted among over two hundred and seventy Australian ISO 9000 certified organizations. The respondents were either quality or finance managers of the organizations. The findings suggested that organizations that recognized continuous improvement as an important quality goal also promote knowledge sharing and organizational learning culture. (Oliver, 2008.)

The participating respondents' organizations had a preference to generate new information internally either through their existing knowledge bases or recruitment activities. The majority of organizations also had a low employee turnover rate, which would enable them to retain the existing knowledge resources. In these organizations the majority of employees were aware of how and where to retrieve information they required in their work. (Oliver, 2008.)

The majority of the respondents agreed that new ideas from employees were encouraged by the management. However, the ideas were not so often taken into practice, which was seen by Oliver (2008) as risk to potentially deter employees offering suggestions in the future. According to the study, the organizations were committed to building knowledge in-house by the management encouraging the employees to "*work smarter not harder"*. Engagement in training activities was also supported. Employees were given the responsibility to make decisions related to their specific working activities and thus employee skill development was considered important. This was also considered to support continuous quality improvement efforts. (Oliver, 2008.)

According to Oliver (2008) the organization's ability to learn is dependent on its ability to record organizational experience and retrieve that information, when necessary. It was common to the studied organizations to store detailed information for guiding operations and to have top management integrate information from different organizational units. At the same time, according to the study, there was a risk of the organizational memory to be held as tacit by the employees and thus be lost, when they would leave. This is demonstrated by the fact that a relatively low number of respondents agreed that knowledge held by employees could be captured in formal reports. (Oliver, 2008.)

It was also common to the organizations to foster a climate, where knowledge and information sharing was encouraged. It was found that an atmosphere of openness supported knowledge and information sharing in the form of continual dialogue as well as formal reporting. Information was considered to be accessible to the employees, and approximately two thirds of the organizations had employees engaging in the ongoing debate about work practices. A vast majority of the organizations held regular meetings to distribute information to the employees. (Oliver, 2008.)

According to Oliver (2008) a knowledge sharing culture based on trust and openness was the key, when developing a shared vision for the organization and working towards continuous improvement. Employees working together in teams and sharing experiences helped form a shared organizational culture. It was also pointed out that a stable work force was important in retaining the individual's knowledge and encouraging the employees to share ideas for improvement. Finally, it can be seen that people, rather than technology, are the major source of knowledge transfer, as according to Oliver's study decisions were made mostly based on the active organizational memory. (Oliver, 2008.)

5.2 Leveraging Customer Knowledge

Customers are the lifeline of every organization and therefore understanding what customers expect and what they see as quality is crucial. Leveraging knowledge about, from and to support customers (Desouza & Awazu, 2005, 119) can give organizations indisputable benefits in terms of quality improvement and innovation. It can even provide a competitive edge in comparison to the competition.

Before an organization can start leveraging their customer knowledge, it must first recognize who the customers are. A customer can be internal or external. Internal customers are those that use products or services of other employees within the organization. (Desouza & Awazu, 2005, 119.) For example, the financial department will need a report created by the sales, making the financial department the customer and the sales the service provider. External customers are the more traditional ones, the ones that create the revenues with which the organization continues to exist in the market place (Desouza & Awazu, 2005, 119).

Emphasizing the customer perspective in every action of the organization, precisely by treating each other within the organization as internal customers, is also promoted as a management philosophy within the field of quality management. This thinking alone can improve any organization's quality and culture, as it underlines the importance of different departments and processes in the supply chain as part of the entity.

In the era of the Internet the customers gain more information about the products and services on offer than they ever did before. They can compare the quality and characteristics of the products they are planning to purchase using company web sites, for example. Or they can visit online forums to seek previous user experiences before making the purchase decision. Therefore, an organization as a service or product provider must engage with the customer and take into consideration their needs more than ever before. This is where organizations need to leverage customer knowledge, which has three aspects: knowledge from, about and to support the customer. (Desouza & Awazu, 2005, 119.)

Knowledge about customers includes processed information about customers' habits or demographics, which can be used to segment customers in different ways. Utilizing knowledge about customers involves gathering information and transforming it into knowledge that can be acted on in better meeting the customers' needs and detecting emerging patterns. Organizations can use this information not only in attracting new customers but in maintaining the existing ones by improving their offering and targeting it to the right people. Knowledge about customers can be gained by capturing customer data, for example credit card purchase information. In order to use the information and turn it into meaningful knowledge it must be processed and analyzed, for example by using data mining techniques. (Desouza & Awazu, 2005, 119-124.)

Knowledge to support customers entails improving the user experience and thus retaining the existing customers. Transaction data and information can be used to obtain this knowledge. The goal is to create personalized products as well as pre- and post purchase solutions. For example, upon purchasing a car, the customer may want to customize the colors or equipment beforehand. This has led to a trend where companies' selling a stand-alone product is not enough; an entire solution must be offered. Organizations often utilize different CRM systems and the Internet in leveraging the customer support knowledge. (Desouza & Awazu, 2005, 124-130.)

Knowledge from customers comes from the ideas and feedback received with regards to the products and services of the organization, and thus is the most relevant form of customer knowledge in the context of this work. Knowledge from customers can prove to be very useful in innovation and improvement efforts, as the end-user of the product

or service may actually have more knowledge of using it than does the organization. What comes to capturing this kind of knowledge, databases can be utilized in recording customer feedback that can then be further analyzed to answer questions about customer satisfaction and preferences. (Desouza & Awazu, 2005, 130-134.) By analyzing the feedback the organization can identify bottlenecks in their processes and offerings. The processes can then be improved, and the results monitored by using further received feedback or customer satisfaction surveys.

As the customers' awareness of what is being offered and what is available increases, in turn the companies need to increase their awareness of the customers. Organizations that are able to deliver high quality, personalized solutions are the ones that can be seen as market leaders of their field from year to year. Utilizing customer knowledge can prove invaluable in the pursuit of discovering what the customers what, how they behave and what they perceive as quality.

6 Knowledge Management Solutions

Knowledge management starts with people and is not to be confused with merely delivering the systems where to maintain information. A cultural acceptance of knowledge management practices needs to be achieved and the employees need to perceive value gained (Leming, 2002, 2). However, technological solutions can greatly help achieve the knowledge management goals in sharing and storing information. In addition to knowledge-exchange and practical training sessions different computerized knowledge bases, computer-based training and other solutions can be used.

When designing a knowledge management solution, it is useful to organize the contents of the system, i.e. the information stored in it, according to its context or the subject matter. Certain entities can be identified and the system can be built around them in a logical manner. These entities include for example: companies and other business partners, people, transactions, processes, and markets. The relationships between these entities can be stored into and managed by using the system. (Lee, 2000; Leming, 2002, 2-3.)

The solution should be easy to navigate, reliable, accurate, up-to-date and pleasant to use. The information should be stored according to the subject matter and the pre-defined business rules, which are identified in the beginning of the project. This provides a structured organization of information and its retrieval. (Lee, 2000; Leming, 2002, 6-7.) The users should be able to add their experiences of the subjects into the system to help capture tacit knowledge and increase the value of information. In an ideal situation it would be possible for the users to personalize the system according to their preferences and areas of expertise and interest, which would facilitate user acceptance. In practice, such as system could be in the form of an intranet. (Leming, 2002, 6-7.)

Desirable features of such a system would include contact management information, information publishing, document management and content management features. These could contain a corporate library with an access to different documents such as business process descriptions, corporate policies, manuals, handbooks et cetera. The system should facilitate the retrieval of the documents and possibly include automated

document classification and version control. Also features such as e-learning platforms with online courses and operational manuals could be included. (Leming, 2002, 6-8.)

Publishing of corporate news and an access to the Internet are included in standard intranet solutions by their nature so they hardly require further elaboration. In addition application integration, such as a portal to the ERP system and the user's e-mail account may be very useful, as all the tools are accessible from one point. Furthermore, discussion forums or other channels for dynamic information and knowledge sharing provide extra value to the system. (Leming, 2002, 6-7.)

In conclusion, knowledge management solutions can provide an effective tool for corporate learning and knowledge sharing, the "*mobilization of collective intelligence*". It can help employees reach not only the required information but also each other. Lessons learned and best practices can be captured in an explicit form and organizational memory can be created. (Leming, 2002, 5.) However, it is necessary to remember that IT solutions are only a tool for knowledge management. In order to make full use of the tools the importance of fostering knowledge sharing and collaboration culture should not be overlooked.

7 Organizational Information Management

Information management is directly linked to the knowledge management capacity of an organization. Organizational information comes in many forms: data, paper documents, electronic documents et cetera. It is important that the right people have access to right information at the right time. Therefore information management can be defined as the "*ability of organizations to capture, manage, preserve, store and deliver information* --". (What is Information Management, 2010.)

Information management brings numerous challenges to any organization, especially if the information flows are various and the organization handles many types of business critical information. In today's business environment organizations have many information management tools in use, which include solutions such as ERP, CRM (Customer Relationship Management), SRM (Supplier Relationship Management) and other information systems.

Despite of these tools information management may become cumbersome: The responsibility sharing may not be clear what comes to information recording and maintenance, the information may be shattered around the organization, different teams may hold different valuations to different types of information, working methods may differ from department to department, a lack of suitable tools may be an obstacle and so forth.

According to the article *What is Information Management?* (2010) to overcome the information management challenges an organization has a set of principles that need to be followed:

- The organization needs to recognize that information assets are corporate assets, so that the support for information management remains strong
- Information needs to be available and shared. This supports utilization of the organizational knowledge base.

- Information needs to be managed and maintained centrally. This way information remains timely and reliable. (What is Information Management, 2010.)

Best practices

Some central best practices can be identified in the vast field of enterprise information management: Firstly, the collaboration of the IT service provider and business departments is vital. The lack of communication between the IT and business often lead to solutions that do not serve their purpose. The IT needs to find out the goals, needs and requirements of the business and the business needs to communicate the priorities with which they need to be addressed in the system. The issue may often be that the IT department and business do not speak the same language and therefore may not entirely understand the requirements of each other. Whatever the issues are, they need to be overcome, as without effective communication an enterprise information management initiative cannot be successful. (Dravis, 2008, 11.)

Secondly, the corporate information needs to be trusted throughout the supply chain. As the foundation of the company lies on the knowledge base of the business, the information integrity must be ensured by data quality, data profiling and data integration. If this is not achieved, the risk is that the business users will resort to their own information management sources, that is, spreadsheets. This results in individual management and interpretation of data, based on which it may be difficult to make informed corporate-wide business decisions. (Dravis, 2008, 12.)

According to Dravis (2008) the requirements for trusted information are the following:

- Accurate, error free data capturing
- Standardized data format and definitions
- Moving, integrating, summarizing of data when necessary
- The ability to trace the data to its origins
- Data maintenance and cleansing over time
- The ability of the data to serve its business requirements (Dravis, 2008, 12.)

The trusted information requirements can be also presented in a cyclic form, as shown in the Figure 2. The starting point of the cycle is the planning for information management. Then follow the data collection steps, which can be seen to include *accurate and error free data capturing*. Monitoring data collection can be seen as the *ability to trace data to its origins* as well as *standardized data format and definitions*. The next steps, data preservation, usage and dissemination entail *moving, integrating and summarizing data* as well as *data maintenance*. The advantage of the cyclic thinking is that it allows for feedback and alteration in the information management practices throughout its implementation (Concepts of the Information…, 2010).

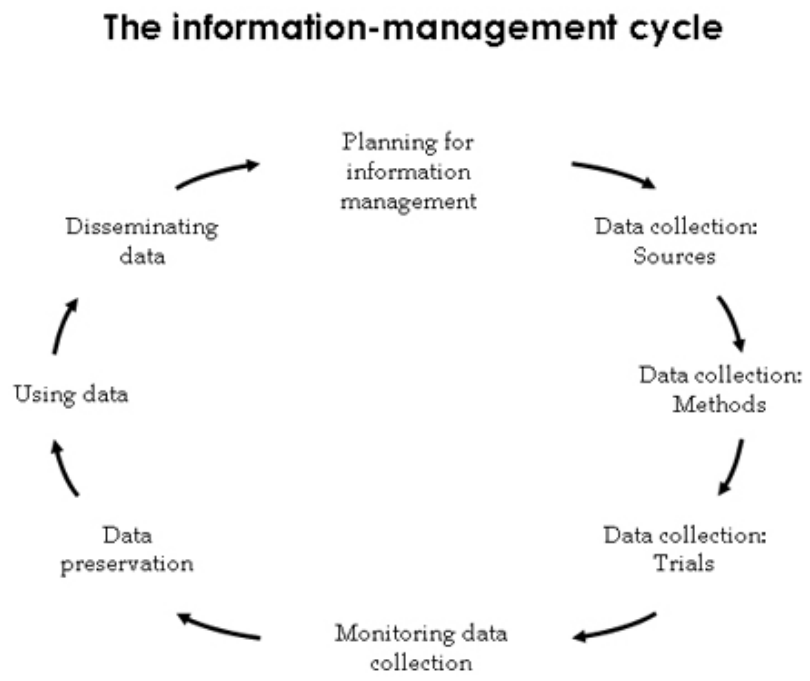

Figure 2: The information-management cycle (Concepts of the Information …, 2010)

Thirdly, the best value from the information assets of an organization is gained, when it is leveraged across the entire enterprise. This helps achieve economies of scale, efficient sharing of information, consistent spread of technology, and the effective use of trained and experienced staff. (Dravis, 2008, 12.) Integrated information systems, such as CRM or ERP are good examples of enterprise wide information leveraging and integration.

Finally, it is important to establish data governance and policy making around corporate information. The goal is to establish and maintain a corporate wide agenda for data, decision making and collaboration for the benefit of the entire organization rather than

for individuals or departments. (Dravis, 2008, 13.)[4] This entails establishing policies and data governance across the organizational hierarchy in a way that does not restrict organizational growth with unnecessarily tight regulations but rather sets standards to processes that deliver greater value (Dravis, 2008, 14).

[4] Original source: Dyche, Levy, Customer Data Integration, Reaching a Single Version of the Truth (John Wiley and Sons, 2006), 151

8 Case: Developing an Interest Group Information Database for Tampereen Logistiikka

The client, Tampereen Logistiikka is the logistics services provider of the City of Tampere. The organization is responsible for procurement and tendering of the purchases for the city. In addition it offers customized materials management, person transportation control and equipment rental services for its customers. Tampereen Logistiikka has a web based purchasing catalogue, centralized warehouse and terminal as well as a daily transportation network. It also offers a Vendor Managed Inventory service mainly to the customers operating in the health care sector. (Tampereen Logistiikka Liikelaitos, 2009.)

The organization has a wide base of customers, suppliers and other interest groups, who have several units, places of business and contact persons. The need for an interest group information database arose, as their current ERP system was not ideal for splitting the information into small enough units or for organizing and categorizing it in desired ways. In addition, there was no system in place to easily record some type of information, such as customer contacts or feedback.

To solve these issues the client had used an array of Excel sheets to collect and manage this information. This resulted in a situation where they hoped to streamline their internal information management by developing a centralized system, where all the employees could maintain and view the relevant customer, supplier and other interest group data in one place. In addition, there was a need for a centralized feedback recording system, which was going to be implemented as part of their quality management system.

Task and objectives

The task was to design a database system for managing customer, supplier and other interest group information and feedback including a user interface, where the users could easily interact with the data. The objectives of the task were the following:

- To design and implement a database system according to the requirements collected from several departments of the client
- The system should be easy and logical to use
- The system should be easily maintainable by the client

8.1 Process Description

The process of the database system design was multifaceted: It included the considerations of the structure and quality of the information collected, as well as the functional and usability requirements of the user interface, not to forget the technical demands and limitations of the implementation.

In this chapter the main steps that were followed in the course of designing and implementing the system are described. Elmasri and Navathe (2004, 366) characterize database designing as follows: *"Design the logical and physical structure of one or more databases to accommodate the information needs of the users in an organization for a defined set of applications"*. They also list a set of goals for effective database design:

- Satisfy the information content requirements
- Provide a natural and easy to understand structuring of information
- Support processing requirements and any performance objectives (Elmasri & Navathe, 2004, 366.)

Many sources describe the database system design with similar core steps, even though the working methods used vary (e.g. Elmasri & Navathe, 2004; Karhulahti, 2002; Hernandez, 2003). In designing this system the steps described by Karhulahti (2002) and Elmasri & Navathe (2004) were adapted to match the needs of the project, as listed below:

- **Requirements collection and analysis**
    - Data requirements
        - What data is to be stored in the database

    - Processing requirements
        - How the data needs to be processed
- **Conceptual database design based on data requirements**
    - Conceptual schema design
        - Entity-Relationship (ER) model describing the database structure
- **Data model mapping**
    - Logical schema
        - The database structure refined to the database tables with the data types and field characteristics included
- **Physical Design**
    - Indexing and physical storage structure of the data
        - How the database management system stores and retrieves data from the database
- **Application design**
    - Functional system design based on the processing requirements
- **System implementation and tuning**
    - Database and application implementation
    - Optimization

The entire design process and results are addressed more thoroughly in the following chapters.

8.2 Requirements Collection and Analysis

The requirements collection and analysis is an integral part of database and system design. Requirements collection and analysis entail close co-operation with the end-users, management of the organization and other stakeholders.

The aims were to define the data requirements of the database objects, to describe and categorize the objects, to recognize and categorize the relations between the objects, to recognize the necessary transactions to be executed in the database and how they interact, and finally, to ensure the data integrity of the database (Karhulahti, 2002). A carefully done requirements collection and analysis can lead the database designer a

long way in answering the needs of the client, as well as ensuring the usability of the system and its adaptability to possible future requirements.

8.2.1 Data and Information Requirements

Data and information requirements include the data and the structure of the data to be stored in the database (Elmasri & Navathe, 2004, 367). The data requirements of the system were characterized by the need to be able to record certain information at a low level as an addition to the current system used, which did not allow this kind of recording. The list below summarizes the requirements:

- Contact information for customers, suppliers and other interest groups
- Contact persons of customers, suppliers and other interest groups
- Contacts between customers, suppliers or other interest groups and the client
- The contact persons for customers and suppliers at the client
- Sales and purchasing contracts per customers and suppliers
- The ability to categorize customers, suppliers and other interest groups in specific ways
- The order placement method and channel for suppliers
- Recording and handling of feedback received from customers and sent to suppliers, including internal feedback between departments
- Communication bulletin address lists

8.2.2 Processing Requirements

The processing requirements included functional and non-functional requirements that would enable users to interact with the data. Functionalities, such as information retrievals and updates would be examples of requirements for user defined operations (Elmasri & Navathe, 2004, 380) that must be collected and analyzed in this phase. In the case of the client most functions were exactly those: information retrievals and updates. The list below summarizes the functional and non-functional requirements:

Functional requirements:

- The user must be able to add, update and remove data
- The user must be able to retrieve data based on specified criteria
- The user must be able to analyze and print out reports

Non-functional requirements:

- The system must be based on client/server architecture
- The system must allow concurrent updates
- The system must be able to handle approximately 60 users of which maximum 10-20 concurrently
- The user interface must offer drop down lists and instructions to support data entry whenever feasible
- Possible future system modifications must be taken into consideration in the design

The following use-case diagram (Figure 3) was drawn to describe the different functional requirements of the system and how they relate to each other:

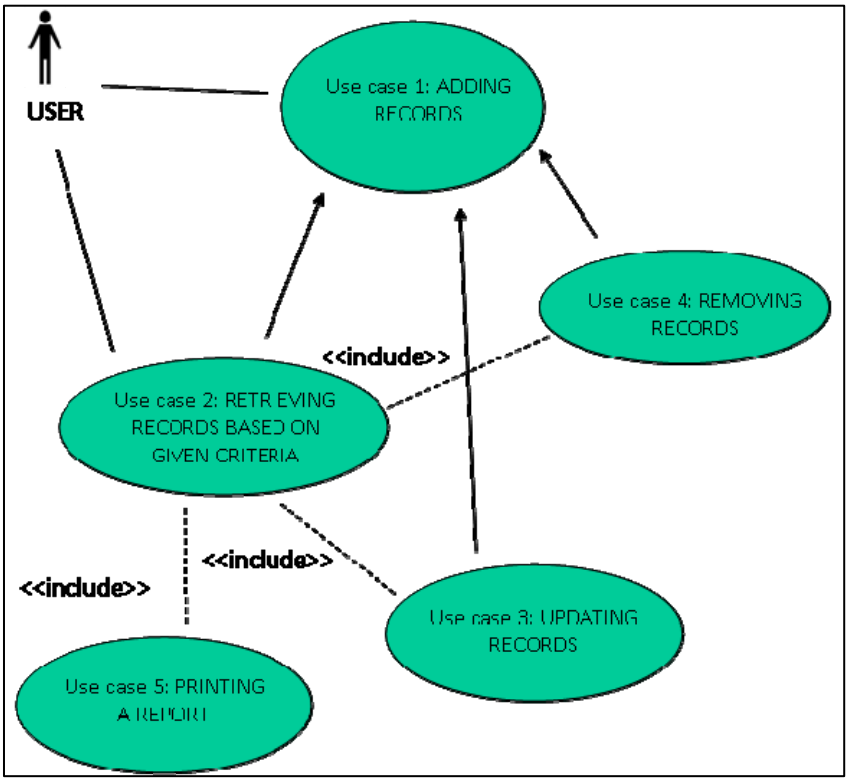

Figure 3: Use case diagram (modified from the source: Karhulahti, 2002)

Each ellipsis in the diagram describes a use case. The actors of the use case are described by a stick man under which is the name of the actor. In this case there was only one actor, the user. The lines between the ellipses and the actors describe the relationship or the interaction that occurs between the use case and the actor. The broken line and label <<include>> between the use cases describes a situation where one use case uses the results of the other use case. An arrow pointing at a use case describes a situation where a specialized use case is inherited from a generalized one (the arrow points at the generalized use case). (Karhulahti, 2002.)

8.3 Design and Implementation

Based on the results of the requirements collection and analysis the products with which the database system was to be built were chosen, a model of the database structure and the organization of the user interface were drafted. Largely the structure of both the database and the user interface were defined by the existing or future business processes of the client. The aim was to design the system so that it would support those processes.

In the following paragraphs the different parts of the system design are discussed in more detail.

8.3.1 Chosen Applications

After consideration it was decided that MySQL server would be used as the back-end of the system storing the data structures and the actual data. Microsoft Access and Visual Basic for Applications programming language were used to build the user interface, the front-end. An ODBC (Open Database Connectivity) driver and SQL (Structured Query Language) statements was used to facilitate the communication between the back-end and front-end. MySQL Workbench was used as a tool to design the database schema. The reasons for choosing MySQL and Microsoft Access are addressed in the next paragraphs.

Microsoft Access was originally designed to be a single-user application and despite the development that has taken place during the recent years it was still problematic to build a sole Microsoft Access database application for a multi-user environment due to data corruption and performance issues (Noabeb, 2010). MySQL server, on the other hand, was designed to handle multiple users concurrently (Top Reasons to Use MySQL, 2010) and it could be used as a back-end, while Microsoft Access with its great user interface design capabilities served fine as a front-end. Also, should the client later decide to move to a web based user interface the same MySQL database could still be used.

What comes to the front-end, the main reason for choosing Microsoft Access over a web based solution were the resources available: The client wished that they would be able to develop the system further themselves should the need arise and this would be more difficult in the case of a web based solution. Also, it would have required extensive knowledge on web page design and the use of PHP programming language to build a web based solution. Therefore Microsoft Access was a natural choice as the front end.

8.3.2 The Database Schema

The things to be considered during the design of the database structure are various. It is important to conduct the design phase carefully, as it is easier and more cost effective to correct errors in this phase than during or after the implementation. In the worst case scenario a poorly designed database application could result in costly re-implementation work or the users not using the system at all (Elmasri & Navathe, 2004, 371). Some of the most important goals of effective database design from the information usability and management view point are listed below:

- Dependability: The user must be able to trust that the information they are using is correct.
- Timeliness: The information must be current.
- Integrity: The data must have correct structure.
- Clearness: The information must be understood correctly by the users. (Pöyry, 2009)

Based on the above criteria and the collected data requirements the database schema was drafted as an ER model (Figures 4-7), which is shown below:

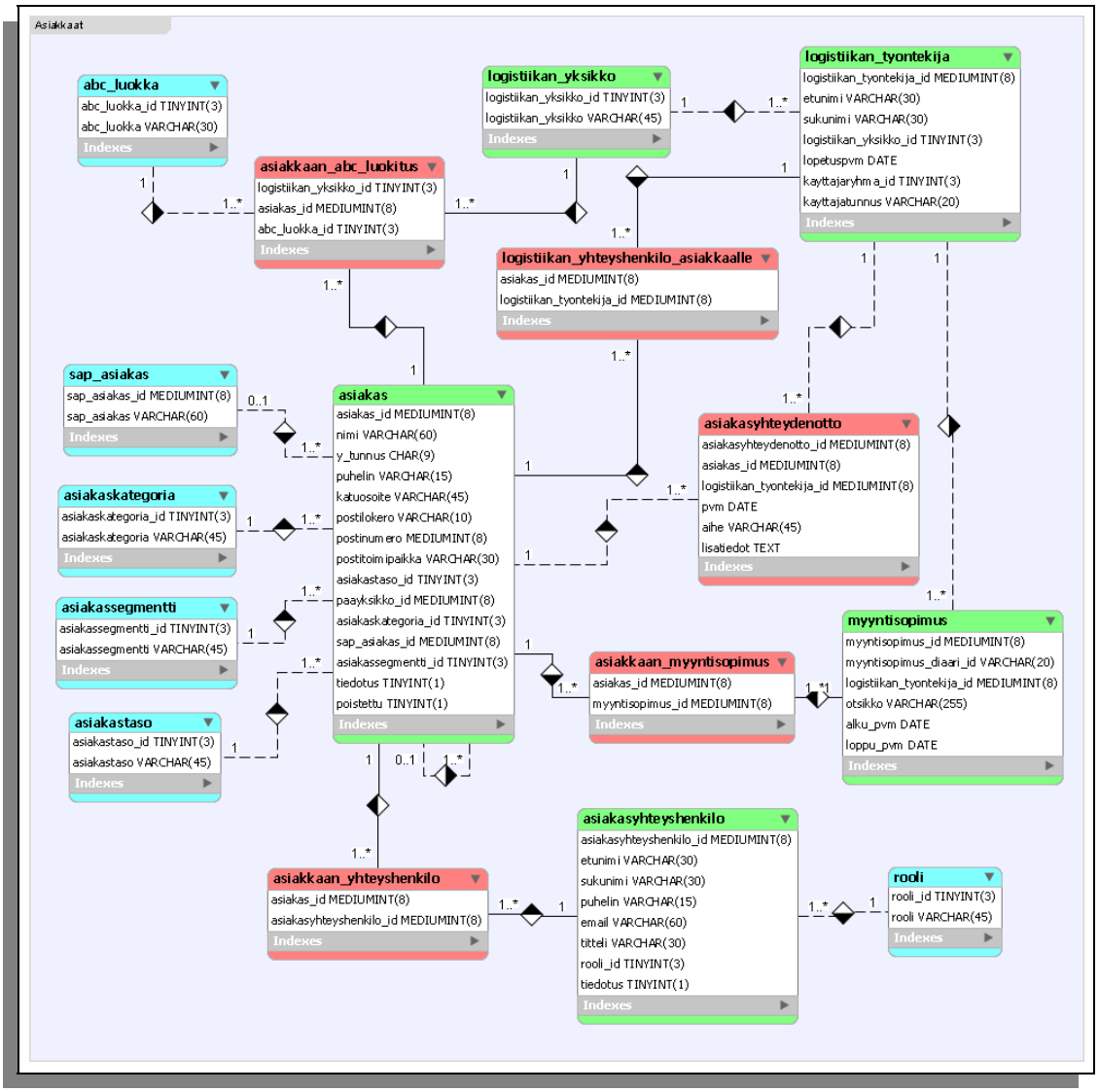

Figure 4: ER-model: Customers

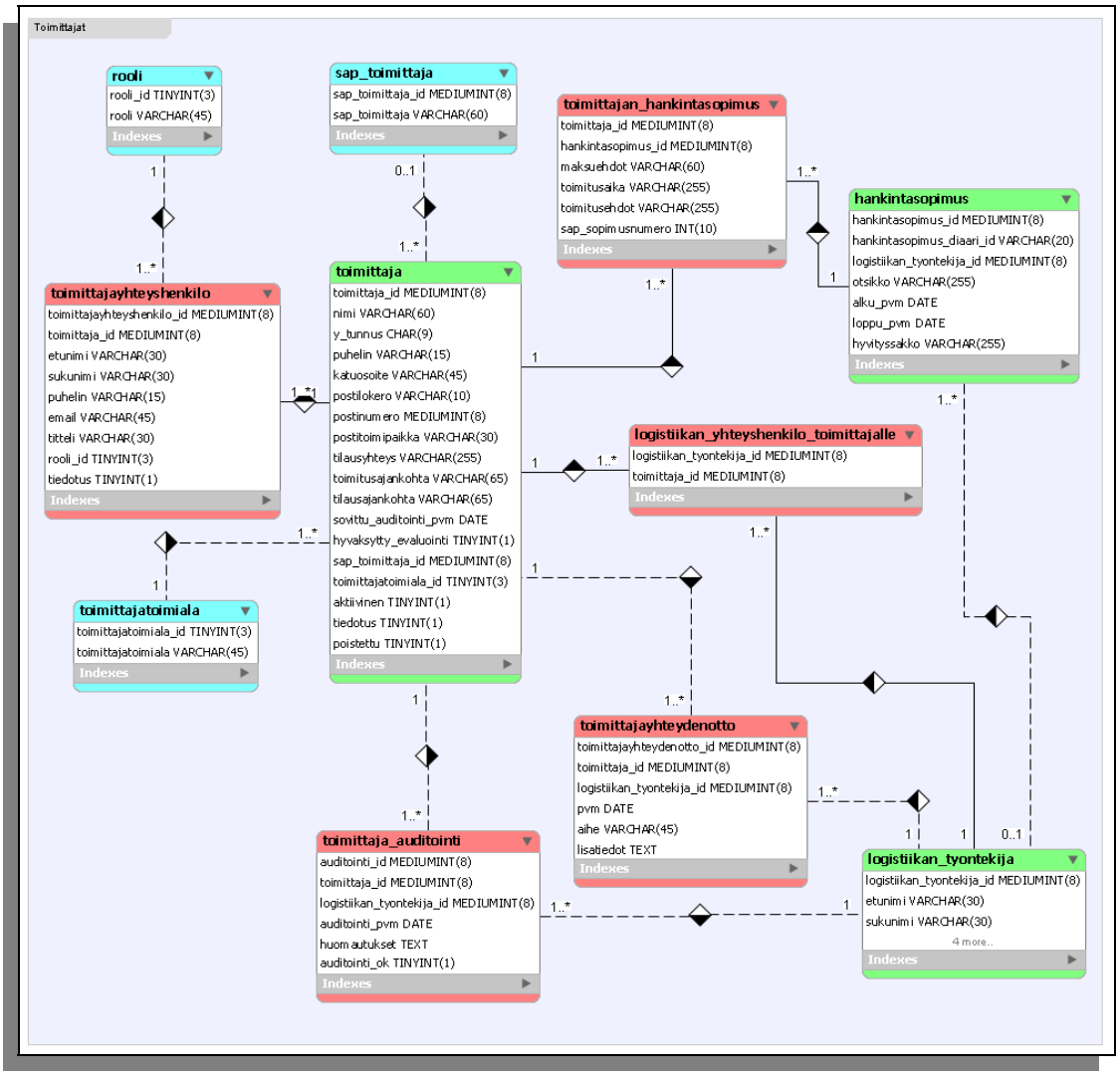

Figure 5: ER-model: Suppliers

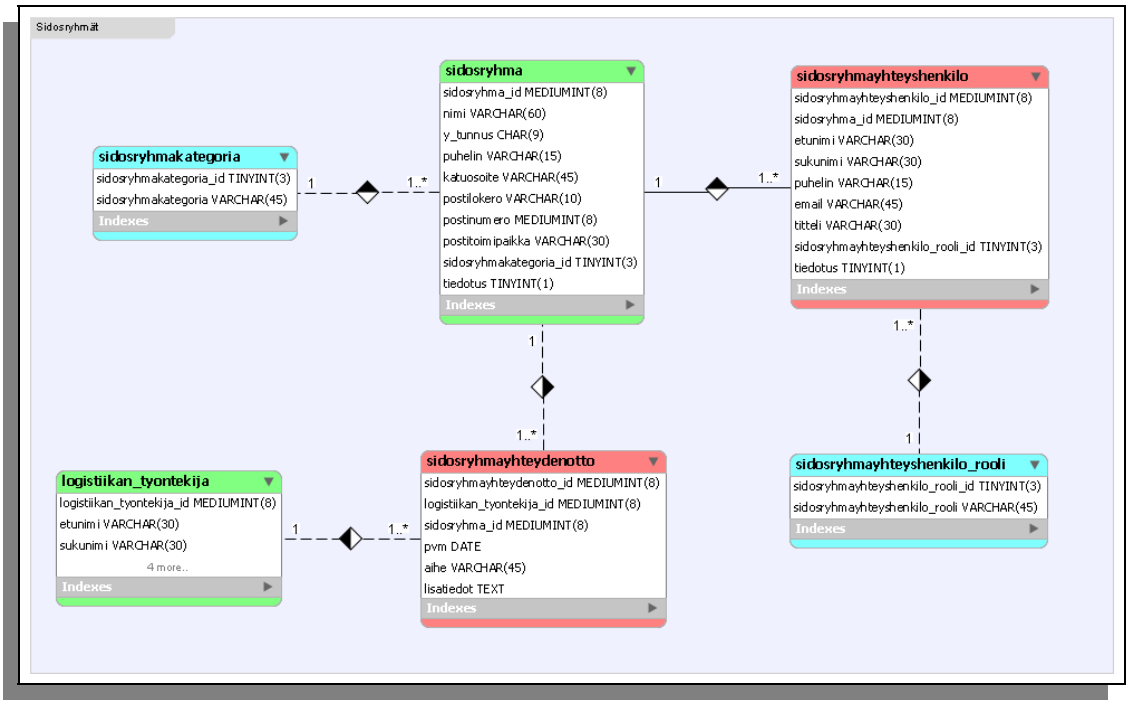

Figure 6: ER-model: Other interest groups

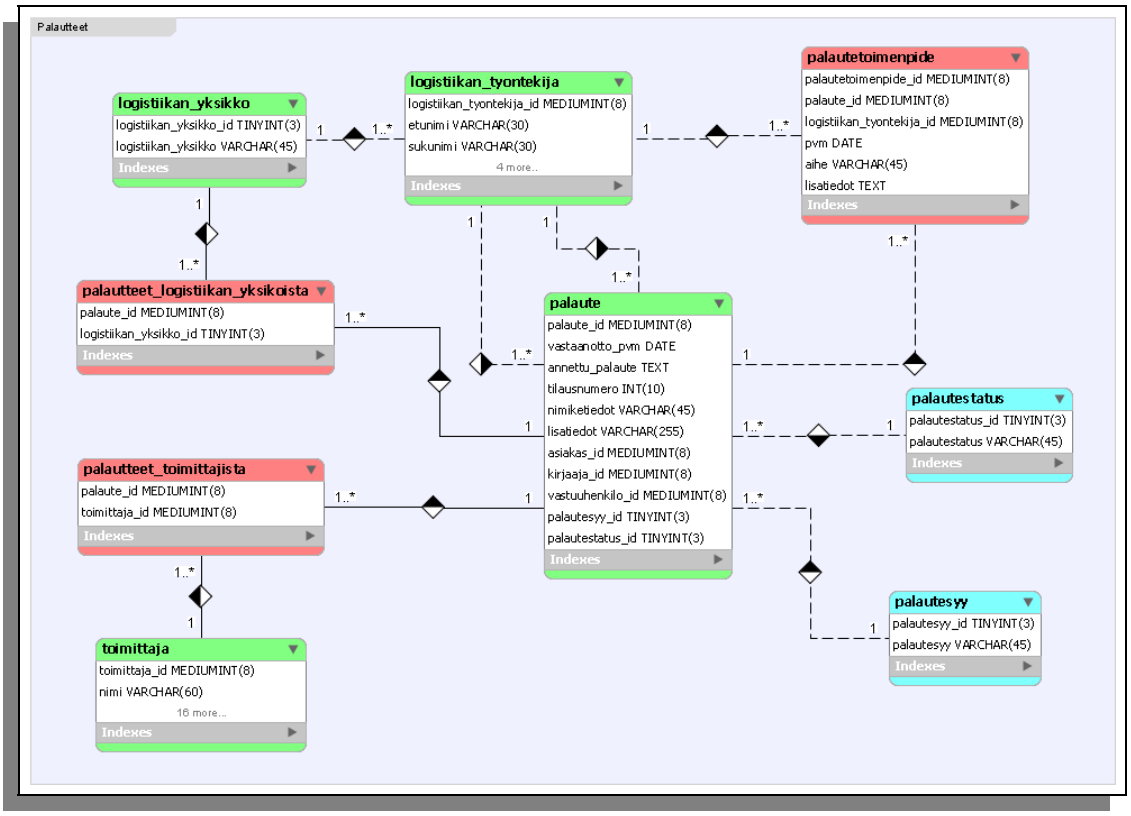

Figure 7: ER-model: Feedback processing

The process of constructing the database schema was rather challenging. Changes were made to the schema along the way anytime it was discovered that the initial data requirements were flawed, or that they did not match to the current processes of the client.

The schema was designed so that later changes would be relatively easy to make should the need arise. All the data structures resided in the same database but they are divided in the figures in four sections, Customers, Suppliers, Other interest groups and Feedback processing, to help perceive the different parts and relationships of the data. Different symbols and colors used in the diagram are explained below:

- The colors of the tables are used to help understand the role of different tables. The color coding is flexible, as one table may have several roles in the database.

    - Green: The “core” tables of the database that each form their independent entity, such as a customer (table *asiakas*) or supplier (table *toimittaja*)

  - Red: Junction tables that are formed using attributes from two or more tables, such as customer's sales contracts (table *asiakkaan_myyntisopimus*)
  - Blue: Independent entities that are used to store static- or semi static data that somehow describes other entities, such as the customer category (table *asiakaskategoria*)
- The lines between the tables describe the relationship between the entities
  - The broken line is for a non-identifying relationship and the regular line for an identifying relationship (i.e. is the existence of the entity dependent on the existence of the other)
- The numbers 0…1, 1…* and 1 describe the ratio of the relationship between the entities (i.e. how many occurrences of each attribute can a single entity possess)

8.3.3 The User Interface

User interface design as a field of study has gained ground during the recent years. Largely the reason behind the interest in design practices lies in the coming of the Graphical User Interface (GUI) technology in the 1990's, which brought with it improved technical capabilities and the possibility for a better user interface experience from the user's view point. (Galitz, 2007, 3.)

The usability of a system is an important part of the system design: The user interface is often the only thing the user sees when interacting with the system. It may actually *be* the system for the user. Therefore, a poor GUI design makes using the system an unpleasant experience, which can lead to increased frustration and aggravation by the user. The number of errors increase and completing tasks becomes more laborious. This can lead to lower productivity, increased stress, erroneous information and even bad business decisions. (Galitz, 2007, 4.)

A lot can be gained by a good GUI design: The users find using the system pleasant and they can focus on the task at hand, and the actual information that the system delivers to the users. It is said that a good user interface is actually not noticed by the user. The goal is to enable the users to concentrate solely on the task they are trying to achieve instead of glitches and cryptic error messages of the system. (Galitz, 2007, 4.) In the

following paragraphs the design considerations and structure of the user interface are discussed in more detail.

8.3.4 Design Considerations

The things that were considered from the beginning of the user interface design were in line with the processing requirements collected. The goal of the design considerations was also to support good usability and information integrity of the system.

Firstly, the flow of task completion in the system was to support the current or planned processes of the client. An example would be recording a feedback from a customer: A user logs in, enters the feedback in the system, initiates the handling of the feedback, and logs the actions taken to solve the feedback and so forth. The system should support the sequence of the user's work flow, so that the task can be logically and easily completed.

Secondly, the system was to provide enough instructions and guidance to the user. In an ideal situation the system would be so easy to comprehend that no extra instructions were necessary. As this often is not the case, the system would have to take some responsibility for instructing the user. In this case custom error messages were built, so that the user would not have to suffer from the run-time error messages that may be quite distracting to the user. Also an instruction text was built for every report, so that before the users run it, they can check whether the report is actually what they need.

Thirdly, the system was to be restrictive enough, so that unacceptable errors during data entry could be prevented. In practice, the system presents an error message, if the data entered does not fill the specified requirements. This was partly achieved together with the restrictions coming from the database and partly with the restrictions built in the user interface. Another way to restrict the users from making unwanted modifications to the database was to restrict the actions they can take by assigning different rights to different users. In this case only two user groups were necessary: the administration and other users. The administration had more rights to create and modify information within the system than did the other users.

Lastly, the user interface was to be logical for the users to use and understand. This, again, helps usability and maintains information integrity. If the interface is self-explanatory, training costs and the number of errors during information processing are reduced. Also, using the application will be more pleasant and efficient, if the user is aware of what is happening in the system and they are able to predict what the consequences of their actions will be.

8.3.5 Structure

The interface was ordered according to the natural categories of different types of data – the entities – that would be processed within the system. The interface grouping followed that of the database, as was presented in the chapter 8.3.2. The application was divided into customers, suppliers, other interest groups, feedback processing, bulletin address lists and general data management.

Each part of the interface had the same logic and similar components, the main form, data management section and reports, apart from the bulletin address list and general data management, for which those components were not applicable. Most of the information processing was done on the main form. The data management section was mostly used by the administration in maintaining static and semi-static data. The other users were given no rights to modify that data. The reports were used to pull different kinds of information from the system. The information could then be exported to Excel and analyzed further there. The below screenshots with test data (Figures 8-9) from the system give an idea of the interface structure:

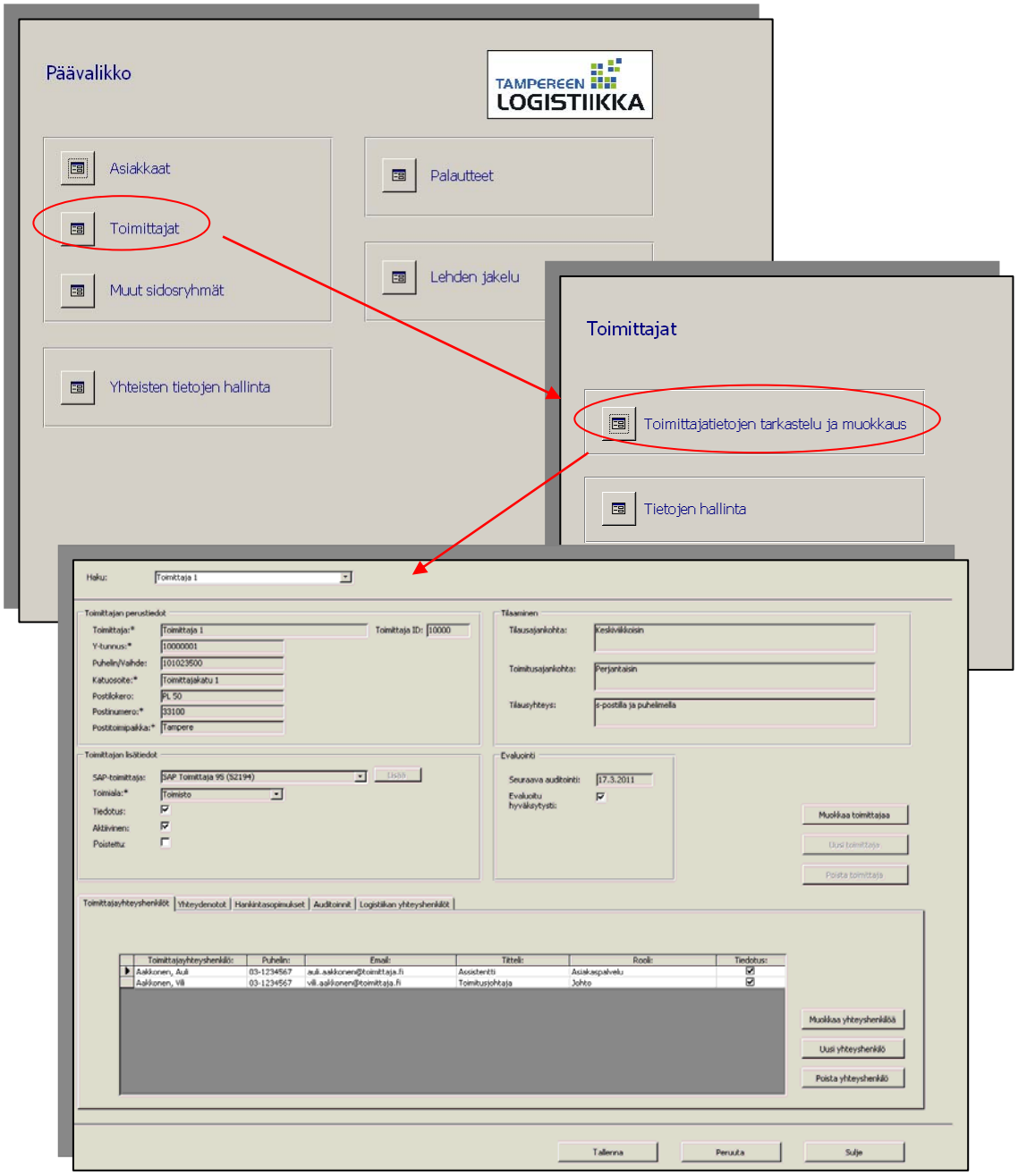

Figure 8: Supplier information

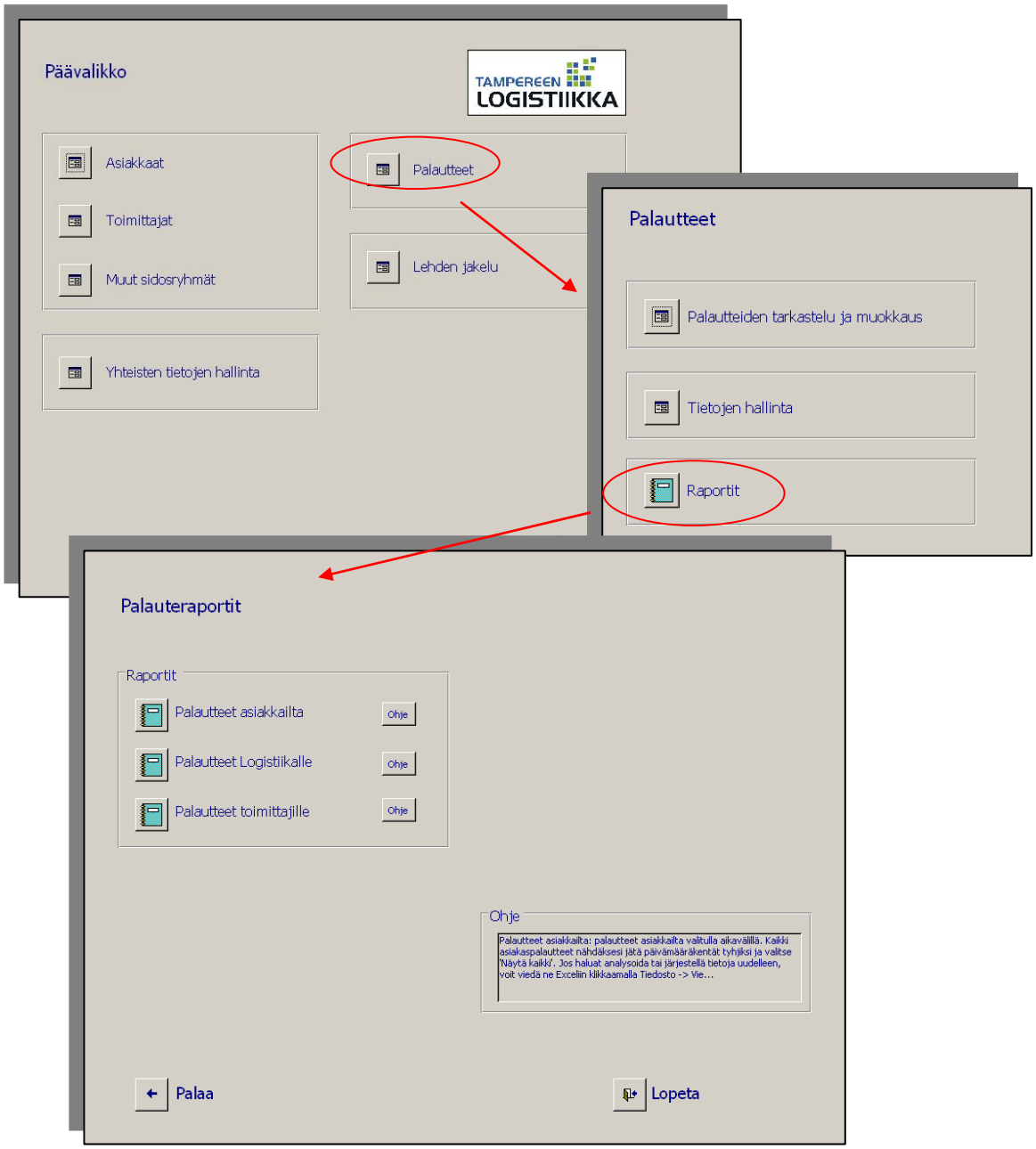

Figure 9: Feedback reports

8.4 Challenges and compromises

As it has been brought up in this report, the process of database and user interface design in general is multi-faceted. This was also true in this particular project. The more was learned about development process, database systems and other applications, the more complex and fine tuned the challenges became. Some of the challenges were related to the project and process in general and others were more of a technical nature.

At the beginning of the project the challenges were mostly to do with getting a grasp of the outwardly complex organizational processes, which would affect the data structure. Also, as the interviews proceeded, it became apparent that different units had different requirements for the system. Combining these requirements into one functioning system was rather challenging. It was also learned during the interviews that the interviewer must be able to ask the correct questions, as otherwise it might simply not occur to the interviewee to mention something that ends up being of importance. In addition, all the requirements were not apparent during the development phase but they only came up as the process had proceeded to the implementation phase.

Technical dilemmas were faced regularly, especially in the user interface building phase. The technical issues mostly resulted from the system's unexpected behavior due to the compatibility issues between MySQL and Microsoft Access, as well as the steep learning curve of the developer. The technical issues were resolved by searching for information until a resolution was found and by consulting with professionals in the field.

Due to time constraints some development work had to be left to the future. This included improving the universal error handling and error logging of the system, as well as the appearance of the application. The error handling of the system at its current level is feasible but the user still encounters a variety of different error messages depending on the type of error occurred. In the future it would be desirable to further develop the custom error messages, so that they would convey more information, have a common format and even contain a help file. The appearance of the application was left in its default Microsoft Access format. It too is feasible but rather uninspiring and could use

some improvement. These issues were left to the future, as they were not at the top of the priority list among the system requirements.

9 Conclusions

The design and development of the database system took approximately six months from the initial interviews to the completion of the database and user interface. At the time of writing this the development work for the pilot version was finalized and the system had just gone into production. Even though the project reached its end, the development of the application will be an ongoing process.

All in all, the project was challenging and inspiring. The task objectives were mainly achieved. The first two objectives (to design and implement a database system according to the client's requirements and that the system would be easy and logical to use) were reached, as was concluded during the testing of the system. It must be remembered, though, that in practice this can only be measured after the system has actually been used in the production environment for some time.

The third objective (the system should be easily maintainable by the client themselves) was reached only partly: It is practical that the client will maintain the information contents of the database by themselves but what comes to the technical maintenance of the system, outside assistance may be necessary. This is true especially, if the client wishes to make modifications to the application code or the database structure.

The process of collecting and analyzing the system requirements was useful from both the client's and the developer's perspective: The client not only got an overall understanding of this project's requirements but also an indication of those for possible future development projects. The developer got to understand the complex processes within the organization that defined the overall requirements and structure of the system.

It can be expected that the system will meet the client's needs with the current data and processing requirements and organizational structure. Should the requirements and organization significantly change in the future, changes may be necessary, and it may be worth thinking of moving towards a web based user interface.

Overall, in the context of the theoretical framework of the thesis, it can be concluded that knowledge, information and quality have a vital relationship in supporting each other in organizations. Furthermore, a conclusion can be drawn that database system design and development is closely related to managing organizational information and knowledge resources, and thus to the overall business processes, including quality. By fostering an information and knowledge sharing culture, an organization can achieve continuous improvement and provide higher quality solutions both to its internal and external customers.

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