Handelshögskolan
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Identification of System Requirements for Next Generation's Treasury Management Systems

Abstract

The contribution of this master's thesis was to provide an identification of system requirements of the next generations' treasury management systems. Using theory of requirements engineering as a point of reference, future system criteria have been presented. These criteria are also based on an evolution and identification of existing system requirements. By conducting in-depth interviews and profound literary reviews, the author identified these criteria against functional and non-functional features. The current non-functional criteria were Duty of Segregation and Authorisation, Real-time Principle, Straight-Through Processing (STP), and Internal and External Integration. The current functional criteria were Full Derivative and Currency Support, Web-enabled Functionality, Netting Functionality, and Pooling Functionality. The future non-functional criteria were Further Integration and Enhanced STP, Modularisation, Partitioning of the Database Architecture, XML versus EDIFACT and Open Standards, Regulatory Compliance, and Improved Technical Reliability and Stability. The future functional criteria were identified as Real-time Trading Functionality, Enhanced Web-enabled Functionality, and Integrated Cash Management Functionality.

Keywords: corporate financial systems requirements, requirements engineering, system criteria, system requirements, and treasury management systems.

Author: Christian Frisch
Tutor: Andreas Nilsson
Master's Thesis, 20 points

"We add value by effectively reducing the financial risk and applying a very broad view of risk, [envisioning] enterprisewide risk, so that management and the people in operations can focus on designing great phones and selling them" (Ramos 2002).

David Blair, Director of Nokia Treasury Services Asia, Singapore 2003.

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1. Introduction

This chapter serves as an introduction to the thesis. The background of the subject and the problem initiating the thesis are presented. In addition, an explanation of the purpose will follow. Finally, the delimitation is drawn and the disposition of the thesis is explained.

1.1 Background

Every large corporation, that has subsidiaries in more than one country (i.e. all Multinationals in the world), need to manage its funds. This kind of money management takes place via the in-house bank, which is simply a department inside the multinational corporation that has the same function as a traditional bank. Typically, money can be grouped as being of short-term or long-term characteristics. If a company has excess of short-term funds, it is said to be in a favourable liquid position. In contrast, if the company is short of cash but has funds in a long-term horizon, it is said to be in a good solid position (Andersson, 2001). According to fundamental business economics, MNC´s must maximise the shareholder value. Accordingly, the value of a company is equal to the net present value of all its future cash flows. The optimal management of these flows are obviously crucial as it has a direct impact on the value of the whole company (Dolfe & Koritz, 1999). For a multinational group having subdivisions all over the world, cash transactions between the entities may be conducted on a regular basis. Surpluses in one part of a region must finance deficits in another part of the region and vice versa. The amount of cash that do not finance such activities must be invested in order to preserve or strengthen its value. The short-term funds consequently consist of pure cash that can be transformed into various forms of short-term assets such as various forms of financial instruments. The transformation of cash, or the very short-term management of cash, is called cash management or *treasury management* (TM). This activity[1] takes place in a very specialised department in a multinational corporation called the treasury department – i.e. the in-house bank as described above. The treasury department is typically divided into front, middle and back office in which crucial operations for *short-term* investment of excess cash and financing of subsidiaries are carried out. Due to the nature of its operations, and its impact on the net present value of the future cash flows, this department has a large impact on the financial position of the whole group. The treasury is therefore very dependent on having a supportive and well-functioning information system, a so-called *treasury management system* (TMS).

1.2 Problem

Some organisations have come far in the process of computerising their treasury activities with advanced front-to-end solutions while others still rely on weak proprietary systems[2] or even excel spreadsheets (personal communication, Bergström, P., 2003-09-01). Some treasury departments deal with as many as hundreds of thousands of financial transactions each month

[1] For example, risk management and trading with Treasury bond futures and other financial instruments. These activities should however not be mixed up with financial operations performed at traditional economic departments. Instead, Treasury departments should be seen as a highly specialised financial function. For further information, please read appendix three.

[2] A proprietary system is a system that is completely developed within the own organization and thus especially made to fit the specific needs of the corporation. Development and maintenance costs for such projects are often very high.

or even each week. The dependence on the TMS functionality and stability is huge, as the successful execution of financial transactions is the backbone of any MNC. Whether an organisation is about to buy a new TMS, or to develop existing solutions, the effect of having identified the proper selection criteria is profound. The simple reason for this is obvious: how could any system be successfully developed if we do not know what functions to develop? This process is often referred to as requirements engineering (RE) and can be expressed as proposed by Karlsson (Karlsson, 1995, s 25):

"Requirements engineering is the application of proven ideas to iteratively discover and select requirements, to document them in a requirements specification, and to validate the set of requirements"

Throughout this thesis system requirements, criterion, criteria, selection criteria, as well as requirements engineering will be used synonymously. Requirements engineering becomes increasingly difficult when applied in organisations that are characterised by constant change (Johansson, 1999). The last decade, the treasury arena in particular have been characterised by such constant organisational change, due to the technological boom, the globalisation and the regulation (Frisch and Lind, 2003). Consequently, there is not only a necessity of matching the specific needs of a treasury department with the appropriate TMS features, but also to employ the correct method for requirements engineering in general, provided this organisational change. In doing this, there are several methods available.

This thesis will through an academic approach identify next generation's TMS requirements, by employing a systems engineering approach based on theory from the following actors, standards and associations: J. Karlsson, (1998), C. Jones (1994), M. Hjelte (1995), IEEE 1471 (2000), IEEE 830 (1993), ISO/IEC 9126 and ISO/IEC 12207.

In many cases, a new requirement is the result of a natural development or improvement of an older requirement. The requirements specification is therefore not a static document that do not allow change, but rather dynamic with a bunch of interdependencies. This fact can be counted for by ensuring proper management of the requirements: e.g. by dividing them into current and future requirements to secure traceability and interdependencies (Wiktorin, 2003).

As a result of the above, the question becomes: **what are the next generation of treasury management system requirements and what RE procedure could identify them?**

1.3 Purpose

In order for the vendors of TMS to meet ever changing requirements from the treasuries regarding functionality, there is a need to identify and introduce possible requirements as early as possible to all actors involved in the TMS context (vendors, users, markets etc.). By a pro-active rather than re-active approach to next generation TMS requirements, the time-to-market of a well functioning TMS will be substantially shortened. This contributes to all actors in the context, including Mr Blair at Nokia Treasury Services in Singapore[3].

[3] Mr. Blair is quoted in the beginning of this thesis. The purpose of having him quoted is to clarify the contribution of this thesis: to help treasurers and others to focus on their main tasks and not on the TMS´s so that they in turn can help their companies focus on the core strategies (in Nokia's case that is to produce mobile phones.)

Thus, the purpose of this thesis is:

"*to identify the system requirements for the next generation of treasury management systems by employing a recognised RE theory and procedure that is well suited for the constantly changing treasury arena.*

1.4 Delimitation

This thesis should not be seen as describing or evaluating any TMS, but instead as an attempt to identify next generation's requirements on treasury systems *in general*. Neither should the thesis be regarded as identifying requirements based on a particular corporation or user group. The criteria are instead general in terms and derived from literary reviews, observations and through interviews with actors in the international treasury arena. Furthermore, this thesis does not claim any prioritization or ranking of the identified criteria.

1.5 Disposition

The first chapter is an introduction to the thesis; the background is described, including the problem and purpose, as well as the delimitation and the disposition of the thesis.

Chapter two explains the method employed for the thesis. The line of approach is described, including how the collection of data has been carried out. Furthermore, the credibility (including validity and reliability) is discussed.

Chapter three provides a framework for the theoretical base employed when identifying and selecting the appropriate system requirements. Requirements on criteria are presented as well as how different types of criteria can be evaluated. The theory described in this chapter will be employed throughout the thesis.

Chapter four consists of a presentation on empirical data applied in identifying the requirements on treasury management systems. The chapter is divided into two parts: *current* and *future* system requirements. These criteria are then further divided into *functional* and *non-functional* requirements or criteria. Each source for this process is given an account through an illustrative table in the beginning of the chapter.

Chapter five presents a comprehensive discussion on the theory and method applied as research approach. Furthermore, the author's general and specific comments on the identified criteria are presented.

Chapter six finishes the thesis by discussing the initial premises and by summarising the main conclusions. References and appendixes can be found in the very end of the thesis.

2. Method

This chapter presents the method and line of approach employed in identifying next generation's requirements for treasury management systems. The collection of data is discussed as well as the credibility of the thesis.

2.1 Line of Approach

In order to identify the requirements for next generation's treasury management systems, the theory on requirements engineering (further described in chapter three) has been employed throughout the thesis. Knowledge about current system requirements – or criteria – has been obtained through an iterative process, as this is a proven method for identifying criteria under constant change (Johansson, 1999). This was achieved through an increasing step-by-step knowledge in the treasury management sphere. As a result the future requirements of treasury systems could be identified. The methodological approach applied in this thesis (as well as the learning process of the author) is illustrated in below figure.

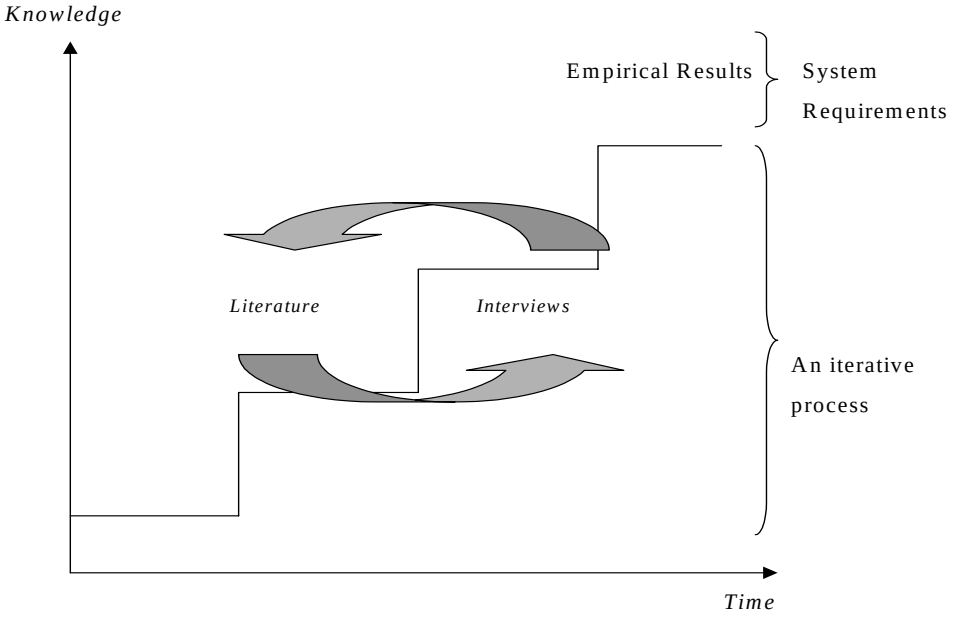

Figure 1Learning Process (authors own illustration).

In order to identify the appropriate criteria for next generation of TMS, seven national representatives of associations of corporate treasurers have been interviewed. This has been combined with in-dept interviews with employees at Nordic Financial Systems[4]. Furthermore, the author has conducted a literary review by auditing every issue of GT News (i.e. Global Treasury News) and Treasury Management International starting in year 2000, combined with

[4] NFS provides specialised business and systems consultancy for some of the world's leading financial organisations. Being Global Sales Managers, Technical and Financial Consultants, the interviewees have a very good over-all understanding of the current and future requirements on TMS's. More information on NFS can be found at http://www.nfs.se

other acknowledged sources such as Treasury Today. In parallel, the author has been forced to absorbing general knowledge about TM and TMS, as these subjects are indeed very complex and belong to a specialised discipline within multinational business management. By starting with presenting current system criteria on treasury management systems, the procedure of establishing the next generation requirements has been considerably eased.

2.2 Collection of Data

The empirical data was collected through literary reviews and interviews, of which the interviews constituted the most important source of information. The interviews consist of people from ACT[5] as well as employees at NFS.

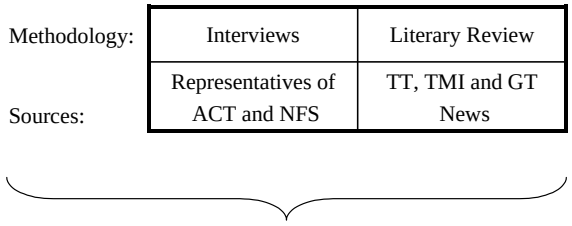

Figure 2 Methodology and Sources of Data (authors own illustration).

2.2.1 Literature

The following literature has been used: theory on selection criteria (presented in chapter three), articles in Treasury Today (TT), Treasury Management International (TMI) and GT News. TT is produced once a month while TMI publishes a new issue once every quarter. They are both paper-based, while GT News is only available via Internet. By going through every issue of TT and TMI since January 2000, the author has gained insight on today's criteria as well as future requirements. GT News was consulted regularly from January 2004.

The theory on selection criteria was mainly derived from J. Karlsson, (1998), C. Jones (1994), M. Hjelte (1995), IEEE 1471 (2000), IEEE 830 (1993), ISO/IEC 9126 and ISO/IEC 12207.

[5] Association of Corporate Treasurers also called International Group of Treasury Associations and abbreviated as ACT. Please find further information at http://www.igta.org. A list of the respondents´ contact details can be found in the appendix.

2.2.2 Interviews

To retain an overview picture of requirements for next generation's TMS the author made a qualitative survey via telephone and through personal meetings. The survey was made among national representatives of Association of Corporate Treasurers. They were chosen for having a good understanding of treasury management, current trends and requirements. Anonymity was a condition given by the author to every interviewee, therefore no conclusions are directly related to any respondent. As most of the contacted people are spread all over Europe and occasionally even in the Americas and Asia, there were not enough resources to collect data through personal visits and meetings. Therefore, the interaction took place through telephone calls. Notes were made during the interviews and the questions were not predetermined, but were rather based on some general subjects. The reasons for this were to avoid any limitations in the answers given.

In addition, in-dept interviews were made with Senior Technical Consultants (Mr Lorentzon and Mr Hacker), the Global Sales Manager (Mr Bergström), as well as Senior Financial Consultant (Ms Romberg) at Nordic Financial Systems´ (NFS) Gothenburg office. As employees at NFS they have a good independent understanding of requirements on TMS, as the company does not produce any particular TMS but instead provides systems and business consultancy for treasury departments in general. These interviews were carried out as face-to-face meetings in Gothenburg, Sweden as well as through telephone calls. Notes were made during the interviews and the questions were based on some general subjects, in order to guarantee a free flow of information. After the interview the findings were appointed once again in order to verify the result.

For purposes of references the following abbreviation will be used: ACT (2003) means the information presented is retrieved through the qualitative survey of ACT's representatives, further information can then be found in the reference list. When information presented in this thesis is retrieved via personal communication it will be referenced based on the following convention: *personal communication, last name, first initial and date*. The personal communications with employees at the Gothenburg office took mainly place during 2003 when the author was employed at Nordic Financial systems.

2.3 Clarification to Ensure Recurrence of Methodology

This section is added in order to ensure the recurrence of the applied research method, i.e. to ensure that the same results are obtained should someone else conduct the same research methodology in a similar study.

Methodology is a kind of tool that supports a certain research; in this case the interviews with ACT's and employees at NFS. It is thus a way of solving potential problems, and a way of reaching new knowledge. Scientists speak of two forms of survey methods; qualitative and quantitative studies. Briefly, the greatest difference is that with quantitative methods one transforms information into numbers and quantities that is later statistically analysed, while qualitative studies generate results according to the scientist's own understanding and interpretation of the information (Holme and Solvang, 1997). As described previously, the author has decided to employ a qualitative approach for the interviews conducted in this thesis. It would have been impossible to conduct a quantitative study of system requirements on the next generation's of TMS; a qualitative study was thus more suitable.

Strategic samples are a non-probability choice. This means that it is the interviewer himself that picks out the respondents that he knows will give answers pointing to a certain direction. Strategic samples is the best way of ensuring a large spread among the answers, in this case the identified system criteria, and to get hold of relevant information (Patel and Davidsson, 1994). As a result, the respondents have been identified accordingly and they were chosen for having a broad understanding of various user requirements. Concerning employees at NFS, they have understanding of the users´ environment as they work as independent consultants on a daily basis. As discussed previously, NFS is neutral in that they do not produce any particular TMS but instead provide consultancy toward existing TMS (i.e. TMS's produced by other system vendors). Therefore, no particular TMS's or functionality is recommended by NFS. Concerning the representatives of ACT's, they were identified as having the best knowledge of their member's needs, simply because they are representatives of several hundreds of TMS users across the world. An alternative would have been to interview specific users of TMS´s. Because that would be too time consuming for a master's thesis, and because the answers would potentially be too linked to a certain TMS, no such user have been interviewed.

A number of errors may arise while conducting a qualitative study. It is simply inevitable that this happens when interviews are carried out. However, these errors may be minimised if the interviewer is aware of this fact. It is therefore important to understand what sources of errors that may arise and to discuss to what extent they can affect the end result. Examples of such sources are[6] *respondent errors* (i.e. respondentfel), *instrument errors* (i.e. instrumentfel), *effect of the interviewer* (i.e. intervjuareffekt), and *effect of context* (kontexteffekt) (Aaker, 2004). Respondent errors refers to when an error arise because the respondent cannot, or will not, leave correct information. Instrument errors arise when instrument used for interviewing are wrongly designed. Effect of the interviewer refers to when the interviewer influences or directs the answers given by the respondents. Effect of context is when errors arise due to the adaptation of the interviewer to the particular environment in which he is conducting the interviews. These sources of errors will be further discussed in section 5.1.1.

Besides the above, a suitable way to better explain the procedure employed in this thesis could be to provide answers to the below questions. In section 2.4, these answers are summarised, constituting the validity and reliability of the thesis.

- *What role has the Author*?
- *In what period of time has the thesis been conducted?*
- *How has the documentation of observations been carried out?*
- *How many interviews have been done, how long were they and with whom?*
- *How are the interviews conducted?*
- *How has the collection of data been analysed?*
- *What theoretical framework has been employed for the thesis?*

2.3.1 What role has the author?

The author is a student at Informatics within School of Economics and Commercial Law. As such, he is well acquainted with the theoretical framework that has been employed for the thesis. Furthermore, the author has gained invaluable practical experience when working at NFS.

[6] Freely translated by the author.

2.3.2 In what period of time has the thesis been conducted?

The time frame for this thesis is very broad, starting in January 2003 up to date, i.e. September 2004. However, the interviews were all conducted during 2003, mainly between the spring and the summer. After that, only documentation, analyses etc have been carried out. The only effect of such a relative long time period is that some parts of the result may be out of date. However, the author estimates this risk to be infinitely small, but it is good to be aware of that fact.

2.3.3 How has the documentation of observations been carried out?

The author wrote down everything that each respondent said. In the end of each interview, the interviewee read the written answer to the respondent who therefore could verify each answer.

2.3.4 How many interviews have been done, how long were they and with whom?

Interviews have been done with 12 individuals. Seven of these were representatives of ACT's from South Africa, Austria, Belgium, Luxembourg, Czech, and Germany. Five of these were employees at NFS. The interviews were approximately 30 minutes with each individual. However, as the employees at NFS were located in Gothenburg, their answers were often followed-up by particular questions raised successively. This is referred to as personal communication thorough the thesis, as discussed previously.

2.3.5 How are the interviews conducted?

The interviews with the representatives of various ACT's have been conducted by telephone. The author wrote down the answer to each question on a paper. Personal meetings at the NFS Gothenburg office have also been an important complement to the interviews conducted via telephone. In these cases, the same procedure were employed, i.e. each answer was written down on a paper and then verified by the respondent.

2.3.6 How has the collection of data been analysed?

The collection of data has been analysed by the author after each interview. Each and every criterion, or even a tendency towards a certain criterion, were written down in a word document. When all the interviews were carried out, a clear and obvious pattern could be seen. All respondents were referring to similar criteria, something that was supported by the literary reviews of various books and magazines. Following the qualitative approach discussed previously, the author then picked out (according to his own understanding and interpretation of the information) the most striking criteria. Employees at NFS later on verified these criteria.

2.3.7 What theoretical framework has been employed for the thesis?

The theoretical framework that has been employed in this thesis is carefully described in chapter three and referred to as requirements engineering. According to that theory, the identified criteria were then divided into current non-functional and functional criteria as well as future non-functional and functional criteria. Furthermore, each criterion was divided into subcategories such as requirement-ID, background, description, scale and level of extent.

2.4 Credibility of the Thesis

TM and TMS are very specialised and complex disciplines that require a step-by-step approach. As the learning process has indeed been iterative and step-by-step increasing the author's knowledge, the method applied can be considered as particularly appropriate. Further credibility of the thesis is given by the fact that the respondents made valuable contributions by providing guidance towards specific literature that were proven to be particularly suitable for research, in order to further identify important criteria. Section 2.4.1 and 2.4.2 further summarises what has been discussed previously.

2.4.1 Validity

The identified criteria have been verified with Mr Bergström, Mr Lorentzon, Mr Hacker and Ms Romberg at NFS, which adds further validity of the result of the thesis. By not asking detailed questions at each interview, but instead start with discussing some general areas, several different aspects of system requirements could be identified. The same approach was employed when interviewing the representatives of ACT's. The validity was further confirmed by the fact that the author has been working within sales at NFS. As such, the writer had an opportunity of getting close to customers and thereby their requirements. However, this thesis did not include any interviews with actual users of any specific TMS. That may cause some requirements to be missing. On the other hand, it would not have been possible to conduct such extensive interviews, as this thesis should fit into 20 points. Besides that, if actual users would have been interviewed, the answers might have been too related to a particular TMS and not TMS's in general[7]. Finally, comparing the result to research made within this field earlier could strengthen the validity of this thesis. However, no such research has been done[8].

2.4.2 Reliability

It is rather difficult to discuss the reliability of this thesis, as the main contribution has been done through a qualitative study. Considering the fact that the environment in which treasuries operates is constantly under change makes the result bounded to a specific period in time. However, the author estimates that should someone else conduct a similar study of next generations' requirements on TMS, the result should be very much the same. This is strengthened by the fact that so many different sources have been applied.

In fact, systems suppliers have not been interviewed in this thesis. This is done deliberately and the reason for it is due to the fact that many suppliers only claim that their unique system enhancements are the very result of responding to the future requirements. However, it is a widespread view in the treasury arena that this is seldom the case (personal communication, Bergström, P., 2003-08-29). By also interviewing employees at an independent company like NFS, a high level of reliability could be obtained, in combination with critical reviews on the literature employed.

[7] The focus of this thesis is to identify criteria on TMS in general. As each treasury only employs one TMS, possible answers would be related only to that particular TMS.
[8] At least according to the best knowledge of the author.

3. Theoretical Base

This chapter describes the theoretical base that is used as a foundation for identifying current and future requirements in this thesis. Initially, the very criterion and its characteristics are described. Then an explanation of the process of identifying criteria will follow. Finally, evaluation of criteria is presented.

3.1 What is Requirements Engineering?

The process of deciding on what combination of properties a software system should have is called Requirements Engineering (RE) (Carlshamre, 2001). RE can also be defined as (Kotonya and Sommerville, 1988, p. 9):

"A requirements engineering process is a structured set of activities which are followed to derive, validate and maintain a systems requirement document"

The objective of the RE procedure is to generate a *requirements specification*, or *document*, as described above[9]. This process is also referred to as the *specification process.* Typically, it includes Elicitation, Specification and Validation (Loucopoulos and Karakostas, 1995). Elicitation is the process of understanding a problem at hand, e.g. identifying the stakeholders and to capture the requirements. Specification refers to the process of describing and documenting the problem or the requirement. Validation is the process of ensuring that the specified criteria are aligned with the expectations of the stakeholders. The specification process is classified differently depending on who makes the classification. For example, Zowghi suggest five categories instead of the three above (Zowghi, 1995). The RE discipline is still evolving and various approaches are discussed (Loucopoulos and Karakostas, 1995). Further below a description of an alternative classification by Wiktorin will follow (Wiktorin, 2003).

Conclusively, RE can be expressed as proposed by Karlsson (Karlsson, 1995, s 25):

"Requirements engineering is the application of proven ideas to iteratively discover and select requirements, to document them in a requirements specification, and to validate the set of requirements"

3.2 What is a Criterion?

Criteria steam from the overall mission of an organisation. The organisational objectives are thus transformed into selection criteria or system requirements on the treasury management system. In addition, criteria are influenced from other factors such as people and the common environment. In particular, requirements are very influenced by social and organisational change (Johansson, 1999). If criteria are derived from the common environment they tend to be more general in nature, compared to criteria derived directly from potential users of an information system. Typically, criteria are divided into "functional" and "non-functional" criteria (Karlsson, 1995).

[9] Throughout this thesis system requirements, criterion, criteria, selection criteria will be used synonymously.

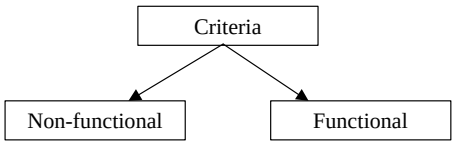

Figure 3Classification of criteria (authors own illustration).

Functional criteria concern information or tasks within the department or organisation and are often more detailed in nature (i.e. they refer to a certain *function*). Non-functional criteria refer to qualitative requirements, e.g. reliability and security, consequently being more of general characteristics (i.e. they do not refer to certain functions).

By definition, a criterion is a desirable feature or function in an IT-system. The criterion should be formulated so that it is possible to decide whether it is fulfilled by the final product or not, it should thus be *measurable*[10] (Hökenhammar, p 112, 2001).

A criterion always has an origin, a motive and a realisation object (Wiktorin, 2003). The origin steams from a user, with a specific requirement that needs to be satisfied, while the object of realisation refers to a module or a certain characteristic within the system. Typically, non-functional criteria are more stabile and less sensitive to organisational change compared to functional requirements (Stevens et Al, 1998).

3.3 Requirements on Criteria

Even if practically very challenging[11], requirements should be formulated so that they are comprehensive and correct. General features for functional as well as non-functional criteria have been presented, e.g. by Karlsson and Hjelte. Some of the requirements on criteria that they present are (Karlsson, 1998 & Hjelte, 1995):

- *Validatable*: each requirement should have the means to prove that the system satisfies the requirements.
- *Unambiguous*: each requirement should be stated in such a way so that it can be interpreted in only one-way.
- *Abstract*: Each requirement should be implementation independent.

Even though these factors refer to general criteria and not systems criteria distinctively, these requirements are still applicable on data based systems.

[10] However, for non-functional criteria this condition is less strict as such criteria are often general in nature.
[11] For example, functional criteria are subject to constant change, as stated by Jones (1994).

3.4 The Process of Identifying Criteria

The process of establishing successful system criteria can be summarised and divided into the following activities: collection, documentation, prioritization, verification and validation, and finally maintenance (Wiktorin, 2003). The order is only a suggestion and the activities do thus not necessarily need to be implemented as such. In this thesis, an iterative process is applied in which collection and documentation is combined with verification and validation and maintenance. However, no prioritization will be conducted, due to the reasons presented in the delimitation in chapter one. The stages in identifying the criteria are illustrated in below figure. The whole process is continuous in that maintenance is followed by collection, something that is illustrated by the dashed line.

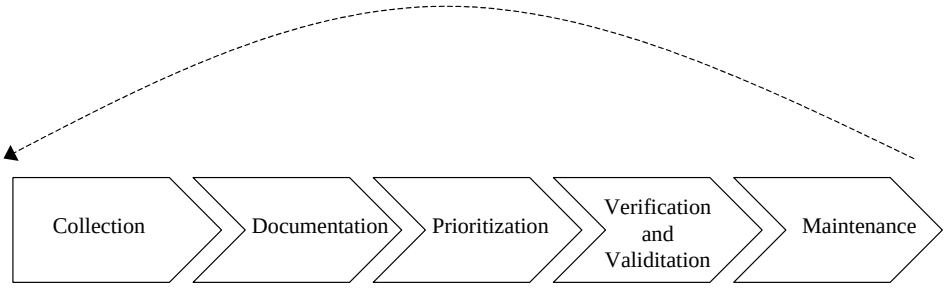

Figure 4 The Process of Identifying Criteria (authors own illustration).

There are other RE-procedures that are not iterative in nature, i.e. they are sequential. As such they do not capture the dynamics and constantly changing requirements that may arise in certain environments (Johansson, 1999). A typical such environment is constituted by the treasury arena, as has been described previously.

3.4.1 Collection

Data for identifying requirements can mainly be derived from two sources: users/surrounding systems/organisation or alternatively via general interviews/literary reviews/observations in the industry (Wiktorin, p. 116, 2001). In this thesis the collection activity has been conducted through the latter source. One particular problem is to find a suitable level of detail in establishing a criterion, i.e. how detailed should a criterion be? This is especially evident for functional criteria, which take the risk of rather being a description of construction than of a requirement for a function. For non-functional criteria, the identification procedure can be more complex as perspectives and issues outside the users and the organisation must be captured (Stevens et Al, 1998). Such criteria are often forming the very architecture of the system, as most functional requirements can actually be implemented in any architecture.

3.4.2 Documentation

According to the standard IEEE 830 (IEEE 830) a requirement should be described so that it is *understandable* and so that it can be *evaluated*, i.e. to what extent it is *fulfilled*. The standard provides guidance in stating how a specification of requirements should be designed. There is a trade-off between the graduations versus the quantification. Functional requirements are difficult to describe while being easy to quantify, i.e. the function either exists or it does not. Non-functional criteria on the other side, are difficult to quantify but can easily be described. Often the separation between functional and non-functional requirements

can be incomplete. In such case, a further subdivision into respective criteria is recommended by the standard.

Concerning the non-functional criteria these need to be better quantified and distinguished than the functional ones, as they are more general in nature. The below headings provide an example of a structure, suggested by Gilb (1977 and 1998). It will be employed in chapter four of this thesis.

Requirement-ID:
The recommendation is to provide a comprehensive and compact name that catches the requirement properly.

Background:
Provides a history of the development of the criterion and what has been achieved up-to-date.

Description:
This typically refers to a description of the criterion and the idea behind it.

Scale:
Under this title follows a presentation of the grade and the scale employed in the level of detail for the criterion.

Level of Extent:
This states the level of fulfilment requested by the criterion. However, for the future non-functional requirements that will be identified in this thesis, the level of fulfilment will naturally have to be altered. Instead, the degree of probability will be discussed as the criterion might be suffering from some degree of uncertainty, being not yet implemented or fulfilled at all.

Complementary headings beside the ones stated above could be added, such as directives for how the very measurement of the requests should be performed.

Requirements documentation is thus a central document in the systems engineering or design process, which presents the above-explained factors. The purpose of such a document is to have a base for the future process that will take place between an organisation or user group (i.e. the buyer) and the supplier (Hökenhammar, 2001). This procedure is further described in *Software Lifecycle Processes* (ISO 12207) and *Recommended Practice for Software Requirements Specification* (IEEE 830). However, as the purpose of this thesis is not to identify any criteria from the perspective of particular organisations or user groups, the theory of documentation criteria will not be followed more than what has been presented above.

3.4.3 Prioritization

Requirements can be altered and even completely changed during the process of identifying criteria. In addition, requirements can sometimes be contradictory. By ranking the criteria these problems can be dealt with. Typically, functional (and to some extent even non-functional) criteria can be divided into three subcategories: must-haves, desirables and nice-to-haves (Karlsson, 1998b). Requirements within the same category should also be prioritized. In this thesis, prioritizing will only be addressed in the case of an obvious conflict between requirements. In the case of any conflicting criteria, these will be highlighted. Otherwise, no prioritization will be made as it is of less interest for the purpose of this thesis[12].

However, some prioritization will take place albeit not in its original form. During the other stages, and in particular during the collection stage, ranking has been employed. The reason for this is simply because all identified criteria cannot be presented. In addition, some ranking of requirements must be done in order to cope with the large amount of interdependence between the different requirements.

3.4.4 Verification and Validation

Verification refers to whether the system performs activities in the correct way. Comparatively, validation refers to whether the correct activities are being made at all (Hökenhammar, 2001). The process of validating and verifying is very difficult to conduct in the situation when no particular system or user group is available for control. However, the empirical results obtained in this thesis are validated with the interviewees from Nordic Financial Systems, as explained in chapter two. The process of verification and validation is probably one of the most important activities in requirements engineering (Pressman, 2001). In fact, auditing was determined as the most important contribution in system design, made in a ranking procedure in the magazine IEEE Software (McConnell, 2000).

3.4.5 Maintenance

Maintenance is closely related to prioritization as the same type of problem is catered for: changing, and possibly contradictory criteria. Traceability of a criterion thus becomes important as it eases the procedure of deriving the interdependence that might exist, providing a better overview of the situation (Wiktorin, 2003). Non-functional criteria are often being realised through the overall architecture. Due to this, they are very difficult and practically almost impossible to trace. In addition, traceability typically involves the very identification of a particular user (Sommerville, 2001). Despite that, this procedure will be employed as far as possible in this thesis.

As a result of the above procedures, it can be said that the requirements specification document is thus not a static document but indeed dynamic and full of interdependencies. A method of allowing for dynamics in the RE process is therefore to ensure traceability and proper management of the criteria (Wiktorin, 2003). Traceability for requirements means that their history can be identified – i.e. to be able to follow the criterion from its origin. Proper management is achieved by ensuring interdependencies between different criteria, i.e. how they are related and if they are affecting each other in any way. One way of ensuring these dynamics is thus to characterise the criteria into current and future requirements, as will be

[12] As discussed in the delimitation presented in chapter one.

done in this thesis. Finally, considering the fact that the treasury arena is under constant organisational change (Frisch and Lind, 2003), the requirements will be identified through an *iterative* process. This procedure is particularly recommended for RE processes that is characterised by constant organisational change, suggested in the book "Social and Organisational Aspects of Requirements Engineering Methods" (Johansson, 1999). Consequently, the criteria in this thesis will follow the classification and procedure below.

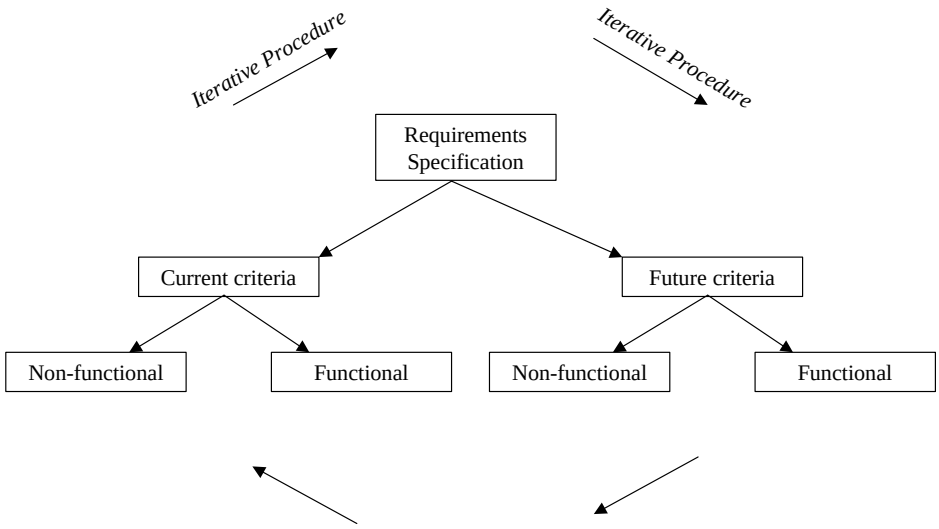

Figure 5 Illustration of the procedure and the classification of criteria in this thesis (authors own illustration).

4. Empirical Results

This chapter presents criteria for treasury management systems that have been identified applying the theory and method described previously. The chapter is divided into three sections: sources for empirical data, current criteria, and future criteria. The two latter sections are further divided into non-functional and functional requirements.

4.1 Sources for Empirical Data

The sources that have been employed in deriving the current and future criteria[13] in the coming sections are presented in table 1 below.

		Interviews		Literary Reviews			
		NFS	ACT	GT News	TT	TMI	Others
Current Criteria	A:Duty of Segregation & authorisation	X	X		X		X
	B:Real-time Principle	X					
	C:Straight-Through Processing (STP)	X		X		X	X
	D:Internal & External Integration	X		X			
	E:Full Derivative & Currency Support	X	X				X
	F:Web-enabled Functionality	X	X	X			X
	G:Netting Functionality	X					X
	H:Pooling Functionality	X					X
	I:Further Integration & Enhanced STP	X		X			X
	J:Modularisation	X	X				X
Future Criteria	K:Partitioning of the Database Architecture	X	X				X
	L:XML vs EDIFACT – Open Standards	X	X	X		X	
	M:Regulatory Compliance	X	X	X			X
	N:Improved Technical Reliability & Stability	X	X				
	O:Real-time Trading Functionality	X					X
	P:Enhanced Web-enabled Functionality	X					X
	Q:Integrated CM Functionality	X					X

= Functional Criteria *= Non-Functional Criteria*

Table 1 Sources for Empirical Data (authors own illustration).

The table shows what sources has been employed in deriving each criterion and that all criteria, except criterion B, have been identified through several sources. Following the theory presented previously, each criterion is divided into functional and non-functional characteristics. The table further depicts that *NFS* (interviews conducted with employees at Nordic Financial Systems; Mr. Bergström, Mr Hacker, Mr Lind, Ms Romberg and Mr. Lorentzon) has been the most valuable source of information, together with *Others* (general literary references that can be found in the reference list of this thesis). This is followed by

[13] The names of these criteria are accepted facts in the TMS business.

ACT (i.e. representatives of various associations of corporate treasurers) and *GTNews*. As the table further suggests, the magazines *TT* (Treasury Today) and *TMI* (Treasury Management International) have not been the most valuable sources in deriving the current and future criteria, as they only support a few criteria.

4.2 Current Criteria on Treasury Management Systems

This section presents some of the most important current requirements on TMS as have been identified on the basis of the empirical research of this thesis[14]. The purpose is not to conduct a comprehensive presentation on all current criteria, but rather to bring about some of the most obvious ones. For both sections on current and future systems criteria, the requirements are divided into non-functional and functional criteria. This is in alignment with the theory and methodology presented in chapter two and three.

4.2.1 Current Non-Functional Criteria

Below follows some of the most important non-functional criteria of today's TMS's that have been identified according to the table above. Each criterion is divided into "Requirement-ID", "Background", "Description", "Scale" and "Level of Content", following the suggestion of the theoretical base formulated in chapter three.

4.2.1.1 Criterion A: Duty of Segregation & Authorisation

The author has named the non-functional requirement-ID for this criterion to *Duty of Segregation and Authorisation*.

Background

Even if most of the Multinationals have specific and unique ways of organising their treasuries, there are some general resemblances to be found. The four-eye-principle[15] divides the treasury into three separate subordinated parts: back office, middle office and front office (The Financial Market Association, 2002). Different individuals carry out detached tasks in each, preferably. The system of duty segregation does thus simply describe who does what within the treasury. This must be reflected and supported in the TMS as well. Some corporations like to argue that their operations are not big enough or that there is not enough workload to motivate such a segregation of duties, as did the Barings management in response to the internal audit, shortly described below. As a result, duty of segregation also entails *authorisation* – the personnel risk. The risk covers action or inaction by treasury employees that can cause financial loss to the company. Personnel risk can arise in three forms: error, lack of expertise and fraud (Treasury Today, 2003). Duty of segregation and authorisation prevents these risks as well as enforcing the organisational structure, depicted in figure 6.

[14] The criteria are not mutually exclusive and will not be presented hierarchically.

[15] A principle stating that certain responsibilities during a deal life cycle should be kept divided between different people ("at least four-eyes"), in order to prevent fraud and undue actions.

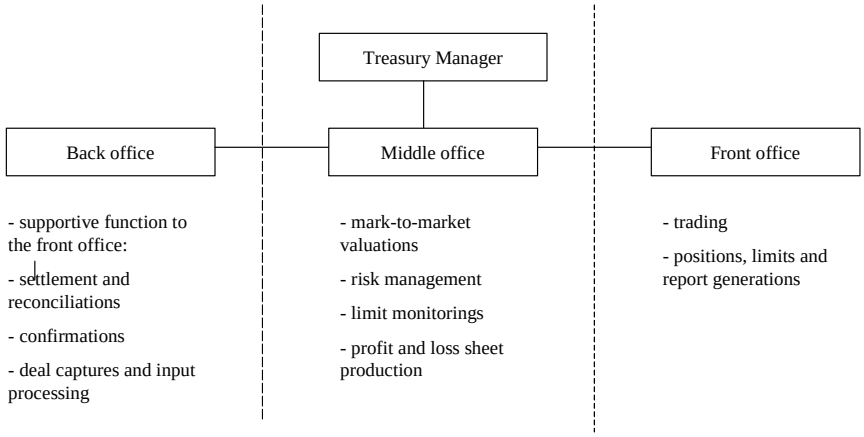

Figure 6 Organisation and tasks of the treasury department (authors own illustration).

Typically, the core functions of the back office are deals management (including deals confirmation and authorisation), verifications and settlements with reconciliation of nostros, positions and books (Nolan & Amos, 2001). While the back office mainly supports and controls the front office, the middle office has similar functions at least as to the supporting extent. Occasionally, the back office can also carry out typical middle office functions such as risk management (e.g. formulation of policies, rules and limits for exposures), forecasts and regulatory reporting (Nolan & Amos, 2001). The front office is where the trading takes place. The personnel at the front office perform the core trading activities and they take care of the contact with external parties such as banks and other actors.

The reasons to the above subordinations are many. In the very beginning banks had their traders organized in a trading room (often in the front of the office). As they needed support with ex-post deals the back office came into use; it was simply the room lying behind the trading room. Banks, corporate treasuries and other actors adopted the same structure as well. But the subordination does not only steam from practical issues, it also satisfies legal restrictions and follows the guiding principles of the Model Code[16] (ACI, 2002, p 48):

"The organisational structure of market principals should ensure a strict segregation of duties and reporting lines as well as independent risk management controls between front and back office staff. Where the middle office has a control or administrative function a similar segregation of duties and reporting should apply."

These guidelines have had a strong impact on the whole industry, including TMS suppliers, with the purpose of preventing undue actions to take place. Many organisations have had to learn this the hard way before realising they had lack in management control and segregation of duties (Moore, 2002). This was clearly the main contributing factor that forced Barings Bank into bankruptcy in 1994 (Zhang, 1995)[17].

The guiding principles above can be interpreted as the most important limitation being between the front and the back office, where middle office delimitation only occur when

[16]For further information please visit: http://www.aciforex.com

[17] One of the banks traders in Singapore, Nick Leason, traded with futures and options on Nikkei index without permission. By creating false and unidentified customers, in combination with solely controlling typical front-to-back office functions, he managed to protect himself from being discovered for a very long time. As a result, he took the world's oldest bank down.

necessary. The organisational structure described above has had a profound impact on how treasury management systems are designed. In reality, segregation of duties in financial software can be circumvented rather easily. In order for the treasury to be efficient and fully functional, physical borders between front and back office, as well as having different individuals performing different task, must be combined with the appropriate TMS (Personal Communication, Bergström, 2003-08-29).

Description

With regard to the system of segregation and authorisation, current treasury management systems are strictly designed with clear limitations on *what kind of actions different users are allowed to take*. For example, a certain employee should not be able to initiate and confirm the same deal. This entails a strict user access. For example, employees at the front office do not have authorisation to enter, delete or modify data that belongs to typical back office operations such as verification and authorisation of deal entries. In addition, segregation of duties also includes a supervising function in all TMS. This entails that the system can make other users (e.g. employees having a controlling function at the middle office) attentive to limit and exposure exceeding by the front office traders. Alternatively, a financial trader might not be able to overstep a certain level of dollar exposure. It is however important to keep in mind that many treasury management system does not actually function as trading systems but rather as ex-post management system – in those situations segregation of duties is less effective in preventing undue actions to take place[18].

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

Segregations of duties must entail strict user access and well-separated front-to-back-office functions. It is generally accepted that most current TMS´s have enabled a full level of extent regarding this segregation of duties and authorisations.

[18] A non-trading system means that actual trading of financial instruments does not take place in the system itself. Instead, deals have to be traditionally executed by the use of telephone or fax, or at least by employing a separate trading system. In reality, ex-post trading management does thus entail input of post-deal information.

4.2.1.2 Criterion B: Real-time Principle

The author has named the non-functional requirement-ID for this criterion to *Real-time Principle*.

Background

When treasury management systems first came into use they were naturally very limited in its functions and only employed as *supportive tools* to typical treasury operations. But today not many treasuries can function without having a proper TMS or at least some excel spreadsheet solutions in place[19]. The reason for this is because TMS functionality has developed significantly the last decades so treasury employees have put more trust, and become more confident in, using these solutions. An important example of a typical development is the possibility of viewing different effects of newly taken financial positions. For example, if a front-office trader goes long in high-beta portfolios he or she will increase the risk exposure of his or her assets[20]. It is important for the trader to keep track of all his positions and the resulting effects, so when the TMS provides a financial statement or report of the financial exposures, it is of course extremely important that they are adequate and up-to date. The real-time principle ensures that kind of accuracy.

Description

Real-time principle means that every financial operation is *instantly* (i.e. in *real-time*) *reflected in the system*. This means that a relatively small deal made at the front-office can have great impact on the back office in that it impacts typical financial figures such as DEAR and VAR values[21]. The value of these figures provides a framework for how risky the operations are and thus indicate whether long or short actions are needed. Real-time principles can include several aspects of a TMS, but means that new information is instantly reflected (automatically updated) in all affected parts of the system, without forcing the user to manually make updates (personal communication, Hacker, M., 2003-09-21).

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

It is generally accepted that most current TMS´s have enabled either a full level of extent, or none, regarding the real-time principle.

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[19] It may seem somewhat surprisingly but many treasuries do still actually rely on simple excel spreadsheets solutions (personal communication, Bergström, 2003-03-18).

[20] Going *long*, or being in a long position, means that you are buying financial instruments (going *short* means selling). Buying a high-beta portfolio means that you are buying a set of stocks that historically have proven to move up, or down, more that the average stocks in the market (i.e. the market portfolio, equivalent to the stock index) have done. For example, if the market portfolio moves down by 10%, your stocks will move down by more then 10% and if the market portfolio moves up by 10% your stocks will move up by more then 10%. The greater the variation in movements, the greater the possible risk and thus the greater are the beta.

[21] Simply put, Daily Earnings At Risk (DEAR) and Value-At-Risk (VAR) indicate, to a certain confidence level and in a certain currency amount, what the maximum potential loss might be on any given day.

4.2.1.3 Criterion C: Straight-Through Processing (STP)

The author has named the non-functional requirement-ID for this criterion to *Straight-Through Processing.*

Background

The Straight-Through-Process (STP) criterion steams from the never-ending wish to improve and constantly develop routines and procedures at treasury departments. STP is sometimes called Stop-The-Paper, due to its goal of automatisation. The TMS suppliers quickly adopted STP in their selling arguments and it became the most employed buzzword in the industry during the late 90ies, and still is in fact (Ronan, 2003). All suppliers argued that their particular system had great STP functionality, which only sometimes was in accordance with the reality (personal communication, Bergström, 2003-05-28). The idea behind STP is to transport information that is required within a certain operation from beginning to end seamlessly, so no surprise the concept became so widely employed. The concept is not limited to only TMS but is used all over. The reason for the STP concept to develop within the treasury arena is because many TMS that supported some areas of typical treasury operations have actually created additional manual work in others. The objective of STP is therefore to minimise all manual procedures and, perhaps most importantly, to eliminate multiple points of data entries (Walton, 2003). This means that data for a certain operation should never need to be input twice. As treasuries historically have employed several systems, such as the general ledger or the company wide ERP solution in combination with trading systems etc., multiple inputs have been very common. STP is thus an attempt to streamline operations and integrate different systems.

Description

A treasury management system supports STP if manual processes are minimised as much as possible and if there are no unnecessary points of data entries, i.e. if there is only of single point of data entry for each procedure (personal communication, Hacker, M., 2003-05-28). A typical example of such a process is when a trader at the front office function initiates a deal by inputting deal information in an external trading system[22], such as counterparty and instrument details, while this information simultaneously is transferred to the TMS. In that case, the back office personnel do not need to enter the same information again because only one single point of data entry has been used.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

It is crucial to understand that STP is a never-ending criterion in that it is constantly changing the circumstances in which it operates – i.e. STP functions will develop continuously. As a result, it is very difficult to determine exactly what is required for its fulfilment. However, if a TMS requires a lot of data entries for similar procedures in combination with redundant

[22] An independent real-time trading system that is linked to the existing TMS.

processes such as those described previously, the TMS is not considered as being STP supportive.

4.2.1.4 Criterion D: Internal & External Integration

The author has named the non-functional requirement-ID for this criterion to *Internal and External Integration*.

Background

This criterion steams from the wish of creating seamless and streamlined operations. An important tool for this purpose has been the employment of Enterprise Resource Planning systems (ERP's), whose objective is to integrate different parts and systems throughout the whole corporation by using mainly one company-wide system (i.e. the ERP). For example, if the economic department employs different systems from those at the treasury, communication between them becomes complicated and will be unnecessarily difficult. However, for purposes of treasury operation, ERP's have a lack of depth of functionality compared to the specialised treasury management systems (Nalder, 2001). The best-of-breed up to date has therefore been to try to integrate existing TMS´s with internal and external systems, instead of replacing them. Internal integration thus refers to the possibility of linking the TMS to other independent internal systems, such as trading or general ledger systems, employed within the department or company. While external integration refers to the possibility of linking the TMS to other systems such as external banking systems. Internal and external integration is very similar to the STP-criterion described above in that its purpose is to minimise manual processes and eliminate multiple data entries. However, this criterion is more focused on integrating independent systems within or outside the department or company.

Description

A typical example of internal and external integration is when the TMS has SAP compatibility towards the internal operations and external compatibility with banks electronic payment or trading systems (personal communication, Bergström, P., 2003-07-25). In order to achieve this kind of integration the TMS must be easily adoptable, with regard to the OOD described shortly, with appropriate interfaces. Therefore, the TMS should be in alignment with international standards for electronic payments such as SWIFT and EDI/EDIFACT.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

Integration takes many forms and it might therefore be difficult to decide whether a TMS truly has this kind of functionality or not. From a programming point of perspective, integration possibilities can be determined on the basis of what programming language that has been employed when designing the software. For example, Object-Oriented Design (OOD) is characterised by the easiness of adding new features and making modifications of existing ones[23]. If a system relies on OOD, such as Java or C++, and has an open architecture, integration will tend to be less difficult and costly (personal communication, Hacker, M., 2003-08-12). However, it is important to understand that this criterion will continuously develop and therefore remains in the future. As a consequence, it might be discussed whether a TMS really supports complete internal and external integration or not. In addition to OOD and open architectures, the TMS should be based on accepted standards and interfaces.

4.2.2 Current Functional Criteria

Below follows some of the most striking functional criteria of today's TMS's that have been identified according to the table, at page 18 in the beginning of this chapter.

4.2.2.1 Criterion E: Full Derivative & Currency Support

The author has named the current functional requirement-ID for this criterion to *Full Derivative and Currency Support.*

Background

As described previously and in appendix one of this thesis, treasury operations entail management of short-term assets and liabilities. This means that treasuries make foreign exchange transactions in various currencies and with various kinds of financial instruments such as Treasury Bond Futures and Forwards[24]. The complicating factor is that as treasuries share some common currencies and instruments, many are specialised in dealing with currencies and instruments that fits their unique needs. Some treasuries demand an extensive functionality concerning e.g. T-bond futures, while others have completely other needs regarding the derivative support (i.e. the support of financial instruments). In addition, as some treasuries are located in Asia and some in US, the most applied currencies differ as well. The result is simply that treasuries deal all kinds of currencies and derivatives, and thus have different needs in terms of system support (ACT, 2003). For a treasury department that is dealing with Thailand Bath on a daily basis, there is simply no alternative but to have a TMS

[23] This requires the possibility of a programmer modifying one part of the program code without having other parts affected.

[24] These contracts constitute an agreement between two parties to buy or sell an underlying asset (in this case a treasury bond), at a predetermined price at a future date.

that is designed for that currency. This can be further illustrated by the situation at ING Insurance[25] in the Netherlands; they are interested in start dealing with Treasury bond futures and forwards, without knowing if these derivatives are actually supported by their existing treasury management system (personal communication, Bergstrom, P., 2003-09-01). The ING case is interesting since it provides a typical example of a situation where a system might be neglected because it does not support certain derivatives or currencies. Even if the derivative cover only may be one of several other important factors influencing the final system selection, many treasuries do indeed expect this kind of system support (EUBFN, 1999a).

Description

Effective management of financial instruments and currencies require that appropriate formulas and procedures are available in the TMS. For example, a long position in Japanese yen by US dollars requires the possibility of calculating conversion amounts.

Scale

This criterion has simply two scales concerning currencies; either it is met or it is not. Regarding derivatives, the scale is more varied as a derivative might be only partially covered[26].

Level of Extent

The correct derivative and currency support is a strong system criterion that must be met by the system supplier before an implementation of a specific treasury management system can be made. It is important to understand that the wide range of traded instruments is subject to constant change[27], therefore TMS suppliers must continue to broaden the cover and to continuously make supportive enhancements. Some treasuries do not trade more than in five or six currencies and can thus be satisfied with only a limited amount of currencies being supported in their TMS.

[25]ING Insurance is owned by ING Group, which is a global financial institution of Dutch origin with 115 000 employees. ING Group offers banking, insurance and asset management to 60 million clients in 60 countries. For more information please visit http://www.ing.com

[26] For example, T-Bond Futures can be risk monitored and forecasted in most TMS´s without the possibility of actually trading them within the system. In that sense, trading must take place via telephone or complementary software, leaving the derivative only partially covered (personal communication, Romberg, A., 2003-05-19).

[27] Instruments, just like fashion, follow trends and new derivatives are continuously being developed.

4.2.2.2 Criterion F: Web-enabled Functionality

The author has named the functional requirement-ID for this criterion to *Web-enabled Functionality*.

Background

Competition forces multinational corporations to continuously improve their way of working. Technological innovations like Internet enable further operational efficiency by shortening the gap between people and processes. Following criterion A described previously, authorisation procedures by the middle or back office provides a perfect example; authorisation can sometimes takes place from remote locations since treasury operations are truly global and require senior executives and other treasury employees to travel regularly. If the treasury manager must authorise new limits and exposures, he or she can enable authorisation to be granted remotely via the use of web-enabled TMS functionality (Nalder, 2001). The employment of Internet has not only enabled treasuries to improve authorisations but also to streamline its operations in general and to centralise its organisational structure in particular. There are innumerable articles and reports that support this view, for example a global study about Treasuries´ Organisational Change (Frisch & Lind, 2003). Internet, and the web-enabled functionality that comes with it, is undoubtedly the most important single factor that has transformed treasury operations, at least since the very introduction of computer-aided operations back in the 70ies (ACT, 2003). However, even if web-enabled functionality might seem as an obvious feature of any TMS, there are many functions that indeed need to be further developed. For example, generation of financial reports and statements are not fully enhanced as treasury managers seldom can receive adequate financial reports concerning limits and exposures on a global basis[28] (personal communication, Romberg, A., 2003-05-16).

Description

In accordance with real time principle described previously, web-functionality can also include the possibility of remotely modifying front office deal information while simultaneously being visible to remotely located back office staff. By definition, a TMS should be considered fully web-enabled when a treasurer can remotely perform the same activities as he or she can do in the office in front of his or hers stationary computer (BRC, 2003).

Scale

The scale of web-enabled functionality can vary dramatically, from only small operations being remotely enabled to full remote functionality. It is therefore of less importance to determine the scale of this criteria.

Level of Extent

Web-enabled functionality takes many forms and it might therefore be difficult to decide whether a TMS truly has this kind of functionality or not. For example, if a front office trader is able to enter deal information remotely, but not able to view, modify or delete the

[28] This is also due to the fact that the world has four major time zones and risk figures therefore change constantly (if trading activities would have occurred in only one time-zone, global exposures should have been much more easily retrieved).

information, the web-enabled functionality would nowadays be considered as non-existent. It is generally accepted that most TMS still need to develop at least to some extent as only a limited amount of functions actually can be remotely performed. Web-functionality does also have security aspects in the sense that all functions made remotely must be protected from unauthorised persons. This aspect must also be catered for in determining whether a TMS is fully web-functional or not.

4.2.2.3 Criterion G: Netting Functionality

The author has named the functional requirement-ID for this criterion to *Netting Functionality*.

Background

For a multinational company having subsidiaries all over the world, cash transactions between the entities take place regularly. Surpluses in one part of a region must finance deficits in another part of a region and vice versa. Furthermore, the company is involved in transactions to and from third parties. Without a treasury netting function, these transactions might look like in below figure (Dolfe & Koritz, 1999, p 80):

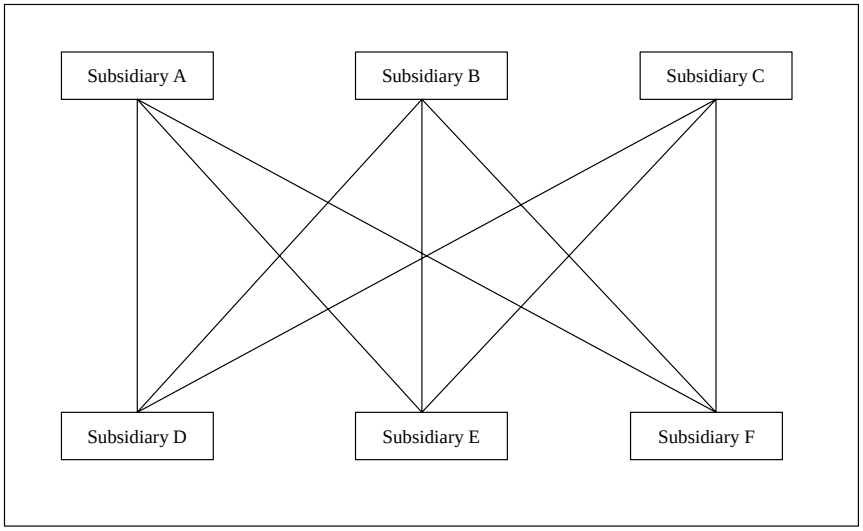

Figure 7 Cash flows between subsidiaries without bilateral netting.

These foreign exchange transactions and the resulting risks, such as foreign exchange and operational risks, need to be managed as interest and exchange rate losses potentially arises (Larsson, 2000, p 125). The transactions generate transaction costs that need to be held down as much as possible. In addition, the more and larger transactions, the higher risk for messages and payment errors. Those errors become more costly, the later they are detected in the settlement process. In order to make the whole process more risk efficient the transactions should be kept at a minimum level. The recipe for attaining this is to optimise the intercompany cash flows with bilateral netting, simply called netting. Netting thus refers to the minimisation of risks and transaction flows between member companies in the group or even with third parties (Shapiro, 1999, p 426). The goal is to match as closely as possible

expected payments in one currency with expected receipts in the same currency. Typically, the netting process is managed by the TMS and works as illustrated below (Dolfe & Koritz, 1999, p 84):

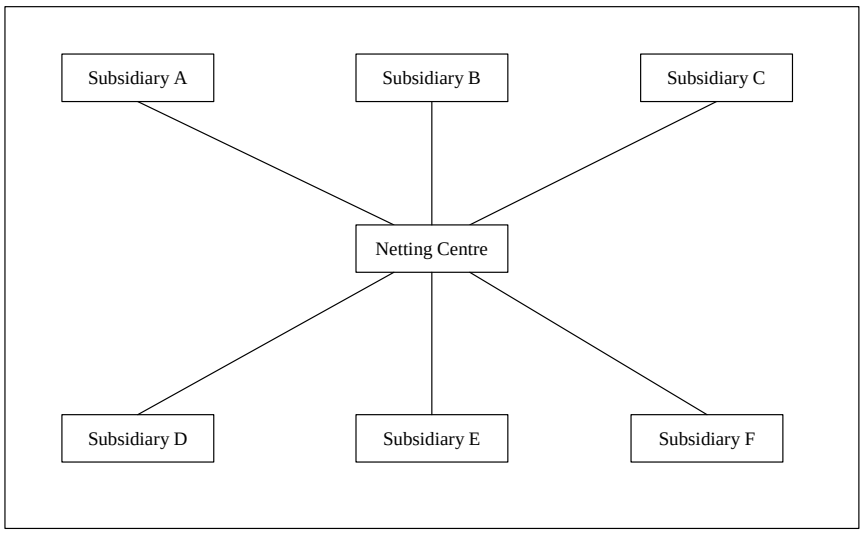

Figure 8 Cash flows between subsidiaries with bilateral netting.

Suppose we have a holding company in Sweden, who owns subsidiaries A-F. Various trade patterns takes place between them, generating accounts payable and accounts receivable in every direction. By having a netting functionality enabled in the TMS, the intercompany payables and receivables (i.e. the volume of the messages and the value of the payments) can be reduced heavily. The netting function simply matches accounts receivable (i.e. revenue) and accounts payable (i.e. costs) between affiliates in different countries. As illustrated in figure 8, the settlements are significantly reduced and the transactions are optimised.

Netting can also take place between external companies, called third party netting or multilateral netting, even if netting is primarily used for intercompany settlements.

Description

The procedure of netting is crucial to every treasury department[29]. As described previously, the objective of netting is to reduce the amount of transactions from account payables and accounts receivables in order to lower the transaction costs. While some suppliers still provide particular netting modules as complimentary software packages, they are becoming increasingly widespread as standard features in TMS (personal communication, Lind M., 2004-08-26). Such netting functionality simply means that all revenue transactions are automatically matched with the expenditures.

Scale

The scale of this criterion is not very detailed.

[29] However, some MNC´s conduct netting and pooling functions in other departments such as Shared Service Centres. In those cases requirements on these special function is not conducted at the treasury department.

Level of Extent

This criterion is met if a system is linked to an external netting software or if a netting module is integrated into the TMS. Alternatively, which is the most common case, if the netting function is a standard feature within the system.

4.2.2.4 Criterion H: Pooling Functionality

The author has named the functional requirement-ID for this criterion to *Pooling Functionality.*

Background

Despite lowering transaction cost, default risks, interests and exchange rate risk; netting does not eliminate all of the potential losses and risks contained with international settlements. When cash needs to be transferred between subsidiaries, the legal framework could be an obstacle as well. In order to circumvent these problems pooling is employed.

Cash pooling refers to the process where a central account system is being established with the help of a bank. Such an account pattern, where the group members´ local bank accounts are sorted under, and connected via, a (regional) central account, results in many benefits to the treasury department. The most important purpose with pooling is to consolidate different accounts to attain interest benefits (Giannotti & Smith, 1981, p 84). This makes it easier to move cash between different accounts and thus different countries (while simultaneously earning interest), something that is heavily regulated by law.

For example, the cash pooling structure eases the management of liquidities between the group members of the corporation since deficits in one local account can be financed with surpluses from another. Cash flows can also be more easily and efficiently transferred since the transaction cost becomes substantially lower. Regulations and other legal obstacles can be avoided this way, albeit not without strong effort. In addition, no interest rates earnings are lost since the rates are counted centrally (i.e. independently of which sub account carries the money as long as they are sorted under the central account, i.e. the pooling account).

Yet another advantage with the cash pooling function is that the external credit requirement tends to be lower since funds primarily are collected internally from the local sub accounts. When the parent company keeps most of its loans in one bank a more favourable interest rate might be given. However, the dependency on only one bank is growing stronger. This trade off between lower price on credit and higher dependency tends to be more negative than positive, at least in practice (AFP, 2003). Appropriate pooling functionality has therefore been crucial to most treasuries.

Description

Cash pooling refers to the process where a central account system is being established with the help of a bank. Such an account pattern, where the group members´ local bank accounts are sorted under, and connected via, a (regional) central account, results in hierarchical account structure that must be reflected in the TMS. In order for the pooling structure to be functional it must also entail external integration to the bank’s systems.

Scale

The scale of this criterion is not very detailed.

Level of Extent

If a central account structure is established and if it is linked externally, pooling functionality is supported by the TMS. However, as with all criteria, this might be done more or less efficiently.

4.3 Future Criteria on Treasury Management Systems

This section presents some of the most important future requirements on TMS as have been identified on the basis of the empirical research of this thesis[30]. Some of the criteria are developed from the previous section, as the future requirements often steam from current criteria.

4.3.1 Future Non-Functional Criteria

This section presents non-functional criteria for next generation of TMS. Following the theory for establishing system requirements the criteria are subdivided into the following categories: Requirement-ID, Background, Description, Scale and Level of Extent.

4.3.1.1 Criterion I: Further Integration & Enhanced STP

The author has named the future non-functional requirement-ID for this criterion to *Further Integration and Enhanced Straight-Through Processing.*

Background

Following criterion C from the previous section, further integration and enhanced STP is a certain bet for the future. Whatever level of STP deployed requires the use of an integrated TMS. However, recent market research shows that almost 60 per cent of treasurers do not currently have an integrated treasury management system (Coleman, 2003). There is a clear trend towards centralisation within the treasury arena (Frisch and Lind, 2003). As a result, the future TMS will even more reflect streamlined processes and minimisation of manual input by employing one single point of data entry. This means that the level of STP will increase significantly, including external and internal integration as described in criterion D previously.

Description

A perfect description of what STP might entail, is reflected by Robert Richardson, an employee at FX Corporation[31] (Richardson, 2003):

"By using web-based technologies and good systems design, treasury software vendors are able to provide solutions that allow for a continuous flow of business information. By logging onto their web browsers, subsidiaries can input their exposures or inter-company payables and can immediately run reports to verify their positions. The central treasury office can review these transactions in real-time and can accept or question individual transactions as appropriate. The key concept is that there is one point of entry for the information into the system. After that point the data can be reviewed, rejected, corrected or accepted as appropriate without having to re-input the entire transaction. The ability for users of the

[30] The criteria are not mutually exclusive and will not be presented hierarchically.
[31] A UK based company providing foreign exchange services: http://www.fxcorporation.com

system to communicate with others from within the system itself makes the process all the more efficient."

As described in the above statement, STP can take many forms. A good example of what Enhanced STP can further entail, is *exception processing* or *error processing*, which is becoming increasingly demanded among treasuries (personal communication, Bergström, 2003-08-29). Employing automated procedures for detecting errors means that the treasury team needs to spend less time correcting inconsistencies in data that has been manually inputted. Further integration and STP is also achieved by using the same standards across business and divisions, as suggested by the future non-functional criterion *XML and EDIFACT – Open Standards*.

Below figure further illustrates how STP could develop within treasuries (Randall, 2003):

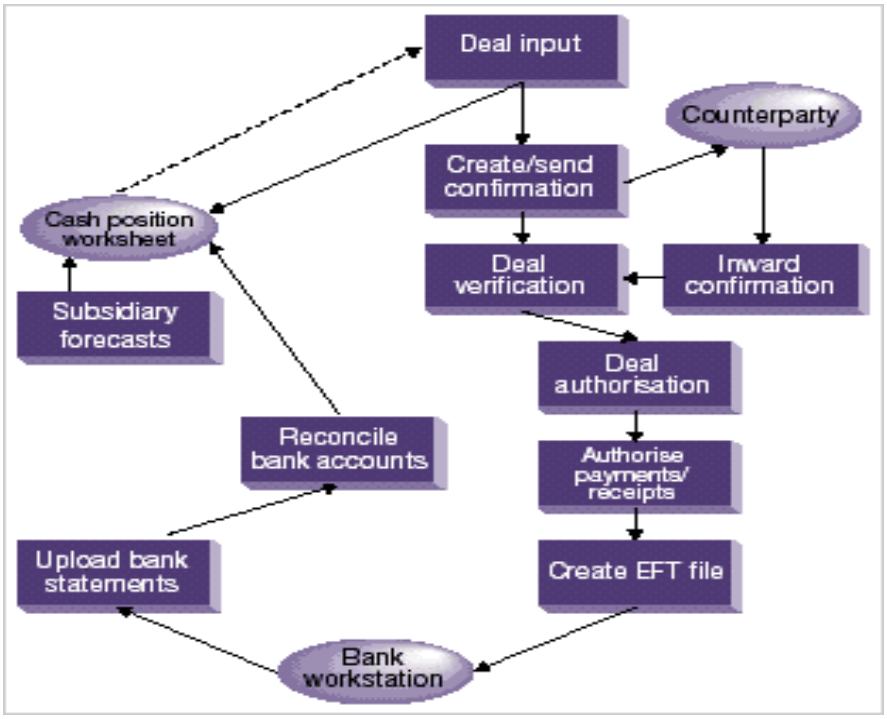

Figure 9 Straight-Through Processing in a treasury department.

The figure shows how banks and other third parties such as financial counterparties are integrated with the treasury operations, from a subsidiary forecast onto deal capture and bank confirmation.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

As there is a clear trend towards integration and streamlined operational efficiency (i.e. STP) the criterion is most likely to occur or even unavoidable in the future.

4.3.1.2 Criterion J: Modularisation

The author has named the future non-functional requirement-ID for this criterion to *Modularisation*.

Background

Until recently, TMS have only been available as standardised products with "one solution fits them all". As the customers require more specific solutions the system suppliers are increasingly moving towards modularised TMS´s (personal communication, Hacker, 2003-03-31). The reason for this is also because the clients do have neither the will nor the resources to pay for modules and functions that they will not employ. Modularisation leaves a choice for the customers – every treasury can specifically decide what modules they would like to employ. It is however interesting to note that many suppliers claim their systems are modularised but that may not always be completely correct. The differences lay in how large part of the TMS that is standardised and what kind of modules that are available to add to this standardised kernel. Modularisation can also entail integration possibilities: large TMS suppliers such as Simcorp and their IT/2 treasury solution, as well as Trema´s Finance KIT, have both acknowledged this trend. Finance KIT seems to be easing modularisation by having a specialised application, which makes integration of existing client applications possible (Trema, 2004). COMKIT makes integration possible and thus provides the opportunity for the client to chose only those modules in Finance KIT that are demanded, while simultaneously keeping modules that the client still finds satisfying. Other examples of modularisation are web interface that work as a link between different applications. Integration between the TMS and the General Ledger is another example of this modularisation trend. In that sense, modularisation is close to the criterion *further integration and enhanced STP*.

Description

Modularisation means that the TMS architecture is built on modules instead of a standardised system solution. Treasury departments that do not conduct a lot of trading may chose not to include trading modules in their TMS while treasuries focused on lowering financial risks may include well-developed risk management modules. A typical example of modularisation is the cash management module that is further described in the functional future criterion Q: *Integrated Cash Management Functionality*. Below figure illustrates a recently developed modular solution provided by Trema, producers of a TMS called Finance KIT (Trema, 2004b):[32]

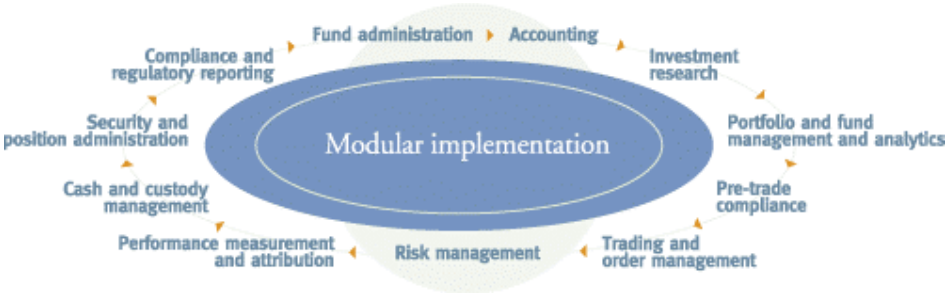

Figure 10 Modular design in Trema´s TMS Finance KIT.

The figure shows modules such as risk management, cash management, trading and compliance and regulatory reporting that can be added to the standard kernel of Finance KIT.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

As there is a clear trend towards integration and streamlined operational efficiency (i.e. STP) the criterion is most likely to occur or even unavoidable in the future.

4.3.1.3 Criterion K: Partitioning of the Database Architecture

The author has named the future non-functional requirement-ID for this criterion to *Partitioning of the Database Architecture.*

Background

There is a clear trend among multinational corporations to reorganise their treasuries into only one centralised department with only one global database (Frisch & Lind, 2003). As such,

[32] Trema is in the forefront of having such functionality. In the future, other TMS vendor will most probably follow in Trema´s footsteps.

many TMS´s are currently being built on MIS-architectures[33] with one central, global database[34]. The structure of the databases admits centralisation and makes information easily available as it stored in only one place. However, this structure has setbacks like longer response times as well. The reason for this is that as more and more information are stored in only one place, the response times are getting longer and longer. Without partitioning, parts of the database that are not used in operations (i.e. in production) but rather for archiving purposes will still burden the production side of it. On the other side, the information is easily retrieved as it is to be found in only one place. There is thus a trade-off between availability of information and performance (ACT, 2003). As of today, building archived databases has solved this problem although it has negative side effects. An alternative that seems to be requested in the future is instead to design partitioned databases that contain only relevant data for specific functions (personal communication, Hacker M., 20040331). For example, cash management related transactions are stored in a cash management database[35], while data for risk management purposes is stored in another database. Partitioning thus retain the centralised database structure, while simultaneously having the information partitioned. The result may be better response times while simultaneously keeping the information in one central place and thus easily retrieved.

Description

Partitioning of the database architecture is achieved by enabling the TMS to communicate with several different databases. Besides preparing the TMS for multiple database communications, it is also essential that the TMS has well separated modules. This means that data or information concerning certain activities is stored in the appropriate database, as described above. Storage in several databases often includes archiving functionality; when some data becomes redundant, simply because it is no longer in use, it is transferred to the archived database. Partitioning is in alignment with other future criteria such as *Further integration and enhanced STP* as well as *Modularisation*.

[33] Management Information Systems (MIS) is built with the purpose of providing easily accessible general information to the top-management and thus support functions such as customer service, operations management, financial planning as well as accounting. Example of a typical MIS architecture is Enterprise Resources Planning Systems (ERP's) such as SAP R/3.

[34] Volvo Treasury AB´s and Ericsson Treasury AB´s treasury system Finance KIT are typical examples of such MIS-architectures.

[35] Consequently, this CM database refers to the CM module described previously.

A special cash flow database that stores all data that belongs to the cash flow transactions is thus typical for this criterion, which is illustrated in the below figure (Purr, 2003):

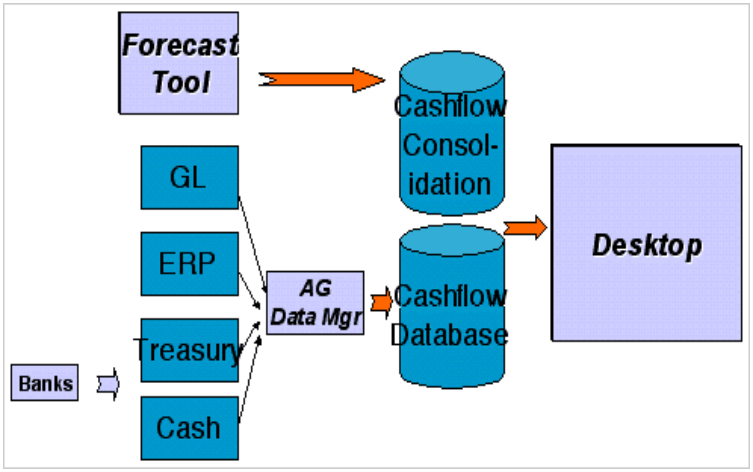

Figure 11 Partitioned Cashflow Database.

The figure shows how a user (i.e. at the desktop) will be able to receive cash flow information about global positions and exposures by having a separated cashflow database in use.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general. However, some technical aspects most be fulfilled such as multiple database communication and modularity.

Level of Extent

As there is a clear trend towards centralisation and improved efficiency, which includes having the appropriate information available at a reasonable cost and time, the criterion is most likely to occur or even unavoidable in the future.

4.3.1.4 Criterion L: XML vs. EDIFACT – Open Standards

The author has named the future non-functional requirement-ID for this criterion to *XML versus EDIFACT - Open Standards*.

Background

There has been a debate going on concerning what kind of standard that should prevail in the future. The problem is that there are many different ones in the treasury arena, especially between treasuries and third parties such as financial intermediaries and banks. Having a lack of compatibility between systems and actors creates inefficiencies and high costs. The reason for the many different standards, especially concerning electronic payments, are that treasuries and customised TMS suppliers have developed unique standards for every TMS in order to make it fit with the existing in-house systems. The result is various proprietary

message standards within formats such as EDIFACT and XML (Root, 2004b). Typically, a treasury department deals with several banks which means that the treasury have to deal with several different electronic payment systems. In addition, each continent has its own way of developing standards, so there is some standards currently developing in Europe while others are developing in the US or in Asia. Considering the fact that there is a clear trend towards globalisation and thus centralised treasuries, the lack of standardisation will become crucial in the future as it hinders further integration and enhanced STP as well as the globalisation trend among treasuries (personal communication, Lind M., 2004-08-23). It is very difficult to predict what the future has in stall, but one thing is clear – a dominating standard must be developed. So far, harmonisation attempts have been made by organisations such as TWIST, SWIFT, RosettaNet and IFX[36]. Currently, most TMS´s are supporting EDIFACT technology – a standard that has been developed by SWIFT. However, most business professionals are predicting a change in the landscape of electronic payments and are speaking in favour of the XML format. XML technology is promising because it can easily be implemented and because it is compatible with other Internet languages such as Hyper-Text Markup Language (HTML) and Standard Generalised Markup Language (SGML). Ideally, the development would process towards a universal payment standard with an *open XML language (ACT, 2003)*.

[36] For further information about the organisations and the standards please visit http://www.twiststandards.org, http://www.swift.com, http://www.rosettanet.org and http://www.ifxforum.org

A typical EDIFACT solution is the "One point of entry" provided by Nordea Bank towards treasury departments (Nordea Bank, 2004):

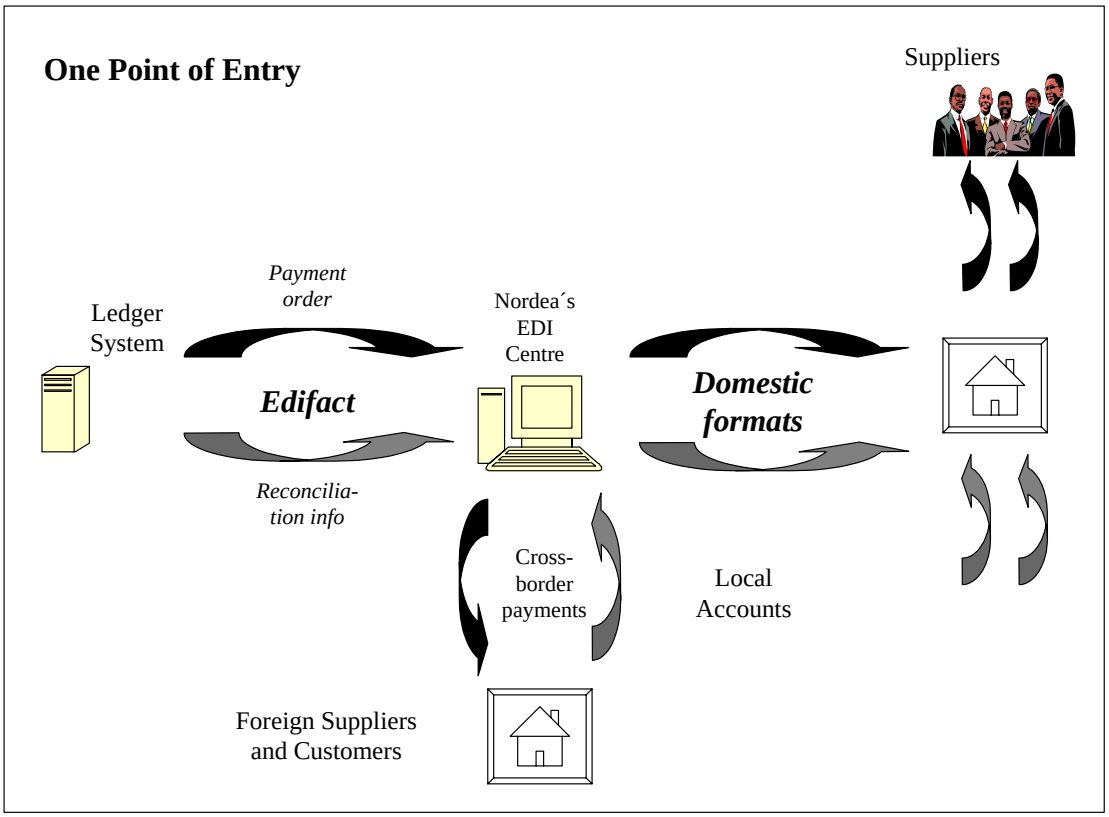

Figure 12 Nordea´s One Point of Entry service based on EDIFACT standard.

The above figure illustrates how EDIFACT could be employed as a one point of entry. Domestic, as well as foreign customers and suppliers, are connected through the EDI centre[37].

Description

Open XML standards entails uniform rules for debit and credit messages as well as payment messages. Ideally, the dominating standard – whatever it might be - should cover bank statements, funds transfer and cheque payments. The XML standard is predicted to become dominant in payments landscape, after initially running in parallel with EDIFACT (Buschman, 2003).

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

[37] The figure further illustrates how STP becomes integrated and is thus exemplifying the close interdependency between this criterion and criterion I.

Level of Extent

Using one standard will dramatically reduce costs. However, it is yet to bee seen what that standard will be. Robert Bol, editor at GTNews, summarises this fact by saying "The next 18 months are going to be a very interesting time for payments standards, which will likely result in a 50/50 split between XML and EDIFACT standards by the end of 2005" (GT News, Special Report, 2004).

4.3.1.5 Criterion M: Regulatory Compliance

The author has named the future non-functional requirement-ID for this criterion to *Regulatory Compliance*.

Background

Regulatory authorities have been very busy the last couple of years as corporate scandals like Enron in the US and Parmalat in Italy have replaced each other. In an attempt to prevent future scandals new regulatory principles have developed. Treasury departments must respond by modifying their TMS´s in order to comply with the new regulations. For example, as International Accounting Standard 39 (IAS 39) applies from January 2005, there is a need for modifying existing TMS to handle for the differences cause by this new regulation (IGTA, 2003). Originally, the regulation was imposed in the US in 2001 and was named FAS 133; the international counterpart is IAS 39 (Nordgård, 2001). In short, this involves modifying standard procedures in order to capture the necessary data for valuating the fair[38] as well as the amortised[39] price of below four categories of financial assets (Hoek, 2004):

- Financial assets held for trading
- Loans and receivables originated by the entity
- Held-to maturity investments
- Available-for-sale financial assets

And below categories of financial liabilities (Hoek, 2004):

- Financial liabilities held for trading
- Other financial liabilities

There are many practical implications of IAS 39 for treasuries, from hedging balance sheets at a macro level, to appropriately calculating risk amounts of assets, liabilities and derivatives (Root, 2004). TMS suppliers have made special functions for that (personal communication, 2004-02-18). For the next coming years, i.e. 2005 and 2006, the regulatory compliance criterion will mainly concern adaptability to IAS 39 (ACT, 2003). Other legislative demands such as BASEL II and IAS 32 also have an impact on the treasury operations. However,

[38] The amount for which an asset or a liability could be exchanged: for financial assets, it is the market bid price (not the mid-market or market offer price); for liabilities, it is the market offer price.

[39] It is the sum of the amount measured at initial recognition, minus principal repayments, plus or minus the cumulative amortisation using the effective interest method of any difference between that initial amount and the maturity amount, and minus any write-down for impairment (Hoek, 2004).

BASEL II mainly concerns banks, is not valid until 2006, and therefore only has a secondary impact on treasuries.

Description

IAS 39 compliance mainly concerns appropriate TMS modification in order for the system to capture the necessary data. This includes improved accuracy in calculating assets, liabilities and management of derivatives. The TMS must further provide the ability of making income simulations with increased macro hedging functionality.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

Some TMS suppliers are already providing these features, such as SunGard´s IAS 39 Solution (SunGard, 2004), but most TMS´s and treasury departments are still far away from complying with the IAS 39 principles. By the end of 2006, it will be certain that this criterion will be meet by all existing TMS.

4.3.1.6 Criterion N: Improved Technical Reliability & Stability

The author has named the future non-functional requirement-ID for this criterion to *Improved Technical Reliability and Stability*.

Background

System stability and reliability has always been an issue in the treasury arena. However, in the beginning of the 80ies, treasuries were not very dependent on the system support. The reason was that TMS were used only as *supportive* tools. Today, the systems have become a fundamental cornerstone in any treasury operation (ACT, 2003). They are employed not only for back-office issues, but also as important trading tools in the front-and-middle office. In addition, the TMS are greatly improved every year, which results in treasury personnel becoming more and more dependent upon the functionality (i.e. stability) of the systems in use (personal communication, Hacker, M., 2003-09-20).

Improved Technical Reliability and Stability also concern physical security, i.e. protection against undue actions such as burglaries and fire accidents (personal communication, Hacker, M., 2003-09-20). In reality, this means that TMS servers must be kept in well-secured establishments.

Description

Improved technical reliability and stability can be achieved by having the TMS running on multiple databases, i.e. by having one production database combined with one back up database. In such case, updates must be made regularly which is typically done every night. A suitable measure against undue actions is thus to have appropriate tools and models in use for

storing and updating information nightly. Furthermore, the TMS servers should be kept in appropriate physical locations.

Scale

This criterion does not have any special level of scale or any special level of detail, since it is non-functional and therefore rather general.

Level of Extent

TMS suppliers can play an important role in providing stabile TMS´s but plays a minor role in making them fire and theft proof. As TMS´s will become even more integrated in the treasury operations, stability and reliability as a criterion will certainly prevail in the future.

4.3.2 Future Functional Criteria

Below follows tomorrow's functional criteria that has been identified according to the table in the above section.

4.3.2.1 Criterion O: Real-time Trading Functionality

The author has named the future functional requirement-ID for this criterion to *Real-time Trading Functionality.*

Background

Some treasuries have employed sophisticated trading software for their front office functions but many treasuries are still trading derivatives by the use of telephone and fax. However, many suppliers of TMS market their software as being real-time trading systems. Following criterion B, this can be further developed in order to reach full real-time *trading*. Criterion B, described previously, did not entail a trading functionality, but rather real-time post management features. In order to streamline operations and to cut costs, there is simply no reason to employ several systems for typical treasury operations such as *trading*. This may seem rather obvious but in contradiction to what many professionals believe, major TMS´s like Trema´s Finance KIT, do not currently entail a real-time trading module (personal communication, Bergstrom, P., 2003-09-01).

Description

The criterions for real-time trading in a TMS is met if a special module or functionality is being designed in order to avoid manual trading (i.e. by the use of email, telephone or fax). This simply means that the front office personnel can put buying and selling orders directly in the TMS. A pre-requisite for this criterion is off course that an external link towards the third party, or dealing house, is established.

Scale

This criterion has a double sided level of scale; either the TMS has a real-time trading functionality or it has not.

Level of Extent

As there is a trend towards integration and streamlined operational efficiency (e.g. through the use of STP), this criterion is very much likely to occur (Frisch and Lind, 2003).

4.3.2.2 Criterion P: Enhanced Web-enabled Functionality

The author has named the future functional requirement-ID for this criterion to *Enhanced Web-enabled Functionality.*

Background

As criterion F suggested previously, most treasuries do currently have web-enabled functionality, at least to some extent. However, there are room for further development as such enhanced functionality is a natural step towards increased efficiency for treasury departments. Currently, this is especially evident as the global treasury arena is under constant change and heavily driven by increased competition (Frisch and Lind, 2003). Naturally, new features and functionalities are being developed for use at stationary computers and therefore tends to lack in remote functionality. So far, much have been concerning web-enabled functionality but there is yet far more to be done in the future.

Description

Enhanced web-functionality entails global and location-independent generation of reports: for example adequate financial reports concerning financial limits and exposures[40], irrespective of the time zone and the region. This further entails updated information in real-time and unlimited calculation of financial key figures. Full functionality is thus attained when all features available on the stationary computer can be remotely conducted, i.e. via the web (personal communication, Lorentzon, M., 2004-03-18).

Scale

This criterion has a double sided level of scale; either the TMS has an enhanced web enabled functionality (i.e. all functions that can be performed a the stationary computer can also be performed via the web) or it has not.

Level of Extent

There is no doubt at all that this criterion will prevail.

[40] This is also due to the fact that the world has four major time zones and risk figures therefore change constantly (if trading activities would have occurred in only one time-zone, global exposures should have been much more easily retrieved).

4.3.2.3 Criterion Q: Integrated CM Functionality

The author has named the future functional requirement-ID for this criterion to *Integrated Cash Management Functionality*.

Background

The backbone of treasury operations is cash management (CM), also called Working Capital Management, Funds Management or sometimes International Cash Management (Austen et al, 1991). Typical CM operations include *netting* and *pooling* as described previously. However, CM also incorporates *cash flow forecasting* and *liquidity management* - the formulation of funding policies, acquisition and allocation of funds and borrowing or investing of short-term funds (McMenamin, 1999). A very important and crucial problem within CM is to achieve appropriate level of accuracy in the cash flow forecasts (Boyd, 2004). Regulatory compliance also reinforces the need of improved CM in that the regulation requires improved control of cash flows. Following the modularisation trend, functionality that supports the whole cash management concept is therefore expected to develop in the future – so called cash management modules (personal communication, Bergström, 200309-21). There are some integrated cash management modules available already, but until today these modules have not been sufficiently developed and not very effective in producing accurate forecasts. Instead the separate systems or functionalities, like criterion G and H suggested previously, have been more effective. However, system suppliers such as Trema have now developed sophisticated CM modules that are far better than the old netting and pooling functionalities.

Description

Integrated cash management functionality should incorporate all aspects of cash management such as accurate cash flow forecasting and liquidity management including netting and pooling. In order for a TMS to fulfil this criterion, a user should, by working in only one system or module, be able to enter, delete or modify data that contains information about cash flows.

Scale

This criterion has a double sided level of scale; either the TMS has an integrated CM functionality or it has not.

Level of Extent

There is no doubt at all that this criterion will prevail.

5. Discussion

This chapter follows a two-tailed discussion i) a critical review of the research approach including the used theoretical base and method ending with lessons learned; ii) comments, thoughts and insights regarding respective identified requirement.

5.1 Research Approach

5.1.1 Method

The method applied in this thesis has been based on an iterative process, according to the method and the RE theory as described in chapter two and three. The iterative procedure is in fact not only supported but also recommended by several profiles within RE, such as Karlsson (Karlsson, 1995) and Wiktorin (2003) just to mention a few. Johansson (1999) have especially recommended this approach for RE identification under constant organisational change. By continuously verifying new results with employees at NFS, as well as continuously consulting literary sources of information, the author has succeeded with guaranteeing a certain level of quality. In particular, the author has managed to identify a RE theory and approach that has proven very suitable considering the constant organisational change that characterises the treasury arena. In addition, as the final result has been verified with Mr Bergström, Mr Lorentzon, Mr Hacker and Ms Romberg at NFS, further quality has been ensured. Another advantage with the method employed, is given by the fact that the respondents made valuable contributions by providing guidance towards specific literature that were proven to be particularly suitable for research, in order to further identify important criteria. Examples of such sources are GTNews, Treasury Today, and Treasury Management International. Finally, as the author made interviews with open questions on general areas within TM and TMS, a broad range of aspects of system requirements could be evaluated and then be neglected or identified as current or future requirements. This interviewing method was particularly employed when interviewing the representatives of ACT's. The fact that systems suppliers have been excluded in this thesis adds further value to the scientific independence of the thesis. If system suppliers were to be interviewed, there would have been a risk of having the wrong criteria identified[41]. As an option to interviewing representatives of ACT´s, specific users of TMS´s could have been interviewed. Because that would be too time consuming for a master's thesis, and because the answers would potentially be too linked to a certain TMS[42], no such users have been interviewed. However, if more time would be available it could still be interesting to conduct detailed interviews with users. In such case, the thesis would probably been much more technical and detailed. Potentially, this could have increased the contribution of the thesis as well.

Following a suggested method by the author of dividing the requirements into current and future criteria has been proven very useful as well. The reason for this is that a greater understanding of the future criteria could be obtained thanks to the historical approach. This is especially true since the criteria are not mutually exclusive but in fact rather integrated and related in between. Furthermore, the traceability and interdependency between criteria have

[41] System suppliers tend to advocate their functional features as "the most promising future solutions" specifically.

[42] The focus of this thesis was to identify criteria on TMS in general. As each treasury only employs one specific TMS, such potential answers would be related only to that particular TMS.

been made visible thanks to this approach. This has been described in previous chapters and illustrated in figures, as well as being supported by the RE theory.

The result of the identification of the final requirements has been validated with employees at NFS. The feedback from them has been very positive and therefore one must say that the thesis has indeed been successful in this matter. The result is further that the RE theory and method applied in the identification of the requirements for next generation's TMS has been very successful as well.

On the other hand, there are potential sources of errors that may impact the result and the credibility of the thesis. As described in section 2.3 Clarification to Ensure Recurrence of Methodology, these sources are *respondent errors, instrument errors, effect of the interviewer,* and *effect of context* (Aaker, 2004). Respondent errors have been minimised thanks to the fact that the respondents were given anonymity in that not conclusions were related to any specific interviewee[43]. However, this source of error is important to consider, as it can never be fully eliminated. Instrument errors are not present in this thesis, as they refer to wrongly designed equipment or instruments designed for interviewing[44]. The effect of the interviewer can also never be fully eliminated. What can be done however is to avoid asking direct and closed questions to the respondent[45] (Aaker, 2004). As a consequence, and as described in section 2.4, only open questions were employed in the interviewing process. Errors due to the effect of context should also be minimised as the interviews were conducted by telephone in an isolated room. Thus, no specific or disturbing environment could cause such errors. The above sources of errors should be kept in mind when reading about end results and conclusions drawn in this thesis, even if their impact on the result is considered to be relatively small.

Finally, in order to ensure that recurrence of the above discussed methodology, a section answering specific questions about the employed methodology was added in chapter two. These questions were answered in section 2.3.

5.1.2 Theory

Initially, the theory employed in this thesis seamed appropriate but as the author worked along setbacks of the theory became obvious. For example, it does not only concern selection criteria for computer systems but also general criteria that can refer to almost any subject. This has made the theory somewhat broad and not specifically designed for identifying system requirements. Furthermore, the theory suggests that the criteria should be divided into *non-functional* and *functional* requirements. This has been somewhat difficult as the characteristics of the criteria in this thesis are already very general. This becomes even more difficult as many of the criteria are interdependent and not mutually exclusive. As a result, it has been easier to divide into non-functional criteria (that tends to be generally formulated) than functional criteria (which are more detailed). This also results in that the purpose of dividing the requirements into these factors becomes vague and could be questioned. However, as a contrast to this difficulty, a further subdivision of current and future criteria has successfully been employed. The reason for this is, as RE theory have suggested previously, that the traceability and the interdependency among criteria could be catered for. In addition, as the treasury arena is characterised by constant organisational change, the iterative approach has been proven to be very useful as well.

[43] Their names and contact details are thus official and are presented in appendix one accordingly.
[44] The only instrument used was a perfectly working telephone line.
[45] Provided that the interview methodology is qualitative and not quantitative.

The advantage of having employed this RE theory is also that an appropriate frame of reference has been available to the author during the whole work of the thesis. Consequently, the theory has been helpful in structuring and dividing the criteria into more tangible parts and has thus been excellent as a guiding reference. Without the theory it would have been very difficult to get a good overview picture of the many requirements that has been reflected in the interviews and the literary reviews.

Following the theory, each criterion has been divided into “Requirement-ID”, “Background”, “Description”, “Scale” and “Level of Content”. The advantage of having a requirement ID, a background presentation, as well as a description of the criterion, is obvious. But the author has found the scale and level of content to be somewhat redundant. Especially for the *future* requirements, as these factors naturally are much more difficult to interpret and analyse. Regarding “Scale” and “Level of Content”, it has proven quite difficult to divide the criteria accordingly. The reason for this is that not all of the identified requirements do actually have a scale. Secondly, the level of content for future criteria that have not yet been implemented is naturally impossible to describe.

5.2 The Criteria

This section covers the author's general comments, thoughts and insights regarding the criteria.

5.2.1 General Discussion

As the author of this thesis has continuously gained insight in the specific characteristics surrounding treasury management and systems, it has become very obvious that treasuries differ from each other and that each treasury has its specific needs and specific demands on the TMS. As a result, treasuries may rank the criteria in this thesis differently; some may say that full currency and derivative support is far more important than any real-time trading principle. For others, who only conducts trade in a few different currencies and with a few different derivatives, trading functionality can be a much more important criterion. Furthermore, the computerisation among treasuries differs as well: some treasuries rely on advanced real-time trading TMS´s, while other still rely on weak proprietary solutions or even simple excel spreadsheets. Consequently, some of the future criteria can already be implemented in their current TMS environment while the rest of today's criteria may seem very futuristic to others. In comparison, many of the future requirements may simply be extensions of the current ones. Because of these differences, the criteria in this thesis have not been hierarchically ranked. There may also be some level of interdependence and integration between the requirements. For example, STP (as well as web-enabled functionality) and Internal and External Integration are very closely linked as they are simultaneously applied. Another consequence of these differences is that the border between current and future criteria may be rather vague. It should also be kept in mind that several of the future criteria mentioned in this thesis may be subject to future modification. For example, another, not currently known and promising standard, may very well replace XML or EDIFACT. Naturally, the future criteria should therefore be regarded as predictions. It is also interesting to note, that all criteria (except one[46]) have been verified through several information sources, irrespective of being current or future requirements.

Maybe the most important general comment regarding the RE process and the identified criteria in general is to remember that one should not evaluate any specific requirement without knowing about the circumstance in which it operates. That is, statements about the importance of a criterion should be made with caution and regard to the business and its stakeholders, in this case the TM and TMS industry. This is indeed supported by several sources, e.g. in " A Language For Enterprise and Information System Modelling" (Wohed, 1997).

The purpose of this thesis was to "*identify system requirements for the next generation of treasury management systems by employing a recognised RE procedure that is well suited for the constantly changing treasury arena"*.

As the author has managed to identify 17 current and future requirements, given a positive feed back from business professionals, and through an iterative process that catered for the organisational change within the treasury arena, this thesis should be considered as rather successful.

In addition to the above, there are two very interesting things to note i) there seems to be a centralisation and total-integration trend within the TMS industry. It is hard to tell what the

[46] Real-time principle (a current non-functional criterion).

future will bring, but most probably we will find one system solution that covers all possible functions within a treasury department. In that sense, treasuries will have something that very much reminds about a company wide ERP system, albeit being limited to the treasury[47]. ii) Unlike what many people might believe, treasury departments have not come that far in the computerisation process. Surprisingly many treasuries do not even have their own TMS and are instead employing advanced Excel spreadsheets for their operations. In that sense the TMS development is only in its cradle.

5.2.2 Specific Discussion

This section covers the author's own comments, thoughts and insights regarding the specific criteria.

5.2.2.1 Criterion A: Duty of Segregation & Authorisation

The purpose of this criterion is to guarantee that no undue actions take place. However, the importance of not solely rely upon a single TMS to fulfil this purpose cannot be stated enough. As many of today's TMS does not include a real-time trading functionality (as will be explained in criterion O), but rather works as a supportive tool to manual trade, inappropriate trading deals can actually take place rather easily. In the future this risk will probably be minimised, as all trading activities must take places within the system. In such case, the TMS will have a controlling function. Although undue trading operations will become more difficult, the risk of fraud has always been present, and will continue to be in the future, in any case. What this criterion mainly stresses is the importance of having the appropriate TMS in place. This criterion does not have any special relation to the others.

5.2.2.2 Criterion B: Real-time Principle

This criterion is closely related to the real-time trading functionality (criterion O) and is actually a prerequisite for that criterion to be met.

5.2.2.3 Criterion C: Straight-Through Processing (STP)

STP has been, and will most likely continue to be, the most misused buzzword in the whole treasury management industry. Not many TMS do *fully* support this concept, even if the STP criterion is more or less obvious as a current criterion. As a result, the STP concept will be further developed in the future non-functional criterion I: Further Integration and Enhanced STP.

5.2.2.4 Criterion D: Internal & External Integration

Criteria C and D are typical examples of the vague borders that exists between some criteria. The reason for this is that they are so closely related and actually constitutes prerequisites for each other's fulfilment. Both C and D are linked to criterion I: Further Integration and Enhanced STP. Furthermore, Criterion D is linked to criterion J: Modularisation, L: XML versus EDIFACT – Open Standards, as well as criterion P: Enhanced Web-enabled Functionality. Figure 13 at page 56 further illustrates these complex relationships.

[47] The reason that current ERP's are not widely employed for treasury operations are well known: ERP's lack in expertise and are thus not as efficient and well developed as specialized systems like TMS´s are.

5.2.2.5 Criterion E: Full Derivative & Currency Support

The author has also identified this criterion through an in-depth study of a particular TMS called Finance KIT. The study analysed pricing and valuation formulas for Treasury Bond Futures and Bond Forwards in the TMS (i.e. the derivative aspects of this criterion). The result can be found in another Master's Thesis conducted and presented at School of Economics and Commercial Law, at University of Gothenburg, Sweden Autumn 2004. This criterion does not have any special relation to the others.

5.2.2.6 Criterion F: Web-enabled Functionality

This criterion, together with C and D, is probably the ones that have the strongest links to the future criteria, as their positive effects are innumerable. These effects are added in criterion I: Further Integration and Enhanced STP.

5.2.2.7 Criterion G: Netting Functionality

Netting functionality will continue to develop in the future and will most likely become an integrated part of a future cash management module, as described in criterion Q. It is interesting to note that netting does not limit to treasury operations but is widely spread across other corporate functions such as shared service centres, and traditional economic functions, as well as within banks.

5.2.2.8 Criterion H: Pooling Functionality

Pooling functionality will continue to develop in the future and will most likely become an integrated part of a future cash management module, as described in criterion Q. It is interesting to note that pooling function does not limit to treasury operations but is widely spread across other corporate functions such as shared service centres, and traditional economic functions, as well as within banks.

5.2.2.9 Criterion I: Further Integration & Enhanced STP

As explained previously, STP has so far been the most misused buzzword in the whole treasury management industry. One of the reasons for this is its strong selling potential that reflects the added value behind the concept. This in turn, lies behind the great potential of being further developed as a future non-functional criterion. This criterion has relations to criteria K, C, D, F as well as Q. Figure 13 at page 56 further illustrates these complex relationships.

5.2.2.10 Criterion J: Modularisation

This criterion is closely related to K, Q and D. In accordance with STP, modularisation has also been greatly used as an industrial buzzword. Consequently, a supplier that currently claims a full modular TMS architecture should be taken cautiously. However, all TMS´s are to be built on such architectures in the future.

5.2.2.11 Criterion K: Partitioning of the Database Architecture

This criterion is quite technical and can therefore potentially be replaced by future technological enhancements that better provides a solution of the trade-off between availability of information and performance. As described, it is linked to criterion J.

5.2.2.12 Criterion L: XML vs. EDIFACT – Open Standards

It is important to note that XML is only one out of several possible standards that will be adopted within the treasury arena - XML is currently the most promising one.

5.2.2.13 Criterion M: Regulatory Compliance

This regulatory compliance criterion does mainly focus on European regulations, i.e. IAS 32, 39, BASEL II etcetera. In the USA, the corresponding regulations go under the names FASB and Sarbanes-Oxley Act. These regulations do differ somewhat and have various impacts on different treasuries and TMS´s. For example, European corporations that conduct business in the US is of course encompassed by the American law, in the same way US based companies must adopt to IAS and BASEL II in Europe. As long as these differences across continents exist, it will be impossible to reflect a regulatory harmonisation in the corresponding treasury systems. This criterion does not have any special relation to the others.

5.2.2.14 Criterion N: Improved Technical Reliability & Stability

This criterion is surprisingly important considering how crucial the treasury operations are to the efficiency of today's multinational corporations. It will certainly become even more important as system dependency among treasuries increase. This criterion does not have any special relation to the others.

5.2.2.15 Criterion O: Real-time Trading Functionality

The fulfilment of this criterion is yet another step towards finding the optimal TMS, i.e. to have one single treasury solution in which all typical treasury functions and feature are available.

5.2.2.16 Criterion P: Enhanced Web-enabled Functionality

The objective of enhanced web-enabled functionality is to have a totally integrated, centralised, global treasury solution that operates from any distance and in any time frames. However, as the world has four main different time zones, this will probably never be achieved.

5.2.2.17 Criterion Q: Integrated CM Functionality

There is no common understanding on what kind of features and functionalities a cash management module should actually contain. As with the expression "Treasury Management", there are many opinions on what it entails. Consequently, some professionals may argue that a certain risk management module will be developed and further integrated into the TMS´s in the future. Such a risk module would consist of similar features as the described cash management module, but would also contain improved functionality concerning risk accuracy.

Below figure summarises all interdependencies and further illustrate the traceability between the criteria as identified in this thesis. Criteria without any independencies are left out (i.e. criterion A, E, M and N).

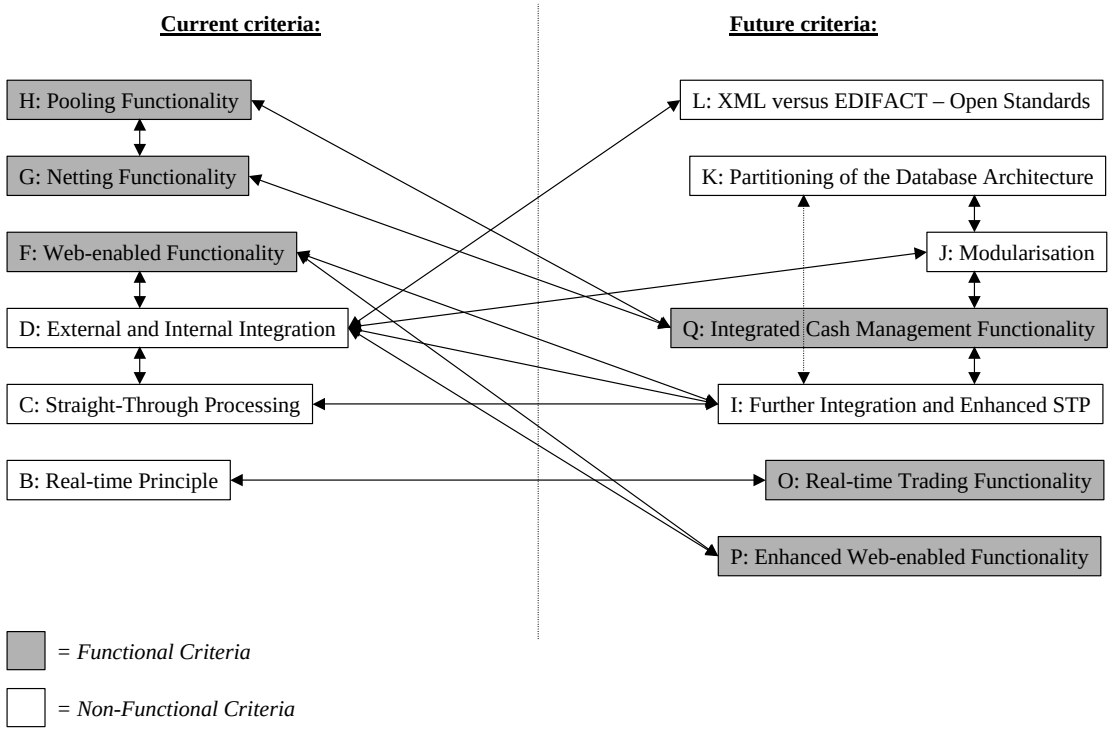

Figure 13 Interdependencies between current and future criteria (authors own illustration).

6. Conclusion

This chapter finishes the thesis by providing an explanation of the initial premises and by summarising the main conclusions.

6.1 Initial Premises

The purpose of this thesis was to "*identify the system requirements for the next generation of treasury management systems by employing a recognised RE theory and procedure that is well suited for the constantly changing treasury arena"*. The purpose was formulated as a natural consequence of the problem, stated previously as *"what are the next generation of treasury management system requirements and what RE procedure could identify them"?*

Successful development of software systems depends on the quality of the requirements engineering process. In order to attain that, a suitable RE theory must be in place, besides a fundamental knowledge about the business (i.e. finance/TM as well as systems/TMS). As the treasury arena is characterised by constant organisational change, as well as technological boom, globalisation and regulation, an RE theory that could cater for these changes had to be applied. It was also necessary to find a way in which a reasonable amount of criteria could be identified without exceeding the time frame for a master's thesis, still contributing to the actors in the industry, as explained in the introductory chapter of the thesis. In addition, all the work had to be done with regard to the academic framework.

In order to decide whether a criterion is appropriate or not, a specific treasury department or system must be studied accordingly. However, it has not been an objective of the author to decide whether any specific criteria are suitable for a specific treasury. As a result, this thesis has identified possible requirements on next generation's TMS in general, without any hierarchical rankings.

6.2 Main Conclusion

The main conclusion drawn in this thesis is the identification of system requirements for the next generation's TMS. Besides this, a suitable *iterative* RE procedure has been identified and tested.

The criteria have been explained previously and are divided into functional and non-functional criteria, as well as current and future criteria. The current non-functional ones are: Duty of Segregation and Authorisation, Real-time Principle, Straight-Through Processing (STP), and Internal and External Integration.

The current functional criteria consist of the following: Full Derivative and Currency Support, Web-enabled Functionality, Netting Functionality, and Pooling Functionality.

The current requirements above have been followed by predictions on the future non-functional requirements, being identified as: Further Integration and Enhanced STP, Modularisation, Partitioning of the Database Architecture, XML versus EDIFACT and Open Standards, Regulatory Compliance, and Improved Technical Reliability and Stability.

Finally, the future functional criteria were: Real-time Trading Functionality, Enhanced Web-enabled Functionality, and Integrated Cash Management Functionality.

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Appendix 1 – List of Respondents

ACTSA – Association of Corporate Treasurers of South Africa
Lily Mitchell, ACTSA Chief Executive, telephone number: +27 11 888 2671
Email: lily@actsa.org.za
Website: http://www.actsa.org.za
Ms Mitchell was interviewed via telephone 2003-05-09.

ASCT - Gruppe Finanzchefs im OPWZ Austria (ASCT)
Wilhelm Stejskal, Head of Controlling Body, telephone number: +43 1 533 8636 31
Email: Wilhelm_stejskal@opwz.com
Website: http://www.opwz.com/Finanz
Mr Stejskal was interviewed via telephone 2003-05-02.

ATEB – Association des Tresoriers d´Enterprises en Belgique
Olivier Brissaud, ATEB chairman, telephone number: +32.2.6454816
Email: olivier.brissaud@volkswagen.de
Website: http://www.ateb.be
Mr Brissaud was interviewed via telephone 2003-05-02.

ATEL – Association des Trésoriers d´Enterprise a Luxembourg
Francois Masquelier, ATEL Representative, telephone number: +352 42 1 42 2121
Email: francois.masquelier@rtlgroup.com
Website: http://www.atel.lu
Mr Masquelier was interviewed via telephone 2003-05-07.

CAT – Ceska Asociace Treasury
Petr Polak, CAT representative, telephone number: + 420.737-824570
Email: petr.polak@vsb.cz
Website: http://www.czechtreasury.cz/
Mr Polak was interviewed via telephone 2003-05-05.

GEFIU – Gesellschaft fur Finanzwirtschaft in der Unternehmensfuhrung e.V
Helmut Schnabel, GEIFU President, telephone number: +49 69 77076606
Email: helmut_schnabel@asecuris-asset.com
Website: http://www.gefiu.org/
Mr Schnabel was interviewed via telephone 2003-05-05.

VDT – Verband Deutscher Treasurer e. V. Germany (VDT)
Jochen Stich, Head of Executive Body, telephone number: +49-8654-4679 11
Email: jochen.stich@porsche.co.at
Website: http://www.vdtev.de
Mr Stich was interviewed via telephone 2003-05-07

NFS – Nordic Financial Systems
Magnus Lind, Managing Director, telephone number: +46 (0)31 720 99 00
Email: magnus.lind@nfs.se
Website: http://www.nfs.se
Mr Lind has been interviewed by telephone and through personal meetings in Gothenburg. The communication has been taking place continuously during 2003 and 2004.

NFS – Nordic Financial Systems
Peter Bergström, Global Sales Manager, telephone number: +46 (0)31 720 99 00
Email: peter.bergstrom@nfs.se
Website: http://www.nfs.se
Mr Bergström has been interviewed by telephone and through personal meetings in Gothenburg. The communication has been taking place continuously during 2003 and 2004.

NFS – Nordic Financial Systems
Martin Lorentzon, Technical Consultant, telephone number: +46 (0)31 720 99 00
Email: martin.lorentzon@nfs.se
Website: http://www.nfs.se
Mr Lorentzon has been interviewed by telephone and through personal meetings in Gothenburg. The communication has been taking place continuously during 2003 and 2004.

NFS – Nordic Financial Systems
Anna Romberg, Senior Financial Consultant, telephone number: +46 (0)31 720 99 00
Email: anna.romberg@nfs.se
Website: http://www.nfs.se
Ms Romberg has been interviewed by telephone and through personal meetings in Gothenburg. The communication has been taking place continuously during 2003 and 2004.

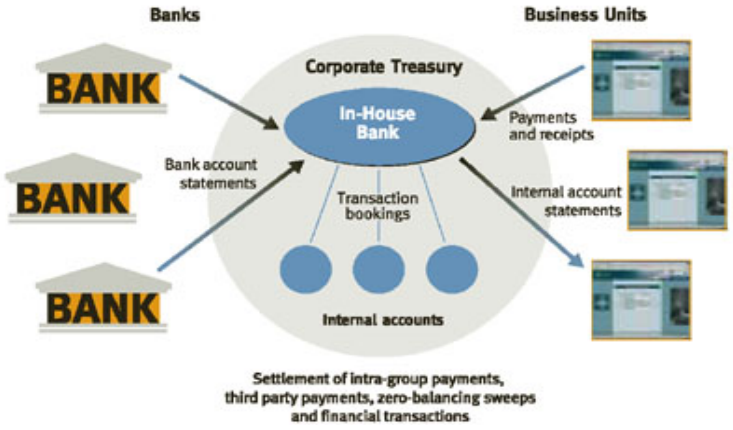
NFS – Nordic Financial Systems
Magnus Hacker, Senior Financial Consultant, telephone number: +46 (0)31 720 99 00
Email: magnus.hacker@nfs.se
Website: http://www.nfs.se
Ms Romberg has been interviewed by telephone and through personal meetings in Gothenburg. The communication has been taking place continuously during 2003 and 2004.

Appendix 2 – Questions employed as a base for interviewing

- How would you like to define treasury management systems? / What is Treasury Management?
- How are Treasury Departments structured? What are the advantages of having alternative structures such as Shared Service Centres?
- Please mention some of the most important current system requirements?
- Please mention some of the most important future system requirements?
- Is it common for Treasuries to outsource its, or some of its, treasury functions?
- What kinds of operations/functions are being outsourced?
- How is typical support given by a TMS, e.g. what functions are that are difficult to perform due to lack of appropriate TMS features?
- What are the impediments/obstacles currently being discussed within treasury management and systems?
- Is it common that the supplier-side promise more than can be met, e.g. full covering of derivatives etc?

Appendix 3 – What is Treasury Management?

The definition of Treasury Management strongly depends on who defines it (Frisch, 2003a). Simply put, a treasury department functions as the company's own bank, i.e. the in-house bank of the corporation. As such, the treasury department often functions as an intermediary between the subsidiaries (i.e. the business units) and external banks, as illustrated in below figure (Trema, 2004):



Occasionally people talk about cash management or risk management referring to treasury management. Working capital management is also used sometimes. In fact, the terminology is so fuzzy that even board members have difficulties explaining the meaning of the role as a treasurer. This has been the case in various boardrooms all over the world, for example at Bank of America and Memec Group Holdings, just to mention a few (Pink, 2003).

The reasons for the different opinions are many. One might steam from the fact that treasury operations largely depend on what corporate policy influenced the organisation. Some companies have very vague borders between what the financial department and the treasury department are authorised to do. Some Multinationals are centralising their treasuries into one global treasury centre[48] while others rely on more decentralised solutions with regional treasuries (Frisch, 2003a). Outsourcing treasury operations with the help of banks has also been an alternative to many organisations, even if this is a less common alternative lately (Frisch & Lind, 2003). Some organisations include their shared service centres´ accounting activities[49] in their treasury operations. For some corporations hedging and speculation of derivatives could fall under the responsibility of the treasury manager, while other multinationals are still performing these functions at local or regional *financial* departments. These different ways of structuring corporate treasuries results in different operations performed at each treasury. Consequently, the definition of treasury management might vary from company to company, since it may include different operations at each (Frisch, 2003a).

These differences in definition also depends on the technological development: some companies has a well-developed treasury department with advanced front-to-end treasury management systems in use, while other still rely on weak Excel solutions (personal communication, Bergstrom, P., 2003-09-01). This is a clear limitation for the ability to

[48] Volvo Treasury Services constitutes a representative example of such a centre.
[49] E.g. management of salaries, usually not seen as a typical treasury function.

efficiently handle complex treasury situations leaving some organisations with strong need for development and therefore less suited to perform certain operations. These various levels of technological development results in different operations and processes performed at each department. This is not so strange considering the fact that technological development has constantly changed treasuries and the circumstances in which it operates (Dolfe & Koritz, 1999). Contingency theories strongly support this as well, claiming the best organisational alternative being dependent on the conditions prevailing in the environment in which the corporation acts (Ask & Ax, 1997).

The Chartered Institute of Management Accountants (CIMA, 1996) uses the following definition of treasury management:

"The corporate handling of all financial matters, the generation of external and internal funds for business, the management of currencies and cash flows, and the complex strategies, policies and procedures of corporate finance"

Above definition is rather general in terms and does not exclude room for interpretations, as it could refer to more than only treasury operations. The following definition has been made of one of the largest management-consulting firms in the world (Austen & Reyniers, 1991, p1):

"The management of the liquidity of the business to ensure that the right amount of funds in the right currency are in the right place in the right time. The management of liquidity should be undertaken in such a way as to maximize yields and minimize costs subject to security, liquidity, interest and currency risk constraints."

This definition brings us closer to, in short, the management of liquidity (or cash). In addition, it is generally accepted to use below summarising expression for treasury management responsibilities (McMenamin, 1999):

"The treasury function is normally concerned with funds acquisition, liquidity management, risk management and investor relations."

Further specification is possible as treasury management can be summed up to include "…Cash management plus the management of foreign exchange risks at the operating level…" (Giannotti & Smith, 1981, p 7).

In addition to this rather narrow definition yet another fact can be established; treasury management is sometimes used synonymous with cash management. This is not always true as treasury management is more concerned with the placing and the borrowing of cash on short-term basis only (Larsson, 2000, p 15).

Therefore, a rather satisfying and acceptable explanation on treasury management might be that it includes short-term cash management plus the management of foreign exchange risks at the operating level (Frisch, 2003d).

What is the Rational Behind a Treasury Function?

It has been well recognized that multinational companies may have a lot of excess cash, either in the holding company or in the subsidiaries. In order to increase shareholder value and overall effectiveness, cash processes need to be optimised, both in terms of management and organisation. The establishment of treasury departments have proven to be a good step toward optimisation of these cash processes, ensuring optimal premises for Multinationals´ cash management function (Frisch, 2003a). Today's demanding business climate drives multinational corporations to take active part in hedging and speculating with the excess cash. This risk management aspect of the treasury activity creates an additional argument for establishing treasuries. Consequently, the added value of having a specialised department for above functions is obvious (e.g. reduction of operational risk and unification of the subsidiaries). Establishment of a separate treasury department does not only result in better control of risks but also in enhanced possibilities for reducing transaction costs. This is especially evident in the case of cash pools and multilateral netting (Frisch, 2003d). Having a sound and well functioning treasury organisation therefore results in increased shareholder value; cash management and thereby treasury management becomes extremely important, as the value of the company in fact consists of the net present values of all futures cash flows. Treasury management has a direct impact on these flows (Dolfe & Koritz). David Blair, director of Nokia Treasury Services Asia in Singapore, sums up the added value of the treasury in following quotation (Ramos, 2002):

"We add value by effectively reducing the financial risk and applying a very broad view of risk, [envisioning] enterprisewide risk, so that management and the people in operations can focus on designing great phones and selling them".

Having a sound and well-functioning treasury department is therefore crucial to any multinational corporation in today's challenging and dynamic world. In that sense, well-developed information systems play a very important part of the overall success of the treasury department.