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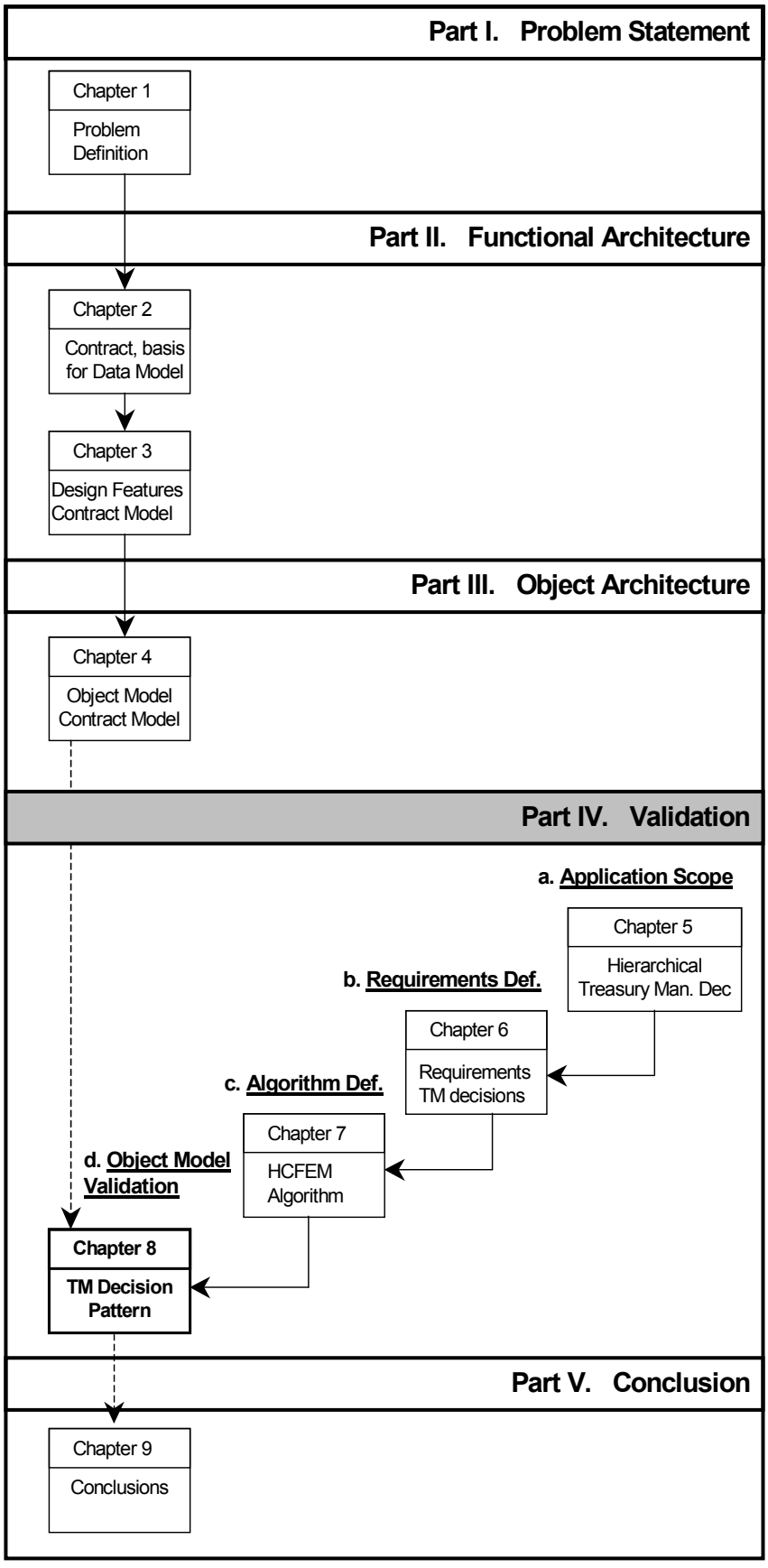
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8. Can the Contract Data Model hold sufficient data to support Treasury Management Decisions?

8.1 Introduction

This chapter is the last chapter of part four and concludes the validation of the completeness of the data stored in the contract data model as proposed in this research. The outcome of the investigation into whether the proposed contract data model can comply with the requirements for data availability for the chosen application as outlined in Chapters 6 and 7 is described here. It represents the answer to research question four of research objective two as outlined in Section 1.4 of Chapter 1.

Research Objective 2, Research Question 4: How do additional functional requirements of the new treasury management application impact on its ability to provide data through the accounting data model proposed as the research result of research objective 1?

The structure of this chapter is as follows. The chapter begins with a summary of the data availability requirements to service hierarchical treasury management decision-making with relevant costs. Next, an elaboration of two treasury management decisions is presented to enhance the information requirements mentioned so far. Section 8.3 considers the 'Setting the Master Financing Schedule' decision. Section 8.4 goes on to discuss the 'Optimizing Financial Resource Outflow Orders' decision. Subsequently, Section 8.5 evaluates which requirements for data availability the contract data model already complies with before any modification or enhancement. Next, Section 8.6 provides an extension of the contract data model incorporating the requirements for servicing treasury management decisions. Finally, Section 8.7 offers some conclusions.

8.2 Summary of the data requirements for hierarchical treasury management decision support

The validation of this research concludes with the question of whether the contract data model can provide sufficient data to support the hierarchical treasury management decision-making application. The requirements for data availability to service hierarchical treasury management decision-making with relevant costs are described in Section 6.3 of Chapter 6. They were generalized in Section 6.4 of Chapter 6 and are summarized below.

- *Requirement 1: Financial Resource Transition*. Incoming and outgoing financial resource flows between the organization and its external markets have to be identified.
- *Requirement 2: Cash Flow Equivalent Transition*. The information system must service the translation of financial resource flows into a common denominator (i.e. the cash flow equivalent, CFE) to exclude differences resulting from: *a)* execution timing, *b)* financial resource flow type and *c)* currency differences between financial resource flows.
- *Requirement 3: Context Congruency*. Information has to be available about longer term plans to enable the validation of whether shorter term actions fit in the context of longer term plans.

The algorithm used to calculate the relevant cost implications for treasury management decisions generically is called the Hierarchical Cash Flow Equivalent Model (HCFEM, see Section 7.7 of Chapter 7) and contains one additional information requirement to support financial resource reservation.

- *Requirement 4: MRP Netting Reservation Logic*. The information system design must support different planning states such as 'planned' and 'final' to indicate with different levels of certainty whether financial resources would be available at specific moments. The information system must also distinguish between financial resource flows known at the moment of planning, and incidental financial resource flows.

The characteristics of the hierarchical treasury management decision framework are similar to business logistics decisions. Research results of an information definition to support business logistics decisions as discussed in Verdaasdonk and Wouters (1999) and Verdaasdonk (1998) are therefore also applicable to the information framework of treasury management decisions.

8.3 The 'Setting the Master Financing Schedule (MFS)' Decision

Hierarchical decision-making was introduced to the domain of treasury management to benefit from the same objectives of resource optimization under constraints of limited available capacity as serviced by business logistics decisions for operational resources (see Section 5.2 of Chapter 5). Fransoo et al. (1995) explain that for hierarchical business logistics decisions, decisions made at a higher level set the constraints for decisions to be made at lower levels. The higher level decision in treasury management is 'Setting the MFS' and is equivalent to the 'Setting the Master Production Schedule (MPS)' decision as discussed in Giesberts (1993). Bertrand et al. (1990) and Giesberts (1993) explain that the complexity of the production control problem can be reduced by applying decomposition, aggregation and omission concepts. Verdaasdonk and Wouters (1999) further operationalize these concepts for business logistics decisions. In treasury management, it implies the following. The overall treasury management objective on optimizing financial resource flows is complex as financial resource flows can have various natures. *Decomposing* the overall problem into lower-level individual sub-problems reduces complexity and increases the efficiency of the decision-making process. As explained in Section 5.3 of Chapter 5, lower level decisions are: *1)* optimizing financial resource outflow orders, *2)* optimizing financial resource inflow orders, *3)* optimizing financial resource surplus orders, *4)* optimizing financial resource deficit orders, *5)* optimizing financial resources, *6)* optimizing financial resource conversion orders and *7)* optimizing financial resource safety stock levels. Breaking the decision down into different aspects as discussed by Giesberts (1993) relates to parameter setting (i.e. the definition of norms per decision as discussed in Section 5.4 of Chapter 5), volume co-ordination (i.e. absorbing medium-term fluctuations), mix co-ordination (i.e. fine-tuning the right variety of financial resource types at specific locations to guarantee the right financial service level) and operations co-ordination (i.e. realizing the right financial resource amounts as the execution of mix co-ordination). *Omission* refers to the fact that financial resource types and/or locations are not used in the higher level planning process so as to diminish complexity. This is done when volumes in financial resource types and/or locations are not material and therefore do not have an impact on the MFS. *Aggregation* is the concept of combining two or more financial resource types and/or locations into one higher level financial resource type or location in order to reduce the complexity of the planning process. For example, different types of mortgaged loans (e.g. annuity loans, straight line loans etc.) can be combined into one family type, 'Mortgaged Loan', while different locations (e.g. Washington, New York, etc.) can be combined into one aggregated location, 'the USA'.

The features of omission and/or aggregation outline the following additional requirements for data availability for the evaluation of the MFS.

- *Requirement 5:*[68] *Financial Resource Family Type Definition*. The information system must support the concept of financial resource family types at different hierarchical levels including the relationship with specific financial resource types.

[68] Requirements 1 to 4 are summarized in Section 8.2.

- *Requirement 6: Aggregated Location Definition.* The information system must support the concept of aggregated locations at different hierarchical levels.

8.4 The 'Optimizing Financial Resource Outflow Orders' Decision

The 'Optimizing Financial Resource Outflow Orders' decision is investigated in a hierarchical context with the 'Setting the MFS' decision. Wouters (1997) investigated the equivalent decision within business logistics (i.e. optimizing order acceptance in relation to the MPS) whereas Wouters and Verdaasdonk (1999) investigated the order acceptance decision related to the MPS when supported by financial information. As explained in the previous section, following Fransoo et al. (1995), the higher level decision (the 'Setting the MFS' decision in treasury management) sets the constraints for lower level decisions (in this case, 'Optimizing Financial Resource Outflow Orders'). The initial answer should therefore be that only financial resource outflow orders within the decision space as defined in the MFS can be accepted. However, Wouters and Verdaasdonk (1999) have pointed out that the execution of lower level decisions can actually be different from the assumptions used when defining the higher level decision. Therefore, it remains relevant to investigate all possible situations. Wouters (1997) refers to two situations that merit specific investigation. First, that the lower level decision had already been considered in the higher level decision (i.e. the financial resource outflow order had already been considered in the MFS). Second, that the lower level decision had not been considered in the evaluation of the higher level decision (i.e. the financial resource order is new and had not been considered when evaluating the MFS).

8.4.1 The financial resource outflow order is considered in the MFS[69]

If the financial resource outflow order had already been adopted when evaluating the MFS, investigating whether the volume and terms of the outflow order did not change in relation to the outflow order volume and terms at the moment the MFS was decided upon becomes necessary. Relevant aspects of lower level decisions from a hierarchical perspective to the MFS relate to the volume of financial resource capacity reserved per type and location, and specifications of norms, such as accepted financial resource types to be used, etc. If the financial resource outflow order amount does not exceed the financial resource capacity reservations made in the MFS, and where the terms specified on the individual outflow order lie within the boundaries set by the MFS, the financial resource outflow order is automatically accepted. If one of these aspects deviates from the MFS, the financial resource outflow order is automatically rejected. Should this occur, the amount of the originally reserved financial resources at the location specified are not used and become available for other purposes. The following destinations can be chosen for these financial resources.

a. *Do not reuse newly available financial resources*. In this case, the MFS will automatically indicate a surplus in available financial resources. If in line with norms for surplus investment, option c. will be executed.
b. *Use new available financial resource capacity to optimize other financial resource outflow orders*. Financial resource outflow orders rejected on the grounds that the financial resource capacity as scheduled by the MFS had already been optimized can now be reconsidered.
c. *Use new available financial resource capacity for surplus investments*. If no other outflow orders need to be optimized within the relevant time period, new available and idle financial resources can be optimized through surplus investment.

[69] This section is based on Verdaasdonk (1998), p. 127. The solution presented here is identical to a production order considered in the MPS.

d. *Reschedule (lag) financial resource inflow orders as financial resource capacity can be provided alternatively*. Financial resource capacity is provided by inflow orders like operational demand contract clauses (e.g. customer receipts) or financial supply contract clauses (e.g. loan inflows). Where financial resource capacity becomes available because of rejection of outflow orders, the terms for customers payment can be delayed (delaying operational demand contract clauses) or loans can be terminated or delayed (termination or delay of financial supply contract clauses).

The object of this activity is that the outcome of each of these alternatives is compared with the outcome of the acceptance of the 'Optimize Financial Resource Outflow Order' decision.

8.4.2 The financial resource outflow order is not considered in the MFS[70]

The purpose of hierarchical treasury management decision-making is to execute all actions from the perspective of a higher level plan. In this respect, the 'Optimizing Financial Resource Outflow Orders' decision arguably should always be defined in the MFS, otherwise the goal of hierarchical decision-making will not be attained. However, there are two situations where a financial resource outflow order will not be considered in the MFS, though a hierarchical decision structure is in place.

1. The financial resource outflow order relates to financial resource *types* and *locations* that are not material or critical, therefore not adopted in the MFS planning process.
2. The financial resource outflow order relates to incidental financial resource demand, not yet known at the moment of the MFS planning.

The following situations can occur and have to be evaluated when accepting an order not scheduled in the MFS.

a. *The MFS indicates available, idle financial resource capacity*. If not all financial resources are in use by known financial resource outflow orders, the new financial resource outflow order could be accepted and use some or all of the available, idle financial resource capacity.
b. *Reject existing scheduled financial resource outflow orders and accept the new financial resource outflow order*. Financial resource capacity can be made available by rejecting financial resource outflow orders that had already been planned by the MFS and accepting the incidental financial resource outflow order instead. This will occur, for instance, when less financial effort (e.g. bank costs) is involved in the new financial resource outflow order or if the incidental financial resource outflow order is more critical.
c. *Create new financial resource capacity by expansion*. If the MFS has scheduled all available financial resource capacity and rejection of already scheduled financial resource outflow orders is not possible, expanding the financial resource capacity by accepting new financial supply contract clauses, e.g. new loans or credit lines, is an option.
d. *Create new financial resource capacity by conversion*. If the MFS has scheduled all available financial resource capacity for a specific financial resource type and rejection of already scheduled financial resource outflow orders is not possible, converting surplus financial resources into required financial resources is an option. The incidental financial resource outflow order can be accepted later.
e. *Reschedule (lead) financial resource inflow orders in order to create financial resource capacity*. Financial resource capacity is provided by inflow orders like operational demand contract clauses (e.g. customer receipts) or financial supply contract clauses (e.g. loan inflows). If additional financial resource capacity is required because incidental financial resource outflow orders potentially have to be accepted, discounts in return for earlier payment terms can be offered to customers (speeding up receipts of operational demand contract clauses) or loans can be called earlier (speeding up acceptance of financial supply contract clauses).

[70] This section follows the same line of reasoning as Verdaasdonk (1998), p. 128. The solution presented here is identical to a production order not considered in the MPS.

The objective here is that the outcome of each of these alternatives be compared with the outcome of the acceptance of the 'Optimize Financial Resource Outflow Order' decision.

The analysis of the 'Optimizing Financial Resource Outflow Orders' decision has not resulted in additional requirements for data availability.

8.5 Evaluation of the suitability of the Contract Clause Model to support treasury management decisions

The explicit objective here is to accommodate data for hierarchical treasury management decision-making using the Contract Clause Model as discussed in Section 4.2 of Chapter 4. A simplified version of the Contract Clause Model in its basic format is visualized in UML[71] in Figure 8-1.

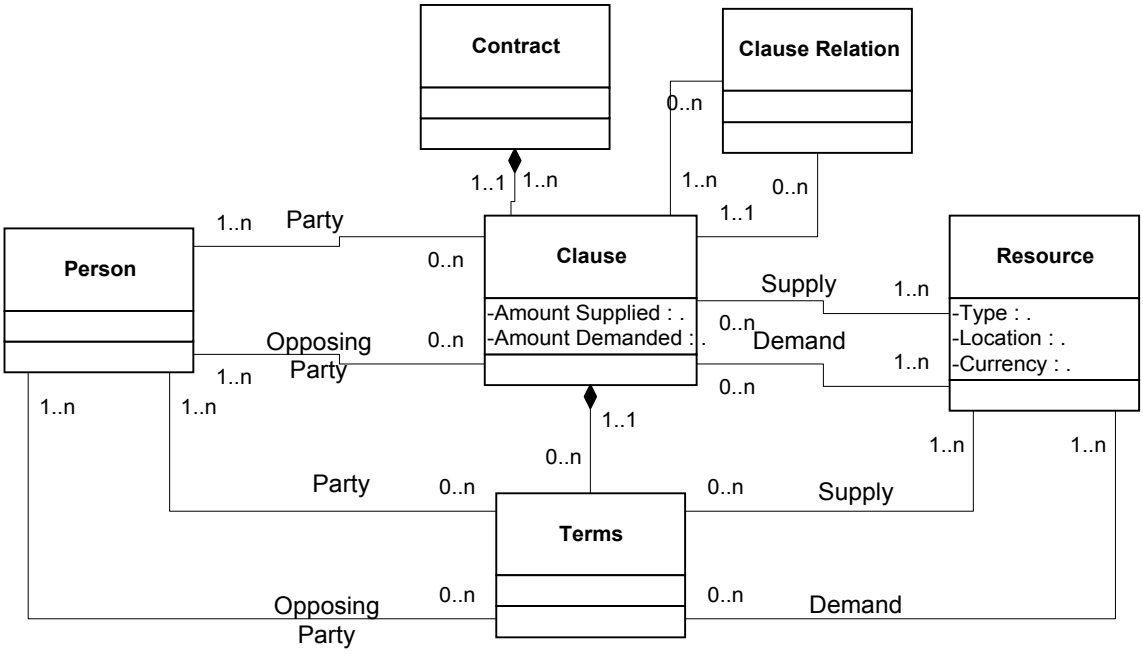

Figure 8-1. Main components of the Contract Clause Model (based on Figure 4-1 of Chapter 4)

The main components of the Contract Clause Model are briefly discussed below[72]. Contracts, detailed in the [Contract] class, consist of one or more contract clauses, defined in the [Clause] class. Each 'clause' is an expression of a resource (defined in the [Resource] class) exchange between persons (defined in the [Person] class) acting in the roles of 'clause party' and 'clause opposing party' (defined as specific association relationships between the [Person] class and the [Clause] class). The amounts of resources exchanged for each other are defined as the 'amount supplied' and the 'amount demanded' properties of the [Clause] class. Resources are characterized by resource 'type', a resource 'location', i.e. the specification of where resources reside and the currency in which the resources are expressed. These aspects are defined as properties of the [Resource] class. The conditions under which the resource

[71] UML notation conventions can be found in Fowler and Scott (1997). See also Appendix 2.
[72] For an explanation of the complete Contract Clause Model, see Section 4.2 of Chapter 4.

exchange is agreed to take place are defined in one or more terms as defined in the [Term] class.

The Contract Clause Model's suitability for accommodating data for hierarchical treasury management decision-making will be evaluated by investigating whether the data model complies with the six requirements for data availability (for requirements 1 to 4, see Section 8.2; for Requirements 5 and 6, see Section 8.3). In the remainder of this section, which requirements the Contract Clause Model already complies with in its basic version will be investigated before enhancements to the data model are made.

The Contract Clause Model *without enhancements* already complies with the following requirements.

- *Requirement: Financial resource transition*. The resource exchange as detailed in the contract clause consists here of an exchange of two financial resources or an exchange of financial resources for operational resources.
- *Requirement: Context congruency.* This relates to the aim of supporting decisions at multiple levels, where one decision is evaluated in the context of the other decisions. This requirement is supported by means of relationships between contract clauses, as detailed in the [Clause Relation] class.

The specific requirements for supporting treasury management decisions with information accommodated by the contract data model, relates to four requirements. *1)* Cash flow equivalent transition, *2)* MRP netting reservation logic, *3)* family resource and *4)* aggregated location functionality. These requirements have to be defined as extensions to the Contract Model and are discussed in the next section.

8.6 Enhancement of the Contract Model to service treasury management decision-making

The previous section outlined which requirements for data availability the Contract Clause Model already complies with in its basic version prior modifications. This section discusses the required enhancements that have to be made to the Contract Model[73] in order render it suitable for accommodating data for supporting hierarchical treasury management decision-making with relevant cost information.

a. Requirement: Cash Flow Equivalent Transition

As discussed in Section 6.3 of Chapter 6, the CFE is required as additional information to handle differences in financial resource flows resulting from *1)* using different types of financial resources, *2)* executing financial resource flows at different points and *3)* applying different currencies to express financial resource flows. The Contract Model only accommodates the storage of amounts of a specific financial resource type of a specific currency. In order to accommodate the CFE Transition data, two solutions are available. First, two more properties can be added to the [Clause] class, 'CFE supplied' and 'CFE demanded'. The user is thus expected to calculate the CFE flows him or herself. Second, additional information can be stored to calculate the CFE flows without storing the CFE information as calculated data. This was recommended in Section 7.2.1 of Chapter 7 by adding the following information: *1)* a financial resource conversion rate (to calculate different financial resource flows towards one common denominator, e.g. financial resources of type 'cash') and *2)* a currency conversion rate (to calculate the different currencies used as one currency, e.g. the home currency). Solving the problem of a difference in timing does not require additional information, though it does assume that the system will return the information at one

[73] Here we consider the full Contract Model (i.e. the integration between the Contract Clause Model and the Fulfilment Model).

commonly used moment via the Net Present Value technique (Brealey and Myers, 1996, p. 73). In keeping with the advice of Sakagami (1995), McCarthy (1979), Everest and Weber (1977), among others, i.e. to avoid the adoption of application artifacts and aggregated data as data phenomena that are stored in the data model, the second approach was chosen for implementation. A new class, [Conversion Rate], is introduced to store currency conversion rates and an additional property, [Resource Conversion Rate], is added to the [Resource] class to register the conversion rate of financial resources as the chosen common denominator (e.g. cash).

b. Requirement: MRP netting reservation logic

Two different aspects have to be supported in the information system. First, it has to be possible to distinguish between financial resource transitions that are already known in MFS planning (registered in 'normal' contract clauses) and financial resource transitions that are incidental and unknown at the moment of MFS planning (defined by 'potentials' contract clause, see Section 7.2.4 of Chapter 7; based on Verdaasdonk, 1998, p. 53). This requirement is implemented in the model by adding the 'type' property to [Clause] class. This property can have two values, i.e. 'normal' and 'potential'.

Second, the information system must be able to differentiate between different planning states to indicate the likelihood of financial resources being available for a particular destination at a particular moment. Two additional information components have to be provided to fulfill this requirement. The first information component is the calendar functionality. Reservations for financial resources are made for a specific time period. This time period is characterized by a start and end date (which is the start date for the subsequent period). The shortest possible relevant period length for treasury management decisions is one day. The calendar is implemented through a new class, [Calendar Unit]. The resources are available in a given period and are defined in the [Resource per Calendar Unit] class. This class is associated with the [Calendar Unit] class. The second information component relates to the accommodation of appropriate reservation logic. In standard MRP netting reservation logic, at least two different reservation states have to be maintained, i.e. 'planned' and 'final'. Reservation states are implemented by adding an additional class, [Reservation], which is associated with the [Resources per Calendar Unit] class. The association relationship between both classes contains the definition of the reservation of resources per calendar unit.

c. Requirement: Family Resource functionality

The 'Setting the MFS' decision has imposed specific characteristics on financial resources. In order to support mix co-ordination as discussed in Section 8.2, and to reduce the complexity of the planning exercise, it is possible to plan at multiple levels. At different levels, omission of uncritical financial resource types or aggregation of financial resource types, which are similar, can be applied. The following modifications to the Contract Model are proposed. An extra class, [Family Resource] is defined, with a specialization relationship between the [Resource] and [Family Resource] class. The latter class contains the properties and algorithms specific to family resources and are additional to regular financial resources.

d. Requirement: Aggregated Location functionality

The implementation of omission and aggregation as discussed in the previous requirement also applies to planning aspect 'locations'. In Section 8.2, the solution using aggregated locations is explained. The implementation of aggregated locations is proposed as follows. In the standard Contract Model, location is an attribute of the [Resource] class. This property is now removed and a new class, [Location], is defined, which is associated with the [Resource] class. This class contains information on regular financial resource locations. Information on aggregated locations is defined in a new class, [Aggregated Location]. This class is defined as specialization of the [Location] class and contains the algorithms and properties specific to aggregated locations.

A revised model of the Contract Model containing the modifications to support hierarchical treasury management decision-making with relevant cost information, is displayed in Appendix 3.

8.7 Summary

This chapter concludes the validation of the question of whether the contract data model can provide sufficient data to support the chosen application of hierarchical treasury management decision-making based on relevant costs. The definition of requirements for data availability for supporting treasury management decisions by relevant costs was the subject of Chapter 6 and was further elaborated by investigating two decisions in particular. *1)* Setting the Master Financing Schedule and *2)* Optimizing financial resource outflow orders. The following two conclusions can now be made about the data availability for servicing treasury management decisions using the contract data model.

a. *Data provision by the contract data model is sufficient for servicing basic transaction information for treasury management decisions*. Two types of data can be distinguished, fundamental basic data components disclosing essential information on business transactions themselves and derived data required to service the application. This means that fundamental data phenomena as provided by the contract clause model (for more detail see Section 4.2 of Chapter 4) are sufficient to service treasury management needs. The most important data are data on resource exchanges as captured in a contract clause.
b. *Enhancements to the Contract Clause Model are required to service treasury management decision support using the relevant cost approach.* A number of specific data phenomena are required to support treasury management decisions. Examples include the Cash Flow Equivalent transition, MRP netting reservation logic and calendar functionality, family financial resource types and aggregated locations. These data components are defined as enhancements of the Contract Clause Model. The proposed data model enhancement observes this condition and therefore reinforces the choice of contracts as the foundation for the data model.