Applying Architecture and Ontology to the Splitting and Allying of Enterprises

Martin Op 't Land

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Applying Architecture and Ontology to the Splitting and Allying of Enterprises

Architectuur en ontologie toegepast
op het splitsen en samenwerken van organisaties

Proefschrift

ter verkrijging van de graad van doctor
aan de Technische Universiteit Delft,
op gezag van de Rector Magnificus prof.dr.ir. J.T. Fokkema,
voorzitter van het College voor Promoties,
in het openbaar te verdedigen op vrijdag 13 juni 2008 om 10:00 uur

door

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doctorandus in de wiskunde
geboren te 's-Gravenhage op 18 januari 1959

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Thesis

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to be defended in public in the presence of a committee
on Friday June 13th, 2008 at 10:00 o'clock

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Er is nog zomer en genoeg
wat zou het loodzwaar tillen zijn wat een gezwoeg
als iedereen niet iedereen terwille was
als iedereen niet iedereen op handen droeg

Judith Herzberg

Propositions

pertaining to the doctoral thesis

Applying Architecture and Ontology to the Splitting and Allying of Enterprises
Architectuur en ontologie toegepast op het splitsen en samenwerken van organisaties

by Martin Op 't Land, TU Delft Netherlands, Friday June 13th, 2008

1 Business dependencies are more important than Information dependencies, when deciding about organization splits (*BI-hypothesis*, this thesis).
2 Organization splits calculated according to the BI-hypothesis, will be recognized for at least 90% as good by experts and management involved (this thesis).
3 The core of a Service Level Agreement deals with the subjects (a) ownership of assets, (b) quality of business and information services, and (c) critical chain-dependencies. Using a DEMO Construction Model ensures completeness in listing this core (this thesis).
4 For detecting similar activities in organizations, a DEMO Construction Model should be preferred as "language" above the language of functions or processes (this thesis).
5 Principle based legislation provokes the right political discussions, at the same time stimulating free market operations.
6 Creating is separating (dr. Oepke Noordmans, theologian, 1871-1956).
7 If you understand a project, you won't know its cost, and vice versa (Dilbert's project uncertainty principle).
8 Better doing well inconsequently, than doing bad consequently (Sifra Op 't Land, inspired by Schindler's List).
9 A third emancipation wave will only be successful if men and women live through it together, thus recognizing their mutual dependence (Cobi Wattez).

These propositions are considered opposable and defendable and as such have been approved by the supervisor, prof.dr.ir. J.L.G. Dietz.

Stellingen (Propositions in Dutch)

behorende bij het proefschrift

Applying Architecture and Ontology to the Splitting and Allying of Enterprises
Architectuur en ontologie toegepast op het splitsen en samenwerken van organisaties

van Martin Op 't Land, Technische Universiteit Delft, vrijdag 13 juni 2008

1 Businessafhankelijkheden zijn belangrijker dan Informatieafhankelijkheden bij het beslissen over de organisatieknip (*BI-hypothese*, dit proefschrift).
2 Volgens de BI-hypothese berekende organisatieknips zullen voor minstens 90% als goed worden beoordeeld door experts en managers (dit proefschrift).
3 De kern van een Service Level Agreement bestaat uit afspraken over (a) eigenaarschap van bezittingen, (b) kwaliteit van de bedrijfs- en informatie-diensten, en (c) kritieke keten-afhankelijkheden. Het gebruik van een DEMO Constructie Model waarborgt volledigheid in het opsporen van deze kern (dit proefschrift).
4 Voor het opsporen van gelijksoortige activiteiten in organisaties is een DEMO Constructie Model als "taal" te prefereren boven de taal van functies en processen (dit proefschrift).
5 Principegebaseerde wetgeving roept de juiste politieke discussies op, terwijl het tegelijkertijd marktwerking stimuleert.
6 Scheppen is scheiden (dr. Oepke Noordmans, theoloog, 1871-1956).
7 Als je een project begrijpt zul je de kosten niet kennen, en andersom (Dilbert, het onzekerheidsprincipe over projecten).
8 Beter inconsequent goed, dan consequent slecht handelen (Sifra Op 't Land, geïnspireerd door Schindler's List).
9 Een derde emancipatiegolf is pas succesvol als mannen en vrouwen die samen doormaken, daarmee hun wederzijdse afhankelijkheid erkennend (Cobi Wattez).

Deze stellingen worden opponeerbaar en verdedigbaar geacht en zijn als zodanig goedgekeurd door de promotor, prof.dr.ir. J.L.G. Dietz.

Summary

Applying Architecture and Ontology to the Splitting and Allying of Enterprises

Abstract Organizations increasingly split off parts and start cooperating with those parts, for instance in Shared Service Centers or by using in- or outsourcing. What is the right spot and way for finding the organization split? And on what subjects should organizations agree to cooperate effectively across the organization split? To find managerial handles for this problem, we applied action research to four large real-life case-studies in which ontology and architecture were used. This resulted in an instrument for supporting organization splitting, allying and post-merger integration, consisting of (1) organization construction rules, (2) algorithms for calculating a plausible organization splitting proposal, (3) a method for finding subjects for contracting split organizations, and (4) a real-life tested combination of all this in a way of working with (5) a known Return On Modeling Effort (ROME). Future research should make this instrument more broadly applicable, more thoroughly tested and delivering faster decision-support, and it should clarify the mutual dependency of organization splitting versus ICT splitting.

Reason

Board members and managers of both profit and non-profit organizations face a multitude of choices in organizing the extended enterprise. The usual choices of centralization and decentralization have been enlarged to include those of Shared Service Centers, Business Process Outsourcing and all types of shoring. The classical motives of cost leadership, customer intimacy and product leadership get global dimensions. And today they are supplemented by the requirements of a Next Generation Enterprise to be agile and able to speedily create new products and services by splitting organizations and skilfully allying with other parties. Decisions to split organizations have therefore to be made more often, faster and at the same time well underpinned in a more complex context.

Earlier research has shown that a model of the essence of an organization – an *Enterprise Ontology* according to Dietz (2006) – delivers practically usable organization building blocks for this type of organization splitting and allying decisions. Little is known about which rules are applied in these decisions. Our research detected and applied such organizations construction rules, using the concepts of ontology and architecture. Architecture is meant here as a conscious restriction of design freedom, and includes general organizational scientific guidelines.

Approach

As indicated by the *action research* method, answers are found in a repeating cycle of intervention, validation, reflection and an adapted approach for intervention. From the broad professional experience of the researcher as a consultant with a methodologically leading role, four large real-life cases were selected:

1 In 2001, ING Europe started introducing Shared Service Centers for its primary processes as a means of achieving synergy in operational excellence, thus reducing costs and improving quality. In Foundations – ING's program to set up its Shared Service Center Securities – an approach was developed and executed which used DEMO-transactions to describe the stable core of the Securities business. The added value of the approach has been measured in 2004.
2 From 2005 at Rijkswaterstaat, under direct steering of its CFO and CIO, a large-scale application portfolio rationalization program is taking place. The Enterprise Architecture Rijkswaterstaat team shaped this program using part of an Enterprise Ontology as a stable description of the business — more specifically, by connecting transactions from the DEMO Construction Model for Road Traffic Management directly to applications.
3 As part of the founding of a Dutch research institute for Delta Technology (Deltares), in 2007 parts of the Dutch Agency of Public Works and Water Management (Rijkswaterstaat) concerning Water quantity had to be split off. Using actors from a DEMO Construction Model as organization building blocks on one hand and criteria from organization science on the other hand, an expert-meeting was presented the organization-splitting choices. Experts were requested to construct their own free-format (gut-feeling) organization choice, as well as to choose from predefined alternatives. These alternatives were based on the *High Internal Cohesion / Low External Coupling* criterion – calculated using the min-cut algorithm from graph-theory – in a way that enabled testing the influence of business dependencies compared with information dependencies.
4 As part of the continued founding of Deltares in 2007, the parts of Rijkswaterstaat concerning Ecology, Water quality and Emissions had to be split off and cooperated with thereafter. We tested a method to make underpinned choices on the organization split, extended with a way to ensure completeness in contracting. Using a DEMO Construction Model, experts were requested to construct their own gut feeling organization split and to systematically list contracting items. The proposed organization split has been compared with more graph theory based calculated alternatives, again testing the influence of business dependencies compared with information dependencies.

Results and added value

The research resulted in an instrument for supporting organization splitting, allying and post-merger integration, consisting of (1) organization construction rules, (2) algorithms for calculating a plausible organization splitting proposal, (3) a method for finding subjects for contracting split organizations, and (4) a real-life tested combination of all this in a way of working with (5) a known Return On Modeling Effort (ROME). The foundation of this instrument are the DEMO-concepts of actor and

transaction – implementation independent itself –, which appeared to be useful as a "language" to express implementation decisions for organization and ICT.

Ad 1 – organization construction rules. By a bottom-up analysis of scripts of case-studies in organization design in which architecture and ontology have been used – thus satisfying the *grounded theory* criterion that the rules sought for actually have been found and used in practice – supplemented by a top-down analysis of organization scientific literature, we found the organization construction rules listed in the table below. In two cases we also tested the organization construction rules PC09, PC10 and PC11, leading to the non-falsification of the so-called BI-hypothesis – *Business dependencies are more important than Information dependencies, when deciding about organizational splits*.

code	Organization construction rule: keep actors together, when ...
PC01	... their mutual *interface* cannot well be standardized, due to *complexity*
PC02	... their mutual *interface* cannot well be standardized, due to *frequent change*
PC03	... they *cannot have a supporting role* for other actors
PC04	... they use the *same language / culture*
PC05	... they operate under the *same regulatory, legal and tax-regime*
PC06	... they more or less work *on the same case / deal with the same event*
PC07	... the *risk to fail* (in banking sector: *operational risk*) of a split is unacceptably high
PC08	... they need *comparable competencies*
PC09	... a *(business) transaction-relationship* exists between them
PC10	... an *information-relationship* exists between them
PC11	... they have *High Internal Cohesion and Low External Coupling* (HICLEC)

Ad 2 – algorithms for calculating a plausible organization splitting proposal. Considering the DEMO Construction Model of an enterprise as a graph with several weights, we have found it to be possible and useful to calculate organization alternatives, using the *minimum Penalty* (minP) and the *maximum Modularity* criterion (maxM) and its corresponding graph-theoretic algorithms. The expert-based gut-feeling alternative appeared to be close to the (non-trivial) calculated organization alternative. This explicit insight in dependencies enables a conscious trade-off between several organization alternatives by management and other experts: *if someone wants to deviate from the calculated alternative, he now will be aware of the penalties of that deviation*.

Ad 3 – a method for finding subjects for contracting split organizations. With a complete DEMO Construction Model as starting point – information links included –, experts were facilitated in systematically listing contracting items on the subjects (a) ownership of assets (b) quality of business and information services and (c) critical chain-dependencies. This helped to determine subsequent implementation steps, e.g., ensuring mutual information supply and formulating performance indicators, in a fast way and supported by the stakeholders.

Ad 4 – a real-life tested combination of all aforementioned elements in a way of working delivers two results for the management, namely (a) a *splitting proposal*,

containing the chosen and underpinned organization split in terms of actors participating in one of the two organizations and (b) *items for contracting* as discussed under ad 3. The core of the approach consists of four meetings, namely on criteria (crit), Construction Model (CM), Organization Split / Ownership of Assets (OS/OA) and Business & Information Services / Critical Dependencies (BIS/CD). To test how this can optimally help to support cooperation and to let the results fit in foreseen contracting and organizational change processes, execution of these meetings is previously tuned with management. The OS/OA meeting is conducted by using a Group Decision Support session. Added values of this way of working appear to be (a) it enables good, conscious, objective, systematic and structured thinking about the organization split; (b) it stimulates collective conceptualization and discussion about risks of the organization split, e.g. for information availability; and (c) it leads fast to underpinned and shared decisions.

Ad 5 – a known Return On Modeling Effort (ROME). The added value of several levels of investment in modeling and domain expertise looks as follows. Just listing actors or transactions from a DEMO Construction Model is sufficient to build bottom-up underpinned qualitative consensus on the organization split. Formulating principles – SMARTly articulating organization and ICT strategy – enables underpinning choices in terms of these principles. Next, when a DEMO Construction Model without information links is created, plausible organization splitting proposals can be formally calculated – assuming the BI-hypothesis generally holds. Finally a complete DEMO Construction Model, so including information links, can be used (a) to calculate a plausible organization splitting proposal – more robust, less dependent on the validity of the BI-hypothesis – and (b) to create a structured inventory of contract items, needed to contract *allying* after the organization split.

General added values of the developed approach appeared to be (a) to create a common conceptualization of current or target situations for all parties involved; (b) to detect similar activities in organizations and redundancies in the ICT-applicationportfolio; (c) to support project scoping and communication on investment decisions; (d) to put governance of operations and ICT in place, clarifying responsibilities; (e) to do this in a well underpinned way at a relatively low cost, building consensus and creating attitude change.

Future research

The instrument delivered by our research has demonstrated its practical value in situations of strategic organization splitting, centralization and post-merger integration. To build on its strength and to overcome its limitations, we propose a research agenda (a) to make the instrument *more broadly applicable* – understanding potential sector-dependencies –, (b) to make the instrument deliver *faster decision-support* – e.g., by simulation –, (c) to *test* the instrument more thoroughly, and (d) to clarify the mutual dependency of organization splitting versus *ICT splitting*. To enable underpinned and fast trade-offs in decision making and to cause the agility to reliably execute resulting decisions at increasing speed, we believe this research is urgently needed.

Martin Op 't Land, 2008

Contents

1

Problem Definition and Research Approach

Abstract Organizations increasingly split off parts and start cooperating with those parts, for instance in Shared Service Centers or by using in- or outsourcing. Our research aims at finding a justified, appropriate way to split off those parts: "The application of which organization construction rules leads to adequate splitting and allying of enterprises"? Architecture and ontology play a role in the construction of any system. From organizational sciences we expect support in developing these construction rules, including criteria for "adequately" splitting an enterprise. We intend to find and test those construction rules by applying action research to real-life cases in which ontology and architecture are used.

1.1 Introduction

Increasingly organizations appear to split off parts and subsequently start cooperating with those parts, for instance in Shared Service Centers (SSC) or by using Business Process Outsourcing (BPO). For example, Ramirez and Weller (2006) show that for the Finance and Accounting business in 2006-2008 (1) the use of outsourcing and shared services is expected to more than double and (2) using own onshore and off-shore shared services is expected to be favored over BPO by a margin of 7 to 1.

Organizations want to be able to offer more complex products and services in a shorter time or to participate in complex product- and service-offerings of another party. Splitting their organization in specialized parts is believed to make those organizations more agile to recombine those parts time and again in the capability to deliver new products/services and to timely drop current products/services. Umar (2005) introduces the notion of Next Generation Enterprises (NGE), which conduct business by utilizing innovative new business models. He claims such an NGE (also known by names such as virtual enterprise, networked enterprise, real-time corporation etc.) will be the standard way of doing business, given its agility and ease of set up: "complete businesses with online purchasing and payment systems can be set up with all IT infrastructure in a few hours". Agility has become a business requirement in many lines of business, from the US army (development time for combat systems had to decrease from 8 years to 2 years) via the US car industry (from thought to finish for a new model in a few months instead of 6 years) to the Dutch banking industry (time to market for a new product from 9-12 months

to a few weeks) (Arnold et al, 2000; Umar, 2005). Friedman (2005) states that businesses are being formed not based on the core competency they have, but instead on their ability to provide services by clever combinations of outsourcing and renting through service providers around the globe.

Splitting organizations in units with clearly separated responsibilities stimulates entrepreneurship and gives those units a customer-oriented focus, with the potential to broaden the customer base. Through a reduction of redundancy in processes and ICT, this results in saving costs and making operations simpler and more manageable. According to Straten (2002), common motives for Business Process Outsourcing (BPO) are (1) cost reductions, by increased efficiency and economies of scale; (2) focus on core competencies; (3) access to additional resources and capabilities; (4) creating incentives and stimulating entrepreneurship. Travis and Shepherd (2005) find comparable benefits for using shared services and add to it (1) improved control and reduced regulatory compliance costs and (2) faster time to upgrade processes, applications and technology.

By *splitting enterprises* we understand the activity that results in assigning roles and responsibilities to a separate organizational entity, which may (but does not need to) be a separate legal entity. Typical results of splitting are an SSC, a BPO-party or just a centralized department in an organization. The roles and responsibilities may concern any business function, from "secondary" (such as catering and housing) via "primary back-office" (such as mortgage back-office processing) to "primary front-office" (such as sales). We will illustrate our concept of splitting in the example case of Mario's pizzeria, for which Fig. 1.1 shows the DEMO[1] Construction Model. This model shows that the sales (A01) is responsible for completing the purchase (T01) against the payment (T04) made by the customer (S01); in the delivery chain the sales depends on the baker (A02) to bake the purchase (T02) and on the transporter (A03) to transport it (T03). In implementing the pizzeria, Mario now can consider several splitting alternatives. Mario could outsource or share the sales function with a national call-centre. Together with his next-door neighbors, Giovanni's pizzeria and Antonio's pizzeria, he could found a Shared Service Center Baking. And also the transportation could be outsourced to a logistics provider or shared with his neighbors.

The question *where to split the enterprise* is not easy to answer. Take for example the sales function of Mario's pizzeria: should Mario outsource the sales function to a national call-center? To retain personal contacts with customers maybe he should not. On the other hand, the ability of handling payments of phone orders for anonymous customers could be attractive. In that case, would it be wise to outsource the payments-part only? For another example, would it be wise to found a Shared Service Center baking, enabling Mario to cooperate in the baking to make this more efficient, while competing in the frontage? If so, should common purchasing and stock control be part of it, maybe even including the financial administration? Already in this simple example we see motives of customer intimacy, efficiency, product uniqueness, broadening the product portfolio, cost control and equalizing capacity emerge. And even if the (functional) priorities chosen in

[1] This thesis refers much to Design and Engineering Methodology for Organizations (see DEMO (2007)). In section 1.2 we will introduce its way of thinking and in subsection 3.3.1 its way of modeling. See Dietz (2006) for a full description.

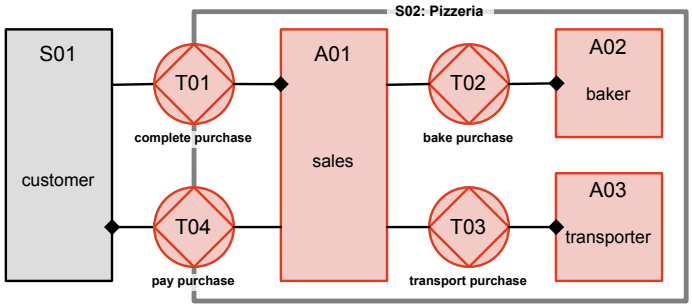

Figure 1.1. DEMO Construction Model Mario's pizzeria

those motives are clear, it is not immediately clear how this mix of priorities leads to choices in the construction of the enterprise. In real-life cases, such as in banks, public or industry, this is even more complex.

According to our literature survey (see Appendix A), almost no research has been done in this area. Gulledge and Sommer (2004) make clear how the SAP Blueprinting methodology (ASAP) can be misleading if cross-functional business processes and organizational alignment are not considered part of the project scope. The costs of a wrong choice for splitting the enterprise, even if restricted to the software changes, can be huge. We summarize the before mentioned common motives for SSCs and BPO's in Fig. 1.2, using the technique of a *benefits logic* (Wortmann and Marees, 2001). In this figure each rectangle represents a factor, an arrow pointing from rectangle A to rectangle B signifies *factor A contributes to factor B* and in the rectangles symbols are used for *increase* (↗) and *decrease* (↘). For example, an increase of "quality of operations" leads to an increase of "offer complex products". On the right side of the figure we show ultimate benefits strived for, in the case of many enterprises "increase cashflow-in" and "decrease cashflow-out". Following part of the lines shown, we e.g. see that (1) a decreased time-to-market, an increased width of the customer-base and an increased ability to offer complex products all contribute to increasing incoming cashflows and (2) the ability of offering complex products is positively influenced by the ability to increase diversity and quality of operations and by taking better splitting decisions. We now arrive at what our research aims for:

> *to improve adequate splitting decisions by increasing the competence for "right-splitting" enterprises.*

1.2 Currently available solutions

Splitting enterprises fits in the disciplines of organizational sciences and enterprise engineering. We start with Mulder (2006), who gives a broad overview of organizational science schools and what they have to say about enterprise engineering. He concludes the Language Action Perspective (LAP-) school currently to be the most attractive option for enterprise engineering, given (1) the increased focus on external behavior of an organization; (2) the (dramatically) increased ability to work independently of location and time, enabled by ICT; (3) the need for constructional

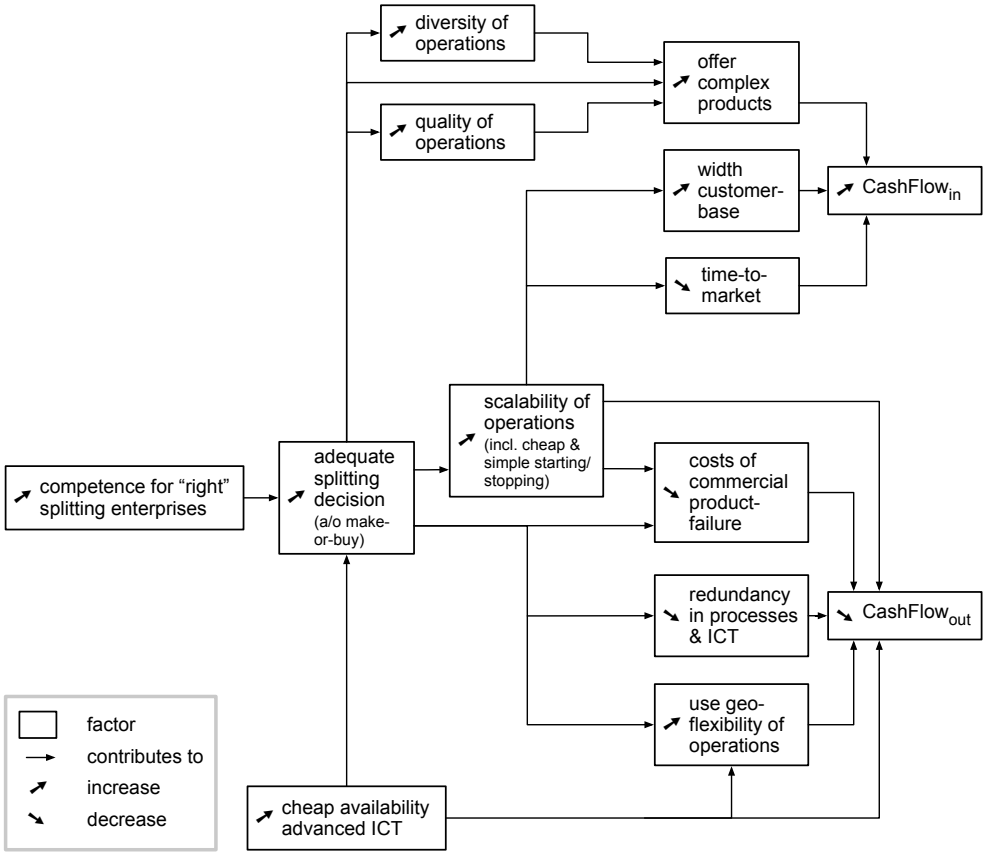

Figure 1.2. Partial benefits logic for the competence of "right-splitting enterprises"

(instead of functional only) guidelines for enterprise engineering; (4) the need for an integral design of business processes, information systems and ICT-infrastructures.

Dietz (2006) has incorporated the LAP-vision into the DEMO-methodology. This methodology aims to deliver an Enterprise Ontology, which is a constructional model of an enterprise that is fully independent of its implementation; it is dependent only of the product (structure) the enterprise delivers. Dietz elaborates mainly how to derive this ontology from descriptions about already implemented organizations and procedures, but does not claim to cover the "brand new creation" of an enterprise from market and customer demands (p 77), although he briefly shows how to derive an ontology from a product structure (pp 99-103). Actually drafting an organization structure based on an enterprise ontology is not in his scope; DEMO itself does not contain criteria or rules for implementing an organization, apart from stating a "one-actor-one-person" ideal (p 195). Furthermore, he claims (p 184) an Enterprise Ontology to be a stable starting point for defining information systems.

In his ROOD-case Mulder (2006, pp 85-116) demonstrates how to apply DEMO to organization design. Especially DEMO's transaction concept appeared to be a suitable unit for the stakeholders to decide about the new organization structure (p 110). The construction rules for that did appear bottom-up while discussing several

organization alternatives for the same ontology. The content of those construction rules and its influence on constructing the organization have not been explicitly researched.

Modern SocioTechnique (MST) is a proven method for structuring organizations. As Sitter (1994) and Amelsvoort (1999) indicate, MST starts top-down from a product structure, builds steering and information bottom-up and prescribes design- and design-sequence-principles. Those design-sequence principles are: (1) start with a strategic orientation; (2) first design production structure, then steering structure; (3) design the production structure top-down; (4) design the steering structure bottom-up; (5) finally, design the information and communication structure and other supporting systems. The design of production structure starts from product-market combinations via product streams to ultimately independent groups of employees, the self-managing teams. The design of steering structure starts to assign regulating tasks as much as possible to self-managing teams; where this is not possible, steering is assigned to the higher levels of operational group resp. business unit.

Comparing MST with DEMO, we observe the following. MST claims to be a complete method, so not only the language for organization construction, but also the "principles" for design and design-sequence. DEMO does provide a language for the "parts" of an organization; however, DEMO does not provide the *criteria* and the method for enterprise engineering. DEMO starts with the product structure and derives from that the production structure, the Construction Model; MST starts with a production structure and derives business activities from that. MST bases its information requirements on the design of an implemented organization, while DEMO states that ontology is the stable basis for information requirements. Neither MST nor DEMO is explicitly interested in the issue of splitting enterprises.

Graaf (2006) is explicitly interested in the subject of splitting enterprises to discern outsourceable lots. He restricts himself to generic principles, where we assume many situational principles can be leading and we also want to understand the impact of the choice of situational principles in drawing organizational borders. Also he uses a diversity of units for sharing/sourcing ("services" or "processes", sometimes "goals" and "products"), without underpinning this diversity. Graaf suggests that in order to decide for "outsourceable units", we should look not only at business coherence, but also at information coherence; we consider that an interesting hypothesis.

We conclude that currently available methods offer promising elements for the method we seek. MST could offer us construction rules and design sequence. DEMO could offer us a language to express the essence of an enterprise, which is also a stable starting point for gathering information requirements. In the construction rules and criteria, we might look to business coherence as well as information coherence. We want to see how this all fits together in a method for splitting enterprises. And we want to see how that works in practice.

1.3 What answer are we looking for?

We define *enterprise* as a goal-oriented cooperative. This leaves still open the decisions about what is external and what is internal. We are interested in *splitting*,

which results in discerning areas of sharing, in- or outsourcing in the enterprise. We are also interested in the issue of *allying* or *co-operating* after the split. Splitting and allying enterprises are two sides of the same medal: the moment the work for an enterprise is split over parties, those parties have to ally in order to stay the "goal-oriented cooperative".

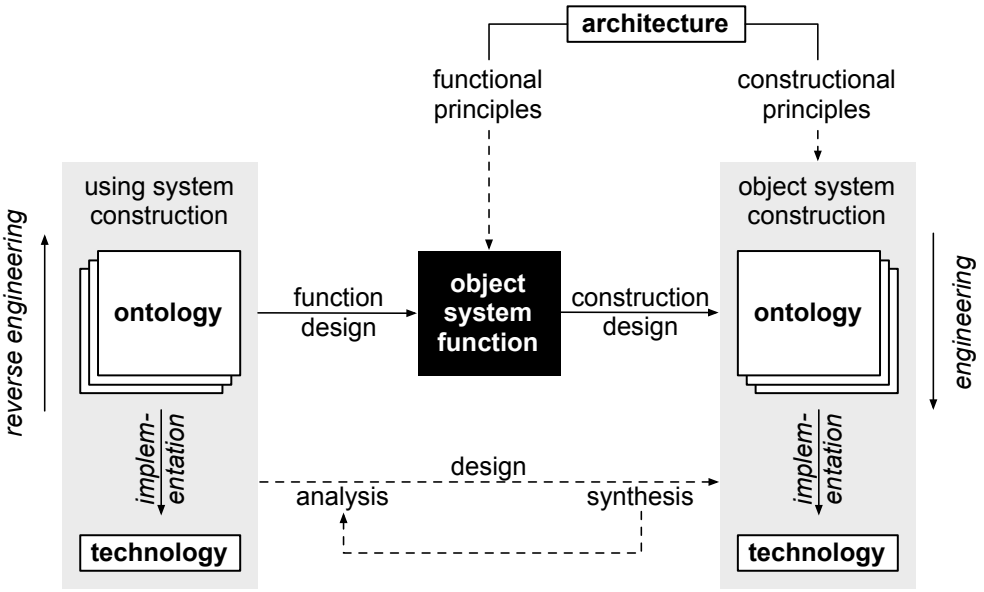

Figure 1.3. Generic System Development Process (Dietz and Hoogervorst, 2007)

We will treat *splitting enterprises* as the implementation-part of a specific case of the Generic System Development Process (GSDP) from Dietz and Hoogervorst (2007), which we will now briefly introduce, using Fig. 1.3. In every design process there are two systems involved, the *using system* (US) and the *object system* (OS). The OS is the system to be designed; the US is the system that will use the functions or services offered by the OS once it is operational. *Function design*, the first phase in the design of the OS, starts from the construction of the US and ends with the function of the OS. Function design delivers the requirements of the OS, so a black-box model of the OS. This function model of the OS does not contain any information about the construction of the OS. *Construction design*, the second phase in the design of the OS, starts with the specified function of the OS and it ends with the construction of the OS. Construction design bridges the mental gap between function and construction, which means establishing a correspondence between systems of different categories: the category of the US (where the function of the OS is defined) and the category of the OS. Construction design delivers an ontology, the highest level white-box model of the OS. By an *ontology* or ontological model of a system we understand a model of its construction that is completely independent of the way in which it is realized and implemented. The *engineering*[2] of a system is the process

[2] Engineering is meant here in the narrow sense of the term, contrary to its general use in civic engineering, electrical engineering, mechanical engineering, etc.

in which a number of white-box models are produced, such that every model is fully derivable from the previous one and the available specifications. Engineering starts from the ontological model, produces a set of subsequently more detailed white-box models and ends with the implementation model. By *implementation* is understood the assignment of technological means to the elements in the implementation model, so that the system can be put into operation. By *technology* we understand the technological means by which a system is implemented. A wide range of technological means is available, varying from human beings and organizational entities via Information and Communication Technology (ICT; e.g., phone, email, computer programs) to vacuum cleaners, cars, drilling machines and screw drivers. In general, the design freedom of designers is undesirable large. Dietz and Hoogervorst (2007) therefore define *architecture* (1) conceptually as a normative restriction of design freedom and (2) operationally as a consistent and coherent set of design *principles* that embody general requirements, where these general requirements hold for a class of systems. Those principles can be functional or constructional, i.e. restricting the function resp. the construction design of a system.

In terms of GSDP, we now define splitting the enterprise as the first step in making an implementation model of the enterprise, namely assigning responsibilities to organizations and organizational units, so not to function profiles or individual people. Splitting is based on the enterprise ontology and, as part of the designing and engineering of the enterprise, restricted by the enterprise architecture. For example, the two car-suppliers Spyker and Porsche are the same in the essence of "supplying cars" and therefore they share the enterprise ontology of a car-supplier. Those car-suppliers will also differ, e.g., in the principle "outsource all production". For example, Spyker has chosen to build cars itself, while Porsche has chosen to outsource its component production and assembly, focusing itself on design, engine development, brand management and sales (Capgemini, 2001). This difference in principles from the *enterprise architecture* leads to a different pattern of co-operation with partners, and there-fore to other organizations. Splitting is a special case of starting drafting an implementation model. Indeed, splitting is taking an existing organization, so an implemented enterprise, and reassigning the roles to one or more new organizations, in which the same product (family) remains to be delivered.

For splitting enterprises, we want to find *organization construction rules*, which we define as the decision rules by which you decide where to split. We expect our rules to look like "if <condition> then preferably don't split the enterprise on that spot, because <reason>". For instance, "don't cut the enterprise on a spot with heavy information-exchange, because this will increase the error-rate". Also the organization construction rules may prescribe the order of working, like "step 1 = distinguish areas with high internal information dependencies; step 2 = ...". Furthermore the construction rules should tell us consequences of applying a decision rule too, like "when in this situation the enterprise is split, new roles will appear at the organization border, e.g., the role of service manager." It might be that these rules are heuristic, not complete and not deterministic.

We expect construction rules from both *general systems development theory* (such as expressed in GSDP) applied to enterprises as system type and *organization sciences* as far as it concerns designing and implementing organizations. Mulder (2006)

demonstrated how enterprise ontology according to DEMO worked as a language for enterprise engineering, enabling conscious choices in splitting the enterprise. A theory about those construction rules, related to the notion of architecture, is however lacking. Organization sciences, on the other hand, will give us commonly used construction rules for enterprise engineering, like "split complex tasks", "keep similar tasks together", "split between primary and secondary business processes", "loose coupling" and "strong internal and weak external cohesion" (Sitter, 1994; Weick, 1982). The influence of architecture and ontology on that is currently not investigated.

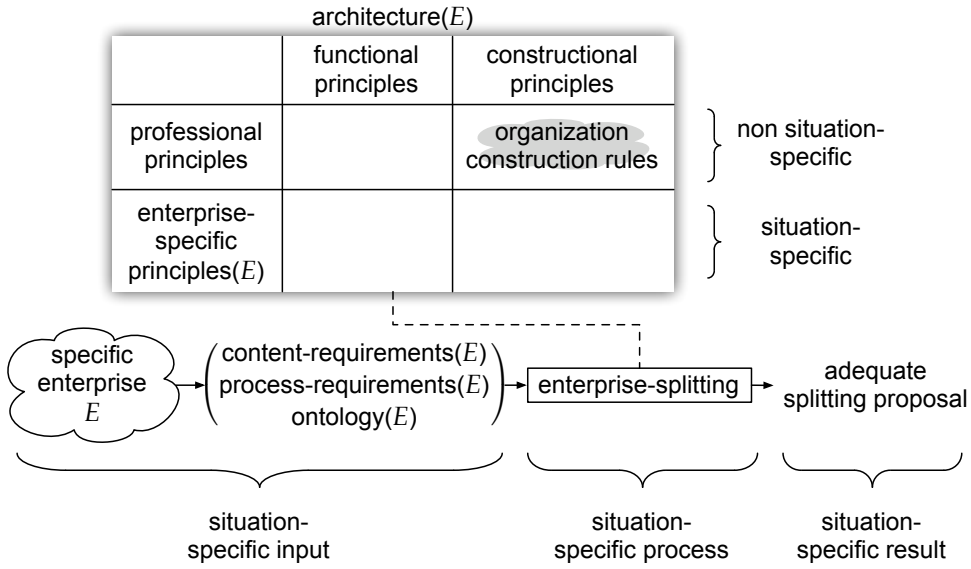

Figure 1.4. Concepts for splitting enterprises

For the splitting of enterprises we need several concepts, which we will now introduce, using Fig. 1.4. We want splitting of enterprises to be done *adequately*, which we define as being compliant with professional principles, enterprise specific principles, situational process requirements and situational content requirements. A *professional principle* is broadly applicable and not situation specific, e.g. "minimize need for tuning"; it will typically originate from general systems theory and organization sciences. *Enterprise specific principles*(E) are the operationalization of enterprise E's strategic choices and policies, including the constraints to be applied . Examples of enterprise specific principles could be "re-use before buy before build" or "all employees should be able to work everywhere in our country in the same way". Constraints will typically originate from the ecosystem of the organization, e.g., from investors, (legal or branch-) supervisors, customers, suppliers, consumer organizations and neighbors. Situational process requirements (*Process-requirements*(E)) are specific for a certain process or project of splitting enterprise E, e.g. project costs, timeliness and process quality. Situational content requirements (*Content-requirements*(E)) are all requirements on the content of the splitting proposal, including the goals and effects to be reached by splitting the specific enter-

prise *E*. As mentioned in section 1.1, the intended goals for splitting of enterprises can be quite diverse and include saving costs (location, people, tax), improving quality (right people with right qualifications in e.g. language, training and experience) and improving agility and flexibility.

Applying Dietz and Hoogervorst (2007)'s operational definition for architecture as a "consistent and coherent set of (functional or constructional) design *principles*", we see that (1) the architecture of enterprise E (*Architecture(E)*) consists of the professional principles and the enterprise-specific principles and (2) the organization construction rules are part of the professional constructional principles. Apart from the principles and requirements, the situation-specific *enterprise splitting* process takes the ontology of the enterprise E (*Ontology(E)*) as an input to arrive at an *adequate splitting proposal (E)*. As said, after Dietz (2006) we will use a DEMO Construction Model for such an ontology. The organization construction rules prescribe the trade-offs which have to be made between all requirements and principles, using the ontology as language of the essence of the enterprise and delivering finally that adequate splitting proposal. Researching all possible requirements will not be in scope.

We do not beforehand further restrict the problem area for which we want the organization construction rules to be valid. This means that the *intended domain* of our research is "all organizations that for any reasons need to be split". So we leave open the possibility that the organization construction rules will be valid for enterprises, currently organized with redundancy in processes and ICT. But also for enterprises wanting to be split for strategic reasons, for bundling core competences or for any other of the reasons we meant in section 1.1.

Summarizing, we want to answer several questions, namely (1) when is splitting done adequately, (2) which organization construction rules help in adequate splitting, and (3) how will organizations ally after splitting. So our problem statement reads:

> *The application of which organization construction rules leads to adequate splitting and allying of enterprises?*

1.4 Research approach

In our research for organization construction rules, we want to see especially (1) how architecture and ontology influence the splitting of an enterprise; (2) what is the "minimum size" of architecture and ontology to still let the organization construction rules give the same result – thus discovering the "right size" of architecture and ontology in the splitting of an enterprise. Finding this "right size" – e.g., in terms of aspects to be modeled, level of detail and content quality – should clarify the *Return On Modeling Effort* (ROME). After all, investing time and money in drafting architecture and ontology should be steered by an insight in its expected benefits, to achieve *just in time, just enough modeling*. Below we will argue that an appropriate approach for the second result is action research and for the first result case studies. For short this means that, in order to find the organization construction rules controlling the enterprise splitting process, we have to repeatedly execute that splitting process, controlling the in- and output.

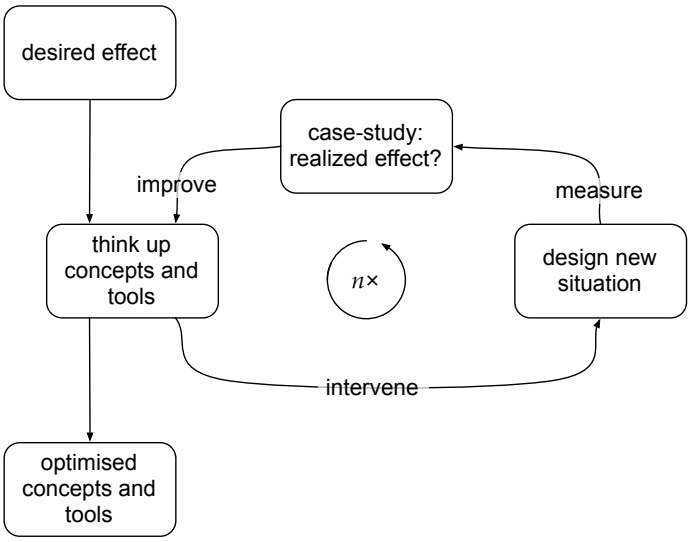

Figure 1.5. The action research cycle

We use a research approach in which in successive situations several enterprises are split. The use of organization construction rules in *one* such a situation is studied according to the method of case study (see below why). Based on the experience of that one situation, new ideas about the construction rules will emerge and be reflected upon, which can be used in the subsequent situation. In that situation again a case study can be executed, etc. This cycle is commonly referred to as *action research*, defined by Avison et al (1999) as a repeating cycle of intervention, measuring, evaluation and improvement (Fig. 1.5). Action research as research instrument is intended to apply a theory in practice and evaluate its value in the reality as changed by (the theory of) the researcher. Here the researcher selects or develops new concepts and tools, in our research program organization construction rules for splitting enterprises, to use it (or let it be used) in new situations. Based on those characteristics of action research and following Babeliowsky (1997) and Eijk (1996), we expect for the realization of the second result, finding the "right-size" of architecture and ontology in enterprise-splitting, and so for the research program as a whole, action research will be an adequate approach.

In a case-study, researchers take a position outside of the case and observe the case in its "natural" environment, without intervening or interfering (Yin, 1994). Here, to achieve the first result, we concentrate on the correlation between architecture, ontology and requirements on one hand and the resulting split enterprise on the other hand, looking at the construction rules applied in a real-life environment. Information about that is available in the specific situation itself only. By using real-life experience of the researcher in his role as consultant, we expect to get access to sources nowhere else available. According to Yin (1994, p 13) and Babeliowsky (1997, p 18), a good research instrument in these circumstances is the case-study. Studying single cases can satisfy the standards of the natural science model of scientific research (Lee, 1989). Therefore, for each single case we have set up a research design for that case study, following the notions of Yin (1994). Each case-study will

therefore have its own sub problem, method, result and conclusions. The result of each case-study will have two levels (1) the splitting proposal for the enterprise and how adequate that splitting proposal was for that situation; (2) what that situation has learned us about the organization construction rules.

We looked for cases in which at least an architecture, an ontology and a splitting proposal is available. We have selected case-material from three organizations, the Dutch-based bank-insurer ING, the public agency Rijkswaterstaat and the research institute Deltares. In all these cases the researcher participated by fulfilling a methodologically leading role, which satisfies the criteria for action research. ING is a large financial institution, operating internationally on many locations. ING is a result of mergers, which caused a significant redundancy in processes and ICT. Rijkswaterstaat is the agency of the Ministry of Transport, Public Works and Water Management, that constructs, manages, develops and maintains the Netherlands' main infrastructure networks. Especially by its strong regional autonomy in the past, Rijkswaterstaat faced large redundancy in processes and ICT. Also regularly strategic choices have been made about the core competences of Rijkswaterstaat in relation to Dutch national priorities. In 2007 this led to splitting of parts of Rijkswaterstaat to Deltares, the Dutch research institute for Delta Technology.

When we compare this *researched domain* – ING, Rijkswaterstaat and Deltares – with the *intended domain* – all organizations –, we see the following. ING, Rijkswaterstaat and Deltares all are supra-local functioning organizations, differing considerably in sector (private-financial versus public versus semi-public) and over-all size (110,000 world-wide versus 10,000 national versus 800 national). From the 11 large sectors served by the consultancy-firm of the researcher until 2008, they are considered rather representative for two of them (Financial Services and Public Sector). So we expect reasonable generalizability in Financial Services and the Public Sector.

1.5 Expected added value

As main theoretical added value we expect to find explicit organization construction rules and how those rules influence the splitting of enterprises. In (Dietz, 2006) this influence has not been dealt with. In (Mulder, 2006) those construction rules have not been explicitly addressed, but they emerge bottom-up while discussing several organization alternatives for the same ontology.

As practical added value we expect an improved insight in the problem of reorganizing, sourcing and sharing. Especially we expect an improved manageability of this reorganizing, sourcing and sharing: what are professional "handles" for this problem? May be even more generic conclusions on the issue of organization structuring can be drawn. Mulder (2006) for instance applies ontology to an issue of organization structuring without splitting issues, so some of our construction rules might be useful as well. Finally we hope to find indications on the "minimum size" of an enterprise architecture and an enterprise ontology.

1.6 Outline of the thesis

The outline of the remainder of this thesis looks as follows (Fig. 1.6).

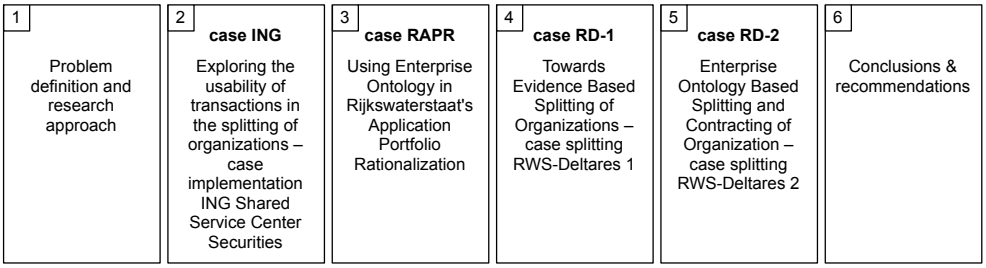

Figure 1.6. Outline of the thesis

In Chapter 2 (case ING) we start an open evaluation of the influence of architecture and ontology on splitting. We learn how ING made its decisions on the borders of its Service Center Securities, among others based on its architecture and parts of an ontology. This gives us a first hypothesis about the influence of architecture and ontology in the construction rules for splitting an enterprise. Also we tested the situational adequacy of the splitting by a survey two years after the splitting process.

Chapter 3 (case RAPR) continues with a practical example of a complete ontology and its use in understanding organizational responsibilities. In this case, the ontology was applied in rationalizing the application portfolio for Traffic Management of Rijkswaterstaat. We looked carefully to the balance of the effort and the added value of making such a more complete ontology – the *Return On Modeling Effort* (ROME).

In Chapter 4 (case RD-1) we formulate and apply common criteria from organization science to the splitting of Deltares from a part of Rijkswaterstaat. Especially we tested the value of a formal prediction of the organization split (based upon some professional principles) against the expert opinions (based upon situational criteria).

In Chapter 5 (case RD-2) we again tested the professional principles on the organization splitting of Deltares from another part of Rijkswaterstaat. Knowing that after an organization has been split, it also has to cooperate with the split parts to stay that "goal-oriented cooperative", we now also pay attention to the allying of enterprises. Therefore we drafted and applied a method to systematically detect items for contracting between organizations, based upon the ontology.

Chapter 6 establishes the contribution and limitations of our research and looks ahead to further research.

2

Exploring the Usability of Transactions in the Splitting of Organizations

Case implementation ING Shared Service Center Securities

Abstract In 2001, ING Europe started introducing Shared Service Centers for its primary processes as a means of achieving synergy in operational excellence, thus reducing costs and improving quality. In *Foundations* – ING's program to set up its Shared Service Center Securities – an approach was developed and executed which used the transactions of a DEMO Construction Model to describe the stable core of the Securities business. In 2004, the main added values of the applied approach appeared to be (1) to create a common conceptualization of the target situations for all parties involved; (2) to support project scoping and communication on investment decisions; (3) to put governance of operations and ICT in place. The transaction concept appeared to be useful as a "language" to express implementation decisions for organization and ICT.

2.1 Introduction

According to Dietz (2006), an Enterprise Ontology is a good starting point for modeling the (re-)implementation of organizations. What parts of an Enterprise Ontology are actually useful or even indispensible for that? And how is its use embedded in a complete approach, including the use of situation specific principles, for arriving at an organization splitting proposal?

In this chapter we explore the use of transactions of a DEMO Construction Model (CM) in the shaping of ING's Shared Service Center Securities (ING SCS). First we will introduce the context of this case where ING in 2001 started introducing Shared Service Centers for its primary processes, among others in the Securities domain by the *Foundations* program. Then we will explain the method developed and applied by Foundations to arrive at its result, a splitting proposal and a corresponding project portfolio by mid 2002. We subsequently show some examples of the results delivered, such as a list of transactions and a splitting proposal. Then we will discuss the benefits of the approach followed and its results, as experienced directly after Foundations, in 2002, and also as experienced two years later, in 2004. Finally we reflect on the results in relation to our research theme, the splitting of organizations.

Note. In the remainder of this chapter we will use the term *architecture* as used by ING in this case, namely "a deliberately chosen set of limitations put on the designing process, consisting of (1) principles, rules and guidelines plus (2) a first sketch of the situation *To Be*, supporting the process of conceptualizing the final organizational structure and ICT systems".

2.2 Context of the case

2.2.1 ING's strategy: moving towards Shared Service Centers

At the end of 2001, the Dutch-based global bank-insurer Internationale Nederlanden Group (ING) had a presence in 65 countries, employing a workforce of 110,000 and serving more than 50 million customers. Measured in market value of April 2002, ING was the 16th largest bank in the world, with three-quarters of its result generated in Europe (ING, 2002b).

Like many other international financial institutions, ING has mainly grown and enlarged its scale by mergers and acquisitions. To some extent this created financial synergy, for instance in its potential to cross-sell and to participate in larger deals. However, operational synergy had not been accomplished. ING was characterized by an abundance of brands, products, and subcultures. Highly similar operations were performed using very different organizational forms and ICT platforms and applications. Only in the Netherlands already 23 brands were active, each with its own label, products, operations and ICT.

ING had prioritized performance improvement by reducing cost levels. These cost levels had to be reduced by operational synergy and this should be implemented by the use of Shared Service Centers. Following Immink and Hendrickx (2002), we define a *Shared Service Center* (SSC) as "...a professional organization, executing specific business functions for (internal) clients":

- the emphasis is on the operational delivery of tangible services that already exist; only now they are shared;
- the SSC, typically supplies its clients on the professional basis of Service Level Agreements (SLAs), and is accountable for the services supplied;
- the SSC has a client focused mindset and is dedicated to providing high-quality, cost-effective, and timely service;
- the specific business functions can be secondary functions, back or front office functions; the essential point here is that those specific functions are instantiated once only.

While reusing the current organization and applications, ING wanted to build a new collection of organizational and application entities, all servicing one another. ING has placed the *split* between the distribution channels and brands on one hand, and the product-oriented back offices on the other hand. Integrated management of these product-oriented back offices for both operations (OPS) and IT is placed in the organizational unit "OPS/IT" (see Fig. 2.1 for an example in Management Centre Netherlands).

To implement this move to SSCs, principles and guidelines for organization and applications had to be drawn up at the level of ING Executive Centre (EC) Europe. The principles and guidelines for the organization were available in the EC Business

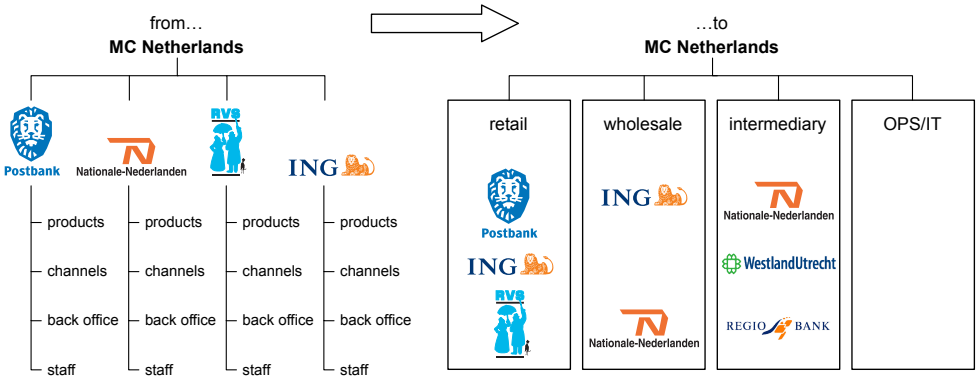

Figure 2.1. The principle of introducing product-oriented back offices (Trip, 2002)

Architecture. Especially a split between front, middle and back office responsibilities was proposed. The principles and guidelines for the applications were available in the so-called "ING Financial Services Architecture" (IFSA). IFSA consists of a number of main elements:

- a blueprint of the application architecture of ING EC Europe at the highest level, distinguishing application domains such as "International Payments", "Savings" etc.;
- principles for the applications in the domains (e.g., services as building blocks instead of business processes);
- principles for cross-domain communication such as communication patterns (e.g., "request-reply", "fire-forget");
- tools for cross-domain communication such as intelligent middleware (the "IFSA-bus").

2.2.2 Using the instrument of Shared Service Centers

For the use of Shared Service Centers several motives are known.

As short time motives are mentioned operational synergy, economies of scale and cost reduction. SSCs reduce costs by increasing the efficiency and quality of internal bank operations. Cost reductions achieved by introducing SSCs are reported to be generally in the range of 10 – 30 % (Lens and Vikram, 2002). Haakma et al (2002) confirm this, indicating an average return on investment of 17%.

The longer-term motivation to set up SSCs is the need to respond to changes in the market place. There is an increasing trend toward globalization and mergers of (retail) banks in Europe. This creates a requirement for post-merger integration of all the constituents of the newly formed group. Another motivation is the development of multi-channel distribution. This has been made possible by the increasing power of ICT and allows new players to enter the market. These new distribution channels need a uniform back office.

Finally, SSCs are used as a stepping stone strategy towards outsourcing.

Almost all known case histories of SSCs in the Banking and Finance sector report a positive outcome (Lobry, 2002). In some cases cost or headcount reductions of up

to 30% have been achieved, in other cases a substantial increase in quality or market share has been reported.

The SSC strives for *Operational excellence*. This means that an SSC does its work at a higher processing speed, with higher quality and at lower cost. This cost reduction effect is explained as follows:

- SSCs require fewer people (dedicated, better utilized, better specialized);
- SSCs use a limited set of uniform and optimized processes and systems; thereby operational risks are reduced and operational quality is improved;
- SSCs need fewer systems to maintain and fewer users to be supported; this reduces IT costs;
- Service Level Agreements maximize their value to the other business units;
- higher volumes can reduce third party costs (e.g., membership of exchanges and Swift, mailing, data vendors) and bring new technology within reach.

2.2.3 The Securities area of ING Europe end of 2001

One of ING Group's Shared Service Centers, the "Service Center Securities" (SCS) states its mission as follows: "Service Center Securities must deliver single world class, customer centric, high quality securities services at competitive conditions to all ING Group companies and their clients". To blueprint this SSC, the *Foundations* program was set up.

At the end of 2001, the situation at ING SCS was as follows:

- a business case was prepared for implementing an SSC in the area of Securities;
- formally, the back offices and product development for Securities were already reporting to the COO of ING SCS;
- a guiding principle for SCS had been selected, the so-called "thin utility approach"; in this approach, SCS will coordinate activities based upon existing organizations; the operations will be rationalized with existing brands taking on one or more roles within the SCS as their focus; the rest of the Group then uses that brand as a service provider.

Foundations had to define a project portfolio (*roadmap*) by mid 2002, enabling ING SCS to set up the SSC with the first benefits – notably employee cost savings – being expected within 2 years. This roadmap had to be based on *architecture* and should be the basis to revisit the business case. Thus during the Medium Term Planning (MTP) budgeting cycle, at the beginning of the autumn of 2002, decisions could be taken and the first projects started. As said before, under architecture ING understood "a deliberately chosen set of limitations put on the designing process, consisting of (1) principles, rules and guidelines plus (2) a first sketch of the situation *To Be*, supporting the process of conceptualization the final organizational structure and ICT systems".

Foundations wanted to improve the success rate of the projects in the roadmap. The architectural approach should introduce a common language and project scoping could be based on insight in the domain coherence.

2.3 The method applied, an "architectural approach"

To arrive at the Foundations goals, a well founded splitting proposal and a project portfolio for ING SCS, we developed and followed a method. In describing the method applied, we will follow a slightly adapted version of the so-called *5 Ways* of Seligman et al (1989) (see Fig. 2.2):

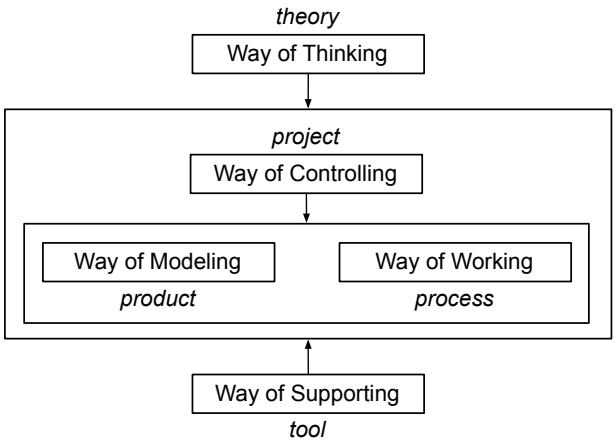

Figure 2.2. The 5 Ways (after Seligman et al (1989))

1 Way of Thinking (WoT): the *theory* about the kind of object systems that the method addresses; it provides the basis for integrating the other 'ways';
2 Way of Modeling (WoM): the distinct *products* (aspect or partial models) that together constitute the complete model of the object system, as well as the applicable representation techniques (diagrams, tables, decomposition, etc.);
3 Way of Working (WoW): the *process* (procedures etc.) of developing the models, as well as the set of techniques (analysis, interview, etc.) for acquiring the knowledge about the object system that is needed for making the models;
4 Way of Controlling (WoC): the organization and the control of the *project* in which the methodology is applied; it regards both WoM and WoW;
5 Way of Supporting (WoS): the set of (software) *tools* that can be used to support the people who apply the method.

2.3.1 The Way of Thinking and the Way of Modeling

As said before, the architectural approach for Foundations had to introduce a common language about the "essence" of the securities business. Based on that we should derive alternative solutions in the re-use and re-implementation of organization and applications. So what would that "essence" look like? First of all, we decided that we should formulate principles, which should guide ING SCS through all its design decisions for organization and ICT. Then for the business side we would need several insights:
1 Which Services are delivered to which Actors, using which (securities-) Instruments on which Markets, and which Actors are needed as a consequence of that?

This was answered in the so-called *SAIM-model* (Services-Actors-Instruments-Markets); as Actor was defined "any party interacting with ING SCS (via services or other relations)", which in DEMO terminology means we restricted ourselves to external actors, i.e. actors external to the system of ING SCS.

2 What are the core activities of the securities business, which should have to be executed in any way you organize it?

3 What are the key concepts of the securities business, so what is its universe of discourse? This was answered in the *Object Model*, comprising a list of definitions for key concepts in the domain and their definition coherence.

Finally, for the ICT side we considered it useful to define information (system) services, which should also be executed in every thinkable implementation.

We had quite some discussion about the 2nd insight, namely how to express the essence of the "core activities of the securities business".

First we considered making a *process* model. Such models, elaborated in quite some detail (flowcharts) in the participating ING Securities countries, were widely available and generally well understood. However, we saw the risk that it would become far too detailed to be useful for us in this timeframe, e.g., since no reference could be used to compare those flowcharts. Also we foresaw that exactly those processes were going to change in the near future, partly as a consequence of the Foundations program we were ourselves conducting! So we needed a higher level and also implementation independent model, which could be recognized and validated by the management and staff of the Securities business.

Then we considered using a so-called *function* model. This model, also known as *goal-tree*, describes an end-means hierarchy of business goals. For example, the goal "keep dry feet for Dutch citizens" could be realized by means such as "facilitate large scale evacuations" or "sustain coastline of the Netherlands"; the last means, considered as a goal, can in turn be realized by means such as "supply sand" or "install artificial reefs", etc. (Op 't Land and Proper, 2007). From industry experience (Franke et al, 1995) we know this model is stable, as long as the mission of the business domain remains the same and the level of detail is free from specific product technology – in the example of the "dry feet" the level with "sand and reefs" should be left out. So with this model we could assess completeness in relation to the business mission. From previous experience we also estimated that making and assessing a good function model would be a challenging learning curve for this team.

At the same time the idea arose to discern *responsibilities*, on one hand as building blocks for the new organization, on the other hand as a basis for the new application landscape. We defined responsibility as an activity:

- as elementary as possible;
- at the same time no smaller than a unit of work we felt to be suitable for both insourcing or outsourcing;
- with a clearly defined result in terms of the business ("is a new fact actually created");
- without making presuppositions about the way the result has to be produced (implementation independent).

Comparing this with drafting a function model, we felt more attracted to the responsibility approach. This responsibility approach contains the concept of deliv-

ering one specific result, when called for; that perfectly matches the *business service oriented* philosophy of an SSC. The test for completeness in relation to the mission could be done adequately by using existing process descriptions in the existing and working ING organizations. We expected it to be easier to build the bridge to the new organization. And it worked fast; the core team was able to define the main responsibilities and draw up a context diagram during a single workshop day.

The concept of responsibility exactly fits the concept of DEMO transaction. Indeed, a DEMO transaction brings about a new fact in reality. And from DEMO theory we know the Construction Model does not change with in- or outsourcing or sharing; indeed only the *allocation* of its executing actors (e.g. "risk reviewer") to organizational units, function profiles and finally human beings is changed. During the remainder of this chapter we therefore will use the DEMO term *transaction* instead of the project term responsibility.

2.3.2 The Way of Working

For Foundations, we designed our approach as follows (see Fig. 2.3).

First we had to draft a common starting point for organization and ICT in the *Target Business Architecture* (TBA). In the TBA we wanted to define and structure only those aspects of the business that depend on the mission and products of SCS.

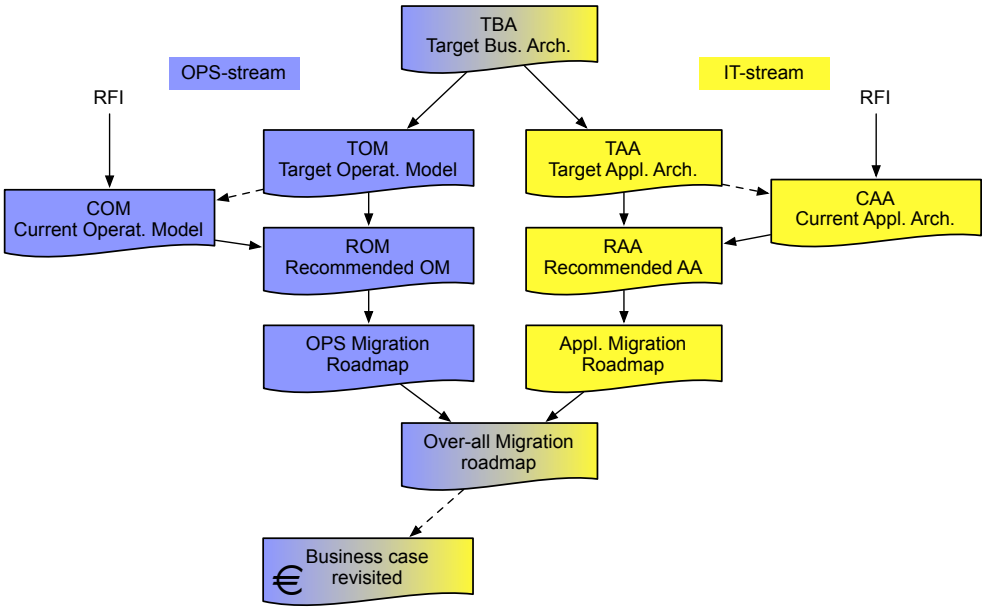

Figure 2.3. Foundations: process and deliverables (ING, 2002a)

Then we worked in parallel on defining organization and ICT. In the *Target Application Architecture* (TAA) and *Target Operational Model* (TOM), an "ideal" solution for application and organizational coherence was drafted, roughly on a 5-year time scale. Based on an ING-internal Request For Information (RFI), the current situation

of applications and organization was recorded according to the TAA/TOM structures in the *Current Application Architecture* (CAA) and the *Current Operational Model* (COM). The *Recommended Application Architecture* (RAA) and the *Recommended Organization Model* (ROM) should present a "feasible" solution for applications and organization, roughly on a 2-year time scale. That was the basis for an organizational and applicational Migration Roadmap.

Finally, the organizational and applicational tracks were integrated again in the Over-all Migration Roadmap and the proposed investment decisions were reviewed against the business case prior to implementation.

2.3.3 The Way of Controlling

An international team of 17 ING and Capgemini architects drafted the results of the Foundations program. The TBA was drafted by the OPS and IT architects together. After that, the team was split into two sub teams, the OPS sub team and the IT sub team. The OPS sub team designed the TOM and the ROM, the IT sub team designed the TAA and the RAA. In between, the team staff executed a joint RFI to gather input for CAA and COM. After that, the joint team together drew up an initial Migration step containing some 20 investment/project proposals with a 6 – 9 month delivery time.

The production of rough results was done by the full international team in ten 4-day workshops. Those workshops were held every two weeks in one of the participating countries. In those workshops managers and staff experts were invited to bring in knowledge, while together building the draft results. Between two workshops, those draft results were validated, tuned and refined by the architects in their home countries with other local management and staff.

We applied a time-boxed approach. In the planning phase, for each of the deliverables milestones were set and meetings for the steering committee were planned and held. Existing background documents were re-used as much as possible.

Alignment had to be guarded along several axes. We ensured business- and ICT-alignment already by creating the TBA as a common starting point for OPS and IT and by drafting the Migration roadmap jointly by the OPS and IT subteam. In between TBA and Migration roadmaps, some architecture staff participated both in the OPS and IT sub team. National alignment was ensured by letting the architects regularly validate all results in their home countries with local management and staff.

2.3.4 The Way of Supporting

The primary concern of Foundations was to enable decision making within say half a year in a coherent way. All results should be easily accessible by all stakeholders. Therefore we chose standard Office tools, mainly Powerpoint presentations, to record all results. E.g. the TBA was delivered as a set of presentations, accessible by one sheet, the TBA-portal, which showed transactions, actors, (banking) services and objects.

2.4 Case results

In this section, we will concentrate on the more generic results of the Foundations program, especially from the TBA, TAA and TOM.

2.4.1 Target Business Architecture (TBA)

The TBA consisted of 6 elements, namely (1) business- and IT-principles (2) a model of Services, Actors, Instruments and Markets (SAIM) (3) transactions (4) objects (5) (business) processes and (6) event-traces. All those results were made accessible by the TBA-portal (see Fig. 2.4).

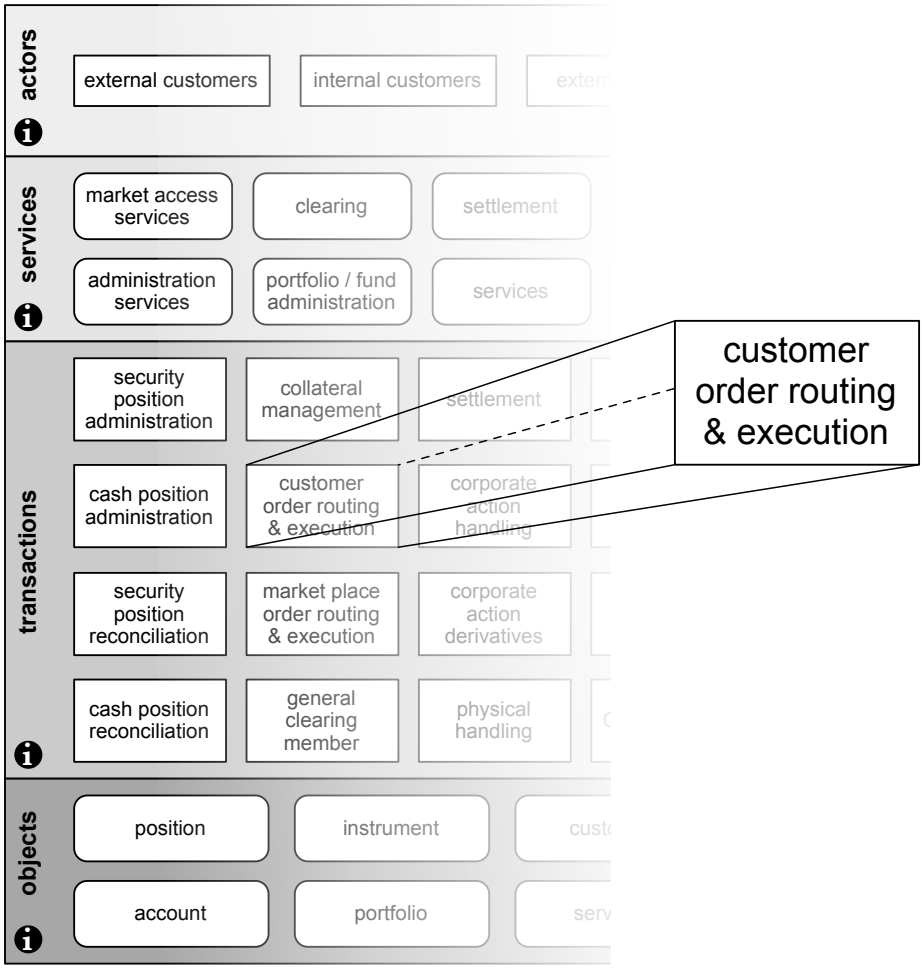

Figure 2.4. INC SCS Target Business Architecture portal (ING, 2002a)

The first result of the TBA was the *business- and IT-principles* set: the starting points and boundary constraints for the architecture and the realization of the SCS. Two examples of such principles are:

- "playing in the distribution with the face-call-click concept has to be supported" (Trip, 2002), so face-distribution (e.g. during a sales dialogue) has to be supported by the same SSC as call-distribution (by phone) and as click-distribution (by Electronic Banking or Internet);
- "known Profit & Loss (P&L) by delivered service": services should be designed and implemented in a manner that allows costs to be measured and monitored; and where appropriate this should be done down to transaction level.

  Note: ING SCS decided at this stage not to include in the TBA invoicing for delivered services yet; however, by choosing this "known P&L" principle, SCS is able to invoice its services in the future, particularly when external customers arrive on the scene, maybe as a part of a fiscal-economic optimized solution for cross-border intra-company invoicing.

Further on, we drafted the *services* and *actors* of the SCS. We defined an actor as being any party (external or internal with respect to ING) that interacts with the SCS (via services or other relations)[1] . And we defined a service as being a (marketable) offering of SCS to one or more customer types. Thus services are the access point for the customer of SCS; actors outside SCS know that they can ask for that service and can have a Service Level Agreement for it. Services therefore describe the behavior of SCS as a whole, so it is a black-box view on ING SCS. An example of a service-definition is: "Custody is the management of events affecting the life of the securities that are deposited with the bank" e.g. the payment of dividends, the convocation of a general meeting of shareholders. Examples of actors are "Tax authority", "Issuer", "Wholesale customer" and "Insourcing customer". In the SAIM-model we also clarified which organizational entities were currently delivering the services (see Fig. 2.5).

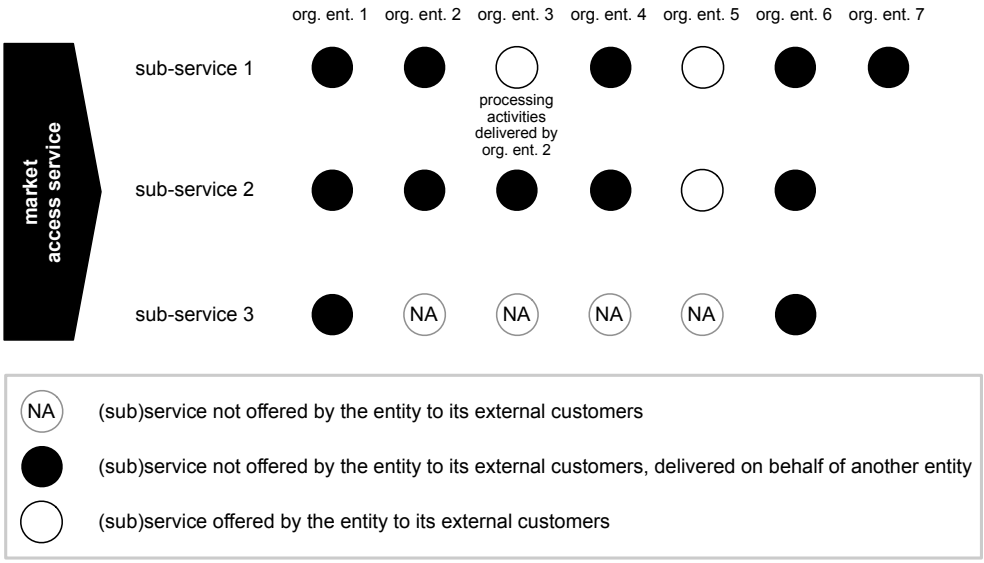

Figure 2.5. Current service-delivery in organization (ING, 2002a)

[1] In DEMO-terminology, we discerned external actors only, i.e. actors external to the system of ING SCS. Within ING SCS, we simply did not define any actors, only the transactions.

To actually provide a service, multiple activities have to be executed. For those activities we chose a level of description which we called *responsibility*, which is in DEMO terminology a transaction. For each transaction we chose a name and defined its (success-) result, initiator and executor. See for an example Table 2.1.

Table 2.1. Example of a documented transaction (ING, 2002a)

name	(success-)result	initiator	executor
Customer order routing & execution	executed customer order, with transfer of economic ownership to the customer	brokerage customer	broker (customer-side)

A transaction can be used in more than one service and, alternatively, a service is provided by a chain of transactions, called a *process*. The transaction is a building block in such a process. Descriptions of current processes were linked to the transaction as another check for completeness of the transactions.

The main common terminology in the SCS domain was defined in the *objects*. An example of such an object is POSITION, which we defined as "A POSITION is the net balance of an INSTRUMENT held on an ACCOUNT". Fig. 2.6 shows the definition coherence between the objects involved in this example.

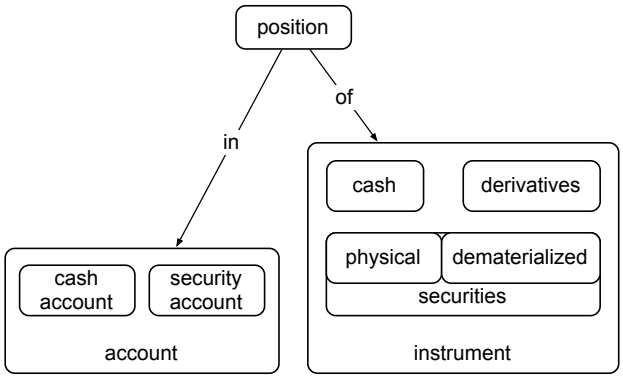

Figure 2.6. Fragment object model (ING, 2002a)

The relationship between actors, services, transactions and objects was visualized in *event-traces* using the TBA-portal as a background. In this way we again validated the transactions for coherence and completeness. See for example a fragment of our event trace for dealing with a market order in Fig. 2.7: the external customer wants to place an order, which means he is going to use "Market access services" (1); he therefore requests the transaction "customer order routing and execution" (2), which can then accept or reject this order (3), based in information about objects such as position, account and instrument; after that the transaction

"market order routing and execution" is called (4), which brings the order to the external actor "securities exchange market" (5).

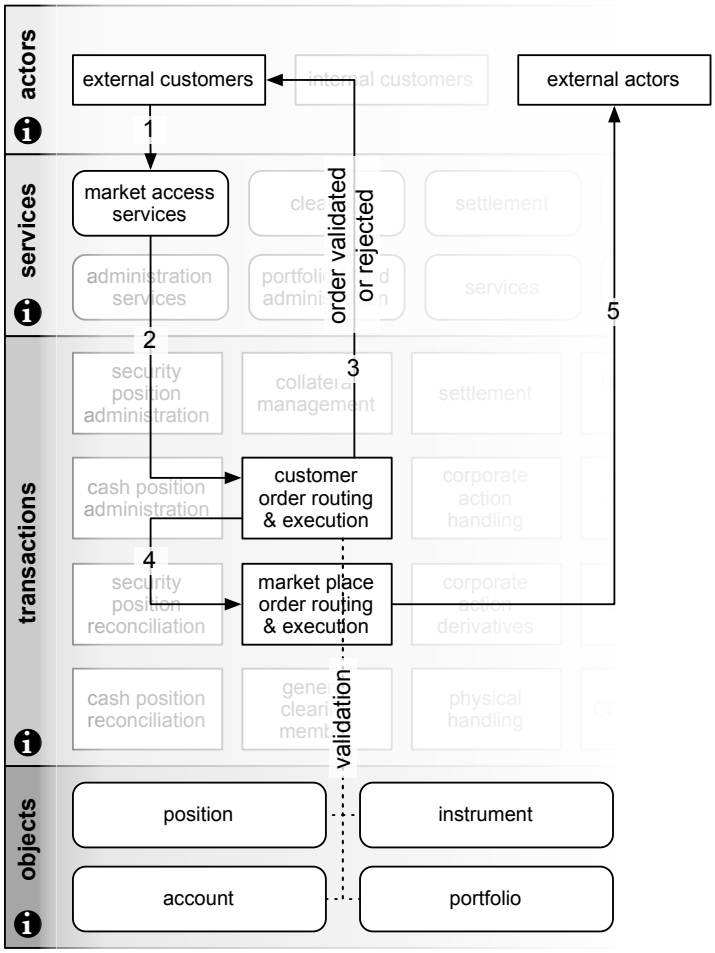

Figure 2.7. Fragment of event trace "market order" (ING, 2002a)

2.4.2 Target Application Architecture (TAA)

We will describe here two parts of the TAA we drafted, namely the Information System (IS) services and the Information System components. An *IS service* is a service to be delivered by an (automated) information system. We started by stating that one IS Service would support a maximum of one transaction, thus enabling in-/ outsourcing in the area of information systems as well. Some new IS services came up, such as "traffic control" ($\approx$ tracking and tracing). For each IS service, we described input/output, business rules and metrics. See for an example Table 2.2.

An Information System component is a clustering of IS services. At first we allocated IS services to the application domains in the IFSA main structure. After that,

Table 2.2. Example of a documented IS-service (ING, 2002a)

name	input	output	business rule	metrics
Customer order routing & execution (part 1)	received info: amount, limit, preferred exchange, ...	info for blocking position, validated customer order, ...	validate customer order on ...	24 x 7 x 365, asynchronous, ...
	retrieved info: instrument info, SLA, ...		determine possibility to group order, ...	

within the domain of the "Securities Product Factory", components were discerned using several scenarios (e.g. "optimal time-to-market", "optimal process control"). Finally, we distinguished three (main) components in the Factory ("market access", "clearing & settlement" and "custody"), based on an expert estimation that this would enable re-use of existing applications to the best effect, especially by minimizing interfacing.

2.4.3 Target Operational Model (TOM)

The TOM clusters transactions in operational units. In this situation, two types of units were discerned: a local unit per country (the so-called local factory) and one common unit (the common factory). We strived to put one transaction either in the local factory or in the common factory. E.g., the transaction for Market order routing and execution appears in the common factory only.

Sometimes a "redundancy" of transactions at local and central levels had to be maintained. From the model this can be seen as still one transaction, but with more implementations due to local, regulatory or timeline restrictions. For example, the transaction Customer order routing and execution appears twice in the TOM, one in the common factory and one in the local factory. In this example this "duplication" of transactions does not create an organizational problem in practice, because the units are serving different clients; the local units serve local customers and the common factory serves wholesale customers. As another example, Corporate action handling takes place in the local unit at a detailed customer level and in the central factory at sub-custodian level. In this case of recursivity in the value chain, such a "duplication" is unavoidable. We see the same with settlement: at the ING Local Factory it has only one counterparty, namely the Common Factory; the Common Factory has all possible market parties as counterparty in settlement. So the transaction and the corresponding actor roles are the same, but different subjects (e.g. legal entities) fulfill those actor roles.

Maintaining local units is currently seen to be an inevitable consequence of close customer contact and language preferences on the one hand, and current regulatory, legal and tax requirements in Europe on the other hand. The tension between local

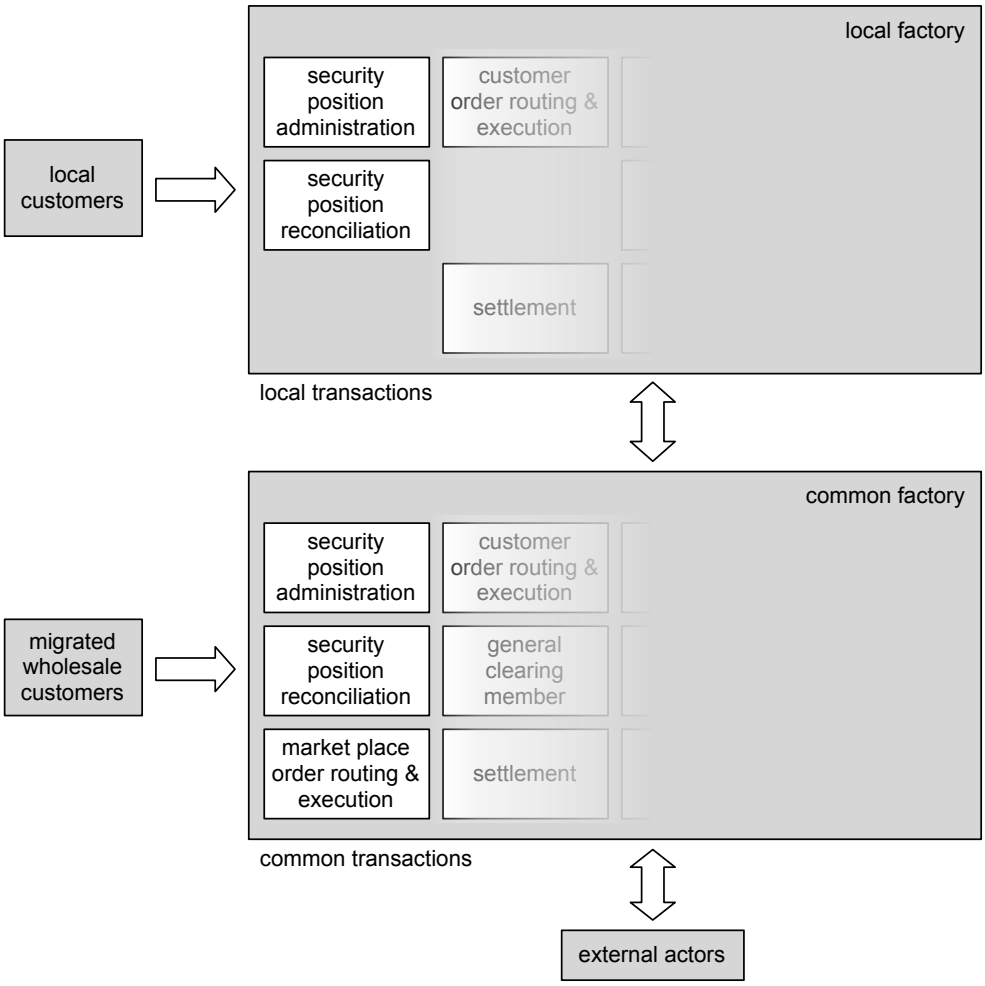

Figure 2.8. ING SCS Target Operational Model (ING, 2002a)

and common level is quite normal as in the local factory the transactions are embedded in the local rules, culture and regulations whereas on the other hand they have to co-work (and hence be synchronized) with the common transactions in order to support/interact coherently in one uniform process that runs across the local and common factory. This kind of discussion illustrates the need for a sustained architectural effort as a critical success factor to guarantee a coherent implementation, making abstraction of any politics.

In the decision making which transaction should be put in the local factory, in the common factory, or in both, we found several organization construction rules. For each rule, Table 2.3 shows the rules found and examples of its consequences in the TOM. The rules 2, 3 and 4 were more or less automatically applied, because we used transactions as organizational building blocks.

Table 2.3. Organization construction rules found (ING, 2002a)

nr	Organization construction rule: keep actors together, when ...	examples of applying this rule
1	... they *cannot have a supporting role* for other actors	This was the argument to put e.g. "Sales support", "Network Management", "Information Provider" and "Securities Data Management" in ING's Common Factory. NB: in terms of Enterprise Ontology, those last two happen to be Infological and Datalogical roles!
2	... sufficient *similarity* in *services* exists	Even the classic differences in service requirements between retail and wholesale customers were not considered to be a reason to split; it could be solved by "flexibility in service level" in delivering the same service...
3	... sufficient similarity of events/work exist	Regulatory reporting is mainly country-specific, so it was kept at ING's Local Factory. For compliance both local and global knowledge is required, so Compliance was put in ING's Common as well as in its Local Factory.
4	... *same order types* occur	Different order types is a reason to split; e.g. we made an instrument-specific split of processes for cash securities and derivatives, because order routing & clearing is different. In this example the split in external capabilities is leading; not many external parties exist which actually do offer both services themselves or they do exist but have split it over different legal entities.
		Difference in complexity is a reason to split; e.g. compare (1) corporate actions for retail: standardized, mass processing, fixed procedures with (2) corporate actions for wholesale: customer focused
5	... those actors more or less *work on the same case / deal with the same event*	E.g. Registration needs to be performed at the same time as a trade is settled $\Rightarrow$ keep Registration and Settlement together.
6	... the *risk to fail* (in banking sector: *operational risk*) of a split is unacceptably high	E.g. the operational risk of clearing to be offered without settlement is too large $\Rightarrow$ keep together

2.5 Achieved effects of the approach

2.5.1 Achieved goals and benefits during 2002

During the Foundations program itself, the target architecture (TBA, TAA and TOM) has been used as follows:

- the TOM was used to make an inventory of organizational capabilities (in the COM) and to decide which unit would serve which product/market combinations;
- the TAA made it possible to compare the current systems (in the CAA) comparable by using the IS-services in the TAA;
- it served as basis to create the project portfolio / roadmap: 21 well-scoped projects have been defined as a quick win (some of them realizable within 6-9 months), e.g. to enable ING BBL in Belgium to provide cash clearing services on Euronext Amsterdam by using existing ING capabilities in the Netherlands.

During and after the Foundations program, the target architecture has frequently been used as a glossary, to keep the common view and understanding of services, objects, etc. E.g. on the terms "depository bank" and "fund administration" it was possible to internationally agree on a common meaning. This was especially useful since ING adopted English as common natural language, where the native languages of the participating countries were Dutch/Flemish, French/Walloon and German. Whenever processes and IT are newly arranged, the TOM and TAA are referred to and used to scope the change. This enables an evolutionary, rather than a revolutionary change, which is yet directed by a common vision on the future.

In European context the results are used as a frame of reference, when talking about OPS-arrangement and OPS-accountability, and also in drafting a more elaborated IT-vision for the next few years.

In the Netherlands, the models have been used to scope areas of change in commonly agreed terms. It enabled e.g. the elaboration of a vision on the retail business for MC Netherlands and its coherence with the wholesale business.

We observed that especially the concept of *transactions* as business building blocks was definitely fruitful in this case. This concept was defined, together with operational managers from the business, and well understood by them (better than business functions – this was too abstract). The communication on those transactions was supported by high-level context-diagrams, just showing external actors and transactions, to fulfill one of the services discerned.

The TBA appeared to be neutral in organizational and IT terms and purely anchored in the mission and products of a business domain. The target situation was clearly described:

- the target model was not clouded by any unwanted inheritance from the existing situation;
- the model of transactions was stable;
- inside/outside discussion (where to make the *split*) was clearly supported; this has been helpful in drafting the organization architecture as well as the IT architecture;
- it proved to be a clear model for the decision to choose for a high degree of reuse; candidates for reuse could be identified and assessed using the model,

i.e. not in the context of the existing situation, but relative to the strategic aims and mission of the company;
- the development of a more detailed design was based mainly on the divisions indicated by the transactions, using the same split both for business transactions as for their supporting IS services.

The over-all effect of the approach used was a steady process, focusing on the essential items without disturbing discussions at the wrong time. This enabled easier and step wise decision making.

2.5.2 Measuring the effects of Foundations on the Designs

As part of our action research program, we decided to measure the effects of Foundations two years later. Action research is a research method characterized by a repeating cycle of intervention, measuring, evaluation and improvement (Avison et al, 1999). In this situation, Foundations was the intervention, in which the author participated as leading architect. We will refer to the set of architectures developed by Foundations as *Architecture2002*. We wanted to measure the effect of Architecture2002 on the designing of organization and ICT of ING SCS. Those designs in the status of 2003Q4/2004Q1 we will refer to as *Design2003*. This measuring was done in a case study, in which we as researcher had our point of view outside the process we were studying; we did not interfere (Yin, 1994). Our leading questions were: what was the role of Architecture2002 in Design2003 and how did it guarantee that Design2003 still meets the original business and ICT goals that were the starting points of Architecture2002?

To find an answer to those questions we followed this procedure. We did a series of free interviews with four key players. Based on the findings of these interviews we constructed a (largely) closed survey question list of approx. 250 questions. The answer to all these questions should give us a clear picture of the view of the respondents on the role and importance of Architecture2002. This survey was sent out through the Internet to 30 managers and architects, involved in the program. We received 18 completed forms. 5 respondents explained their answers in semi-closed interviews. We formulated the findings from this survey and its explanations in a series of statements. These were discussed and validated in an expert-workshop, attended by some highly involved managers and architects. The final outcome of the case study is based on interviews, the survey and a workshop, all held between December 2003 and August 2004. We will now present its outcome.

2.5.3 Effects of the Foundations results two years later

We want to know to what extent Architecture2002 and Design2003 contributed to the business and ICT goals of ING Securities. At the same time we want to take into account that those goals could have been changing in between. Then we want to understand better which parts of Architecture2002 were usable or dispensable in influencing Design2003, e.g. in deciding about subdivisions. The communication on Architecture2002 could also influence the way it has been used and its perceived added value.

For each theme we will present the survey results, the input we received from experts during interviews and the workshop and some conclusions.

The business goals

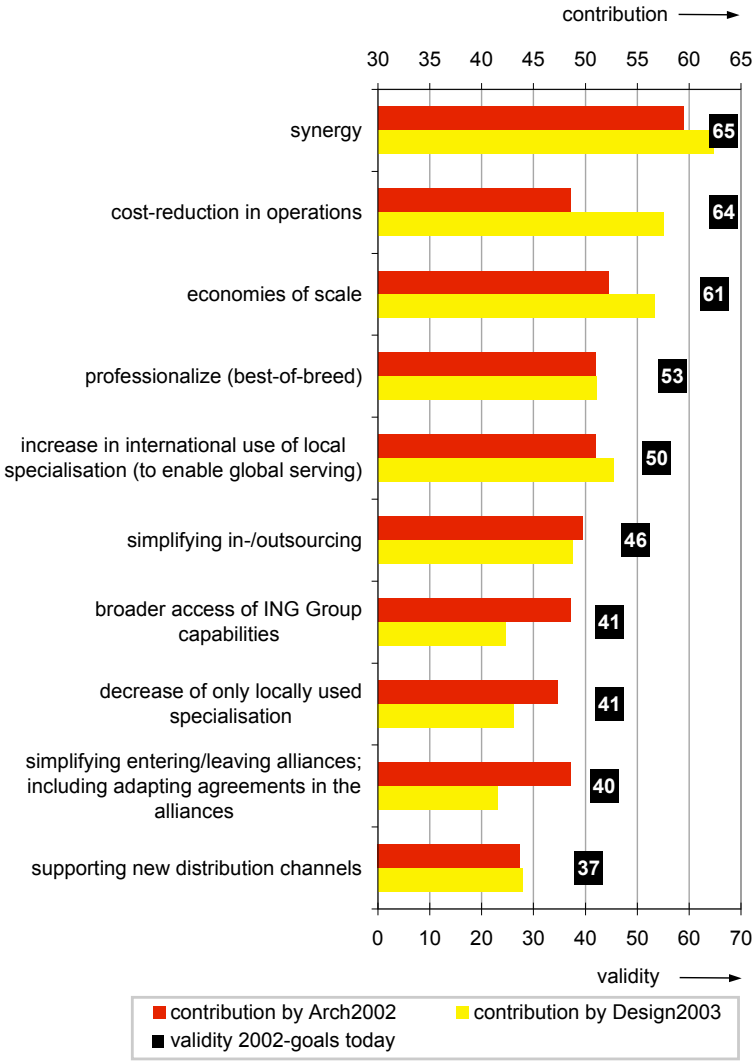

Figure 2.9. The business goals for ING Securities

Survey results. From the business goals beginning of 2002, synergy, cost-reduction in operation and economies of scale are most important today. In Architecture2002, apart from synergy, those goals are not strongly visible. In Design2003, however, they are recognizably in the lead.

We see priorities shifting during this period. The emphasis on cost-reduction, economies of scale and the international use of local specializations has increased. Simplifying in-/outsourcing and alliances, broader access to ING Group capabilities and decrease of only locally used specialization became less important.

Expert input. ING appears to expect cost-reductions within a reasonable timeframe mainly from internal re-use. Re-use is to say "when something works OK for this country, we are going to apply this to another country". By doing this, also local specializations come available for international use.

Therefore, it could be expected that especially replaceability would have a low priority. Replaceability says "this part we currently do ourselves, another party can do this better, OK, let's shift this work to the other party". This explains the low priority for simplifying in- and outsourcing.

Conclusions. Architecture2002 contributed to the business goals. It helped in shaping a working solution with mutual coherence for the Securities domain. Whether that helps simplifying in- and outsourcing or eases entering and leaving alliances or not, is not the primary concern now.

For propagating the business goals Architecture2002 was not necessary. Design2003 has been directly steered by those business goals, in line with the 2003 perception of relative importance of these goals.

The ICT goals

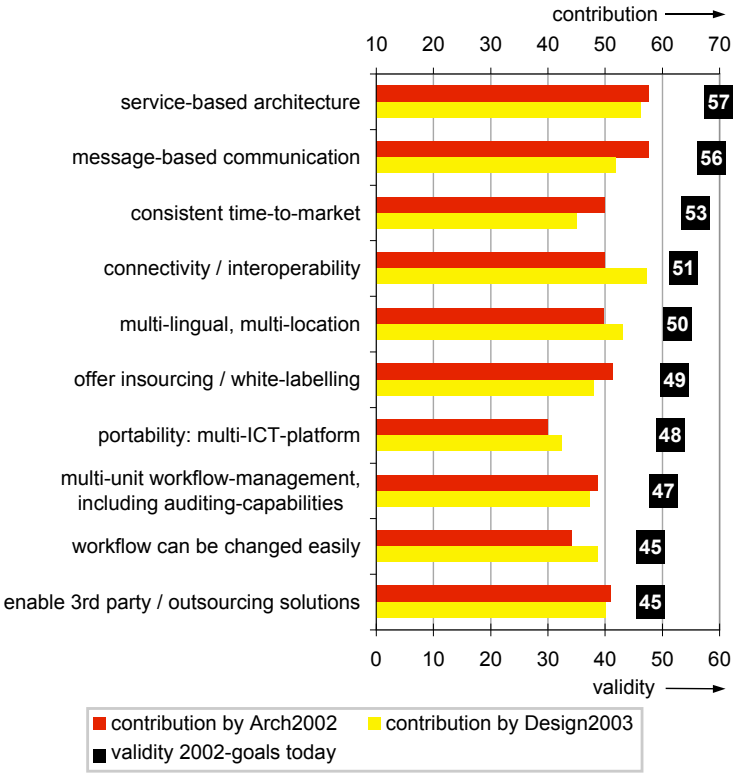

Figure 2.10. The ICT goals for ING Securities

Survey results. From the ICT goals beginning of 2002, service-based architecture, message-based communication and a consistent time-to-market are the most important. Least important are the enabling of 3rdparty / outsourcing solutions and a workflow which can be changed easily.

Compared with Architecture2002, in Design2003 the emphasis on connectivity / interoperability has increased remarkably and also the emphasis on message-based communication has decreased remarkably.

Expert input. ING's strategy has shifted towards re-use of ING solutions. This explains the low interest in 3rd-party/outsourcing solutions, and also the low attention for portability and multi-platform requirements in both Architecture2002 and Design2003.

For re-using ING solutions, connectivity and interoperability remain necessary, but only coarse, at a low level of granularity. E.g. it should be possible to easily connect the whole area of custody to that of order processing, but within the area of custody the requirements for interoperability are low.

Service-based architecture and message-based communication are the preferred solutions for that, though sometimes point-to-point interfaces have been chosen because of time-constraints.

Conclusions. Architecture2002 helped to sustain the priorities in connectivity and interoperability on a low (coarse) level of granularity in Design2003. Service-based architecture and message-based communication were supported as mechanisms for that. This fits into ING's emphasis on re-use. Because 3rd-party/outsourcing solutions were not preferred, portability and connectivity/interoperability on a higher level of granularity (fine) didn't get priority.

Usability and dispensability of parts of Architecture2002

Survey results. The architecture as a whole, Target Business Architecture (TBA) and Target Application Architecture (TAA) have been useful, just as expected, and not dispensable.

The Target Operational Model (TOM) and Current Operational Model (COM) show a strange pattern: many expected it to be useful, only roughly half of the surveyees experienced it to be useful. Yet again, many say it was indispensable.

Expert input. TBA, TOM and TAA had, as expected, a conceptual nature. Each shaped a common language. TOM helped define the management structure for operations and enabled the choice of location for the "common factory" of the operations. TAA served as common reference for application functionality.

The joint drafting process of the Target parts (TBA, TOM and TAA) revealed the entities of ING had lots in common. Before this exercise the expectations for commonality (e.g. between wholesale and retail) were pretty low, after Architecture2002 the belief had increased to say 50%. During Design2003, by the way, in an area such as "order processing" commonality appeared to be more than 80%.

The Recommended parts (R** =RAA and ROM) gave little direction and grip for the designers. Design staff expected specific results there, names of organizational units and names of applications. Causes for this level of quality:

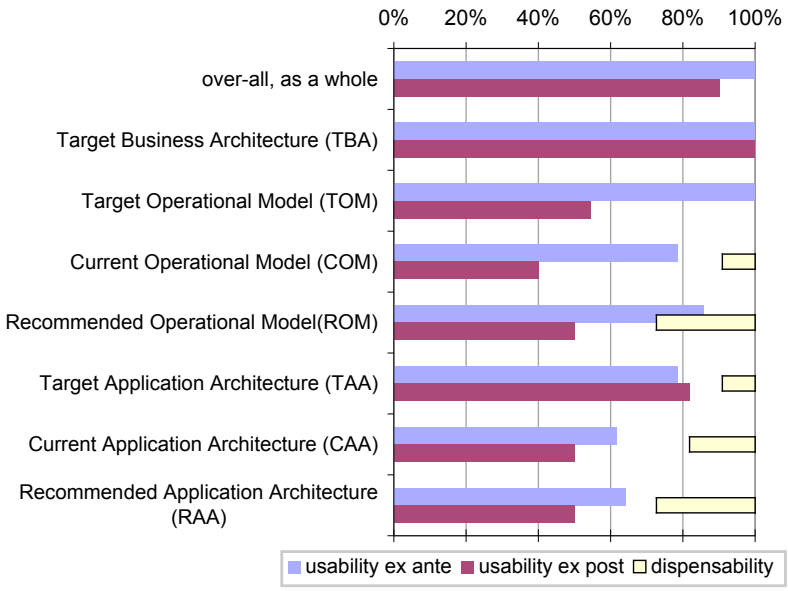

Figure 2.11. Usability and dispensability Architecture2002

- staff who drew up the R** moved to other positions after that, their engagement was noncommittal;
- the governance at that moment was not adequate yet, still along national lines instead of functional lines.

A way to strengthen the commitment is to let staff really propose solutions for which they can be held accountable. These proposals should be made comparable with offers from other e.g. external suppliers.

The governance-issue is a chicken-egg problem, however. By drafting the RAA and ROM, the need for different governance became explicit.

Conclusions. The Target parts of Architecture2002 clarified commonality in ING for all participants. This helped defining management structure and location.

The process of drafting the Recommended parts of Architecture2002 helped in shaping the governance and also in better understanding and co-operation. The big picture is clear enough for planning the business and ICT transformation.

The results of the Recommended parts however were not specific enough for Design2003. A stronger commitment for the drafting staff and management is required. This could be done by making this an open "beauty contest" of several units from ING, together with external proposals.

Subdivisions in Design2003 and Architecture2002

How have the subdivisions, made in Architecture2002, helped to develop and design organization and ICT during 2003?

Survey results. Always or most of the time (together 79%) the subdivisions in Design2003 are the best solutions to comply with the Foundations goals. The subdi-

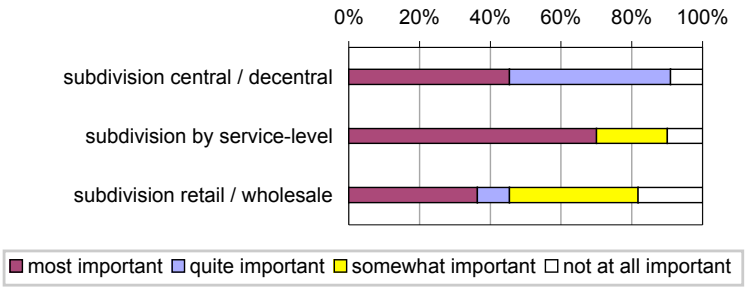

Figure 2.12. Criteria for subdivisions in Design2003

visions in Design2003 however do not necessarily follow those in Architecture2002: 27% completely yes, 18% completely no and 46% somewhere in between.

Many (80%) saw the use of "transactions" as a building block in Architecture2002 as useful.

The main criteria for subdivisions in Design2003 were, in that order: (1) central / decentral, (2) service-level and (3) retail versus wholesale.

Expert input. Long term criterion for central (common) and decentral (local) was: "solution can be central/common if one language, one regulation, one legal & fiscal system".

Wholesale-retail is mentioned as a criterion for subdivision, but in all examples mentioned this can be reduced to service-level. "Wholesale" corresponds to service-levels like complex and tailor-made; "retail" is similar to simple and confection. ING follows the policy to create one solution per service-level.

Differences between service-level appear in the front office, in the way the customer is treated. The back office processing ("the factory") is uniform for all service-levels.

The subdivision "client side" (facing towards ING customers) versus "street side" (facing towards market actors such as exchanges, regulatory bodies) plays an important role too. In it, street side is the potential area for synergy.

Legal and fiscal criteria are not leading for subdivisions, but can impose constraints.

Conclusions. All subdivision criteria in Design2003 were already present in Architecture2002. The survey showed a difference in subdivisions in Design2003 and Architecture2002; this could not be confirmed or illustrated by the experts.

Perceived added value of Architecture2002

Survey results. The value of Architecture for Design is decomposed in several sub-values. A weighed average score was constructed. "Creating a common language and terminology" and "Directing the conceptualization of the To Be situation" scored highest (>70%). Lowest mark was for "Improving Staff Motivation" (30%). All other factors scored average (40% – 60%).

Expert input. Architecture2002 had the important value of creating a shared terminology, vision, conceptualization of the final situation with people from the different

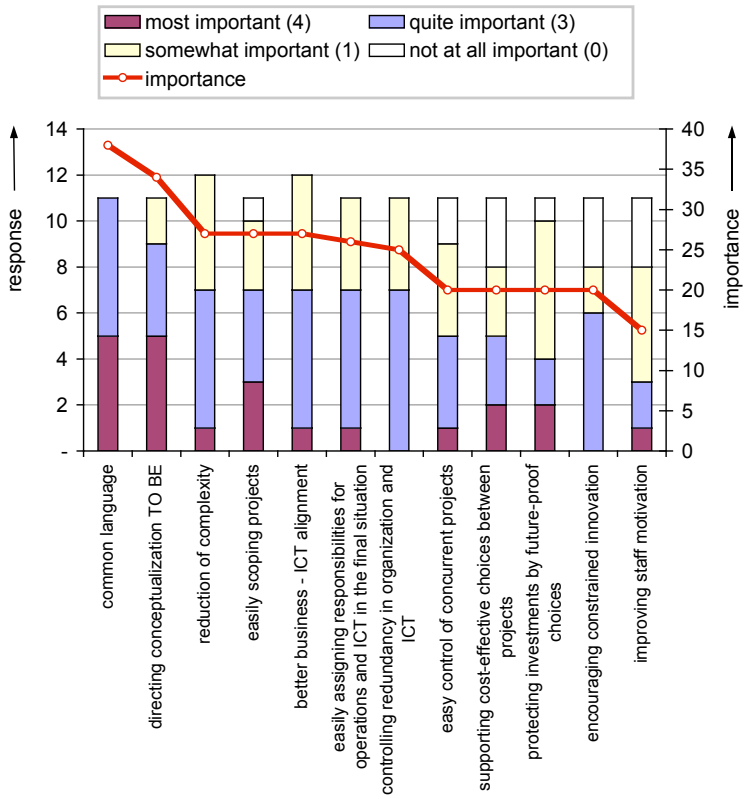

Figure 2.13. Added value of Architecture2002

entities/countries involved. This made possible that Architecture2002 has an important role in the steering of the design process: it enables the right project scoping, clear communication on decisions about investment of resources. For this the first generation of the Target models was useful. During the Design phase these models were considered to be too simple, too high level. For the content steering of Design more detail in Architectural models is needed. The high level models left designers with too much freedom in interpretation. New elements are introduced that have impact on the Design: local (regulatory-imposed) practices, existing IT-solutions, order of realization.

Costs are made more transparent: Architecture2002 identified the processes in the organization where costs (headcount, IT-costs) are measured. Cost reduction is expected as a long-term (4 – 5 year) result. Architecture2002 focused on the primary processes. Supporting processes are not easily measured this way. Cost-figures are, until now, collected for processes. This implies that cost-allocation to transactions (as should be done) is not feasible yet.

Conclusions. The value of Architecture2002, as perceived in Design2003, is primarily:

- reaching consensus on the shared interest of the three countries involved;
- creating a shared language, terminology, and conceptualization of To Be;
- contributing to long term cost-reduction.

Architecture is not a uniform static set of models. The models should evolve in more detail during the Design. Design needs more than what is sufficient for decision making in the first phases.

Architecture by itself does not create the governance of the processes. It is the task of the management to establish the correct governance, to create "maturity" with the local managers. They have to accept and support the concepts of the architecture, and to abandon the specific local solutions.

Only then the value of Architecture will be realized in Design.

Communication about Architecture2002

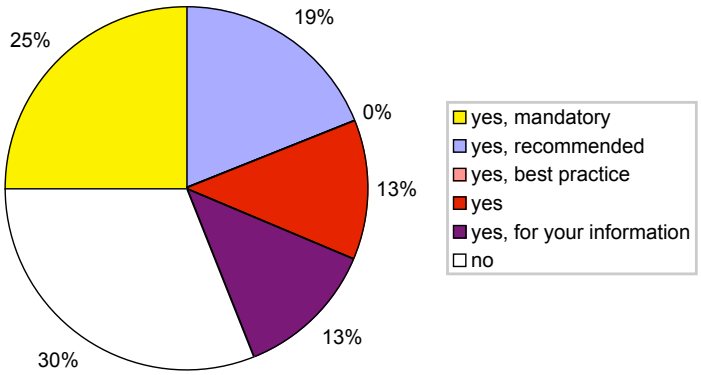

Figure 2.14. Communication of Architecture2002

Survey results. At least 80% of the respondents are at least familiar with almost every part of the architecture. This is not always caused by formal communication, because 30% reports not to have received such communication. Of the respondents which explained the formal communication they received, 80% experienced it at least as recommended.

Expert input. The initial communication about architecture, including the formal part, has worked well. Especially during the setup of the Service Center, architecture as "common conceptualization for all stakeholders" functioned as communication-vehicle.

However, persistency in that communication has been lacking. As soon as new staff arrived or current staff got another role, this new staff has insufficiently been informed about the architecture. As a consequence, the knowledge about the architecture and its importance decreased among non-architects. Among architects on the level of ING Europe, Architecture2002 is known and shared.

For such a persistent communication ("selling"), more time and money should be spent. Especially the target and target-group should be made specific, in order to make this communication effective.

A hindrance to effective communication has been the non-committal attitude by part of the management. No penalty exists for trespassing against the architecture. Now the right governance is in place, this effect should diminish.

Conclusions. Architecture2002 is rather well known by all target-groups. Still more time & money should have been spent on its persistent communication. Only when designers and implementers are familiar with the architecture and management is supporting it by adequate governance, architecture can lead to synergy.

2.5.4 Summarizing the medium-term effects

Did architecture help to propagate ING's goals into the designs?

In the building world, the architecture should completely reflect all goals and principles in a balanced way in its models and drawings. The constructor then has simply to follow the architecture and need not go back to the original requirements of the principal.

Reasoning analogously, in our world of business and information we would also expect the architectural models, especially the "recommended models", to completely reflect the optimum of all business and ICT goals and -requirements.

Architecture2002 indeed formulated "recommended models" for a situation feasible in say two years. This attempt was good, because it brings the line of thought in the right direction. This direction was clear enough to regulate a usable governance of organization and ICT and also to start design-activities.

At the same time, the Architecture2002 result appeared insufficient to completely steer Design2003. In Design2003 still choices for optimization had to be done, directly steered by ING's business and ICT goals and -requirements and not by Architecture2002 only.

How did architecture influence the design?

Architecture2002 created a common language and terminology. Also it directed the conceptualization of the To Be situation. It steered the design process in right project scoping and communication on investment decisions.

The subdivisions of Architecture2002 are reflected in Design2003. During Design2003 some criteria for subdivision were added, especially local (regulatory-based) practices and current ICT-solutions.

The communication of Architecture2002 has been rather effective. More persistency in communication for staff in new roles would have strengthened the knowledge and application of Architecture2002 during Design2003.

What part of the architecture caused the influence in the design?

Target Business Architecture, Target Operational Model and Target Application Architecture were indispensable for the design. Current Application Architecture and Current Operational Model were simply acknowledged as necessary for a common view on the As Is situation.

About the Recommended Operational Model and the Recommended Application Architecture discussion exists. It was not a sufficient starting point for the design & implementation. But it appeared useful in streamlining the steering of the Service Center.

2.6 Conclusions at the level of the action research

The intended effects for ING SCS were mainly cost-reduction in operations, synergy, economies of scale and international use of local specializations. The combination of Architecture2002 and the design method applied was necessary but not sufficient to reach those effects. Architecture2002 helped especially in shared vision, common language and right project scoping and gave direction to better governance. Direct steering by ING's business and ICT goals and -requirements remained necessary.

It is quite early to generalize the conclusions of the ING SCS case to the splitting of enterprises in general. Currently ING SCS exists of internal parties with partly overlapping capabilities. The final situation ING SCS is aiming at is an "internal alliance". It would be interesting to compare this to other types of alliances, in which already existing and complementary parties are joining forces. Also, this case is part of the financial world; can the conclusions be transferred to other subject matter areas (e.g., public administration, manufacturing)?

From the DEMO Construction Model (CM), which will be more fully introduced in subsection 3.3.1, we used the notion of *transaction* only to find both organization and application splits. So we didn't use the concepts of actor roles, information links and all the coherences from a complete CM. It would be interesting to know (1) What did we actually miss? Is actor e.g. a superfluous construct in the CM? (2) What additional value would a complete CM (including actors and the chain of transactions) give in splitting enterprises? (3) Is it worth the effort? How much time and effort does it cost?

Finally we want to know more about how exactly architecture and ontology influences splitting. We now have seen some impact of situational principles and found some organization construction rules, which might be generic. We would like to discover more generic principles and rules.

Acknowledgments

We want to acknowledge all ING and Capgemini team members involved. A special thanks to ING Service Center Securities' Frank Stockx, business change director, and Marc Vanvilthoven, business integration director.

3

Using Enterprise Ontology in Rijkswaterstaat's Application Portfolio Rationalization

Abstract At Rijkswaterstaat, under direct steering of its CFO and CIO, a large-scale application portfolio rationalization program is taking place. The Enterprise Architecture Rijkswaterstaat team, responsible for guarding integrated business-ICT steering, shaped this program using part of an Enterprise Ontology as a stable description of the business. By connecting transactions from the DEMO Construction Model for Road Traffic Management directly to applications, we were able to detect duplications and similarities between applications used in different regions but supporting the same business. At relatively low cost, this led to a well underpinned phasing out proposal of 49% of all applications and also to a positive attitude-change towards the application portfolio rationalization program. In the future the DEMO Construction Model can play a key role in the ongoing clarification of responsibilities in the several Rijkswaterstaat regions.

3.1 Introduction

An Enterprise Ontology according to Dietz (2006) claims to model the essence of a business, without making any assumptions about its realization and implementation. What does such an Enterprise Ontology look like in real-life? What are its practical benefits? How do we arrive at such an Enterprise Ontology? What is its *Return On Modeling Effort* (ROME)?

In this chapter we will demonstrate the making, the result and the practical use of one of the ontological models, namely the DEMO Construction Model (CM), at the Dutch governmental agency Rijkswaterstaat (RWS). First we will introduce the context, an application portfolio rationalization program for the area of Road Traffic Management at RWS. Then we will explain the method applied, with its key elements of drafting a CM, connecting it to applications from the application portfolio and detecting opportunities for rationalization. We subsequently show the results, from the CM via its cross-references with the application portfolio to an underpinned and supported phasing out proposal of 49% of all applications, including a positive attitude-change towards the application portfolio rationalization program. Finally we reflect on the method applied and its results: which value of the CM has been demonstrated and which value can be expected in the future, e.g. in the ongoing uniformization of processes in the several regional departments of RWS.

3.2 Context of the case

3.2.1 Rijkswaterstaat: an organization in transformation

Rijkswaterstaat (RWS), the Directorate-General for Public Works and Water Management, is the executive branch of the Dutch Ministry of Transport, Public Works and Water Management. Under the command of a departmental Minister and State Secretary, RWS develops and maintains the Netherlands' main infrastructure networks. Next to that, it manages traffic on roads and waterways and it manages water quantity and water quality. RWS aims to prevent flooding, to ensure sufficient and clean water, to ensure safe and unimpeded traffic on roads and waterways, and to provide reliable and usable information. In 2004, RWS had an annual expenditure of approximately € 4 billion, a number of staff of approximately 10.500, 17 departments and 160 offices in the Netherlands.

In the same year, RWS formulated an ambitious plan to change from an engineering organization to a public demand driven organization. This transformation plan concentrated on 4 spearheads, namely (1) organizational unity – *one Rijkswaterstaat*, (2) network management – *user oriented*, (3) good internal management – *order in the own organization*, and (4) professional client for private sector – *private sector as first option*. For instance, by taking the perspective of a road user, stimulus was given to provide traffic information on the level of the network instead of on the level of the region; therefore the collaboration with national and international network partners should be intensified. Also RWS wanted to change focus from network construction to network usage. By improving traffic management and traffic information providing, it should be possible to extend infrastructure only as a last resort. In order to achieve *more with less*, and *order in the organization*, RWS decided to change into a more centralized organization. Centralization should occur in business decision making, in IT decision making and in the IT Service Organization.

One year before, RWS started the Enterprise Architecture Rijkswaterstaat (EAR) program. This program aims to be a central point for the numerous initiatives fulfilling the RWS ambition. It is used for diagnostic reasons, e.g. establishing impact of change, and for supporting decision-making, primarily in the ambition *order in the own organization* and secondary in the ambition *private sector as first option*. EAR wants the content of its Integrated Architecture Framework (IAF) (Goedvolk et al, 1999; Op 't Land, 2004) to gradually be built and validated by letting EAR participate in RWS's main change programs. Because of its broker role between information demand and information provision in RWS, EAR is steered from two sides; the business and information part is steered by the CFO/CIO, the Information and Communication Technology (ICT) part is steered by the director Corporate IT.

3.2.2 The Application Portfolio Rationalization program

One of RWS's initiatives to achieve *more with less* and bring *order in the own organization* was the creation of one IT service organization in RWS. This IT service organization, Directorate Corporate IT (DCIT) became responsible for all the applications and technology infrastructure in RWS, a task which used to be managed by 17 different organizational units. The inheritance of this new IT Service Organization was initially estimated at 8000 applications. The CFO gave his top priority to decreasing

this inheritance before transferring it to DCIT and demanded a major application reduction: *reduce the application portfolio by 90% in 4 years*. The expected benefits are (1) cost savings by removing duplication of IT functionality, (2) increased uniformity in processes and IT – thus decreasing risk, (3) simplification in application manageability, and (4) easing of future developments. Especially the last benefit, easing of future developments e.g., corridor management, should build on one solution instead of many solutions – this is impossible with non uniform processes and applications.

Several application portfolio rationalization strategies were considered. For the long term application guidelines should be developed and enforced, favoring Commercial Off-The-Shelf (COTS) standard application packages and Service Oriented Architecture. On the short term duplicate application solutions in the existing application portfolio should be detected quickly, ensuring that business functionality was implemented only once and uniformly (Seeley, 2006). With this aim, a large program was started to reduce the RWS application portfolio. In it, the match between business and IT would have to be scrutinized, and it had to be made explicit which applications supported which parts of the business. This had to be done in an organization where several rationalization processes were running in parallel, including the business process reengineering project Uniformizing Primary Processes (UPP). A final result from UPP was not to be expected before the application portfolio rationalization program would need a single unified and stable description of the RWS business.

As a first step in this application portfolio rationalization program, we divided the application portfolio in chunks we could manage. For that division we used the criteria (1) follow the main processes / services of RWS, (2) the interaction of applications between chunks should be low, and (3) the chunk should fit in the responsibility of one coordination director. In this way we formed a number of rationalization projects. The first rationalization project, focusing on network and traffic management on water & integrated water systems, was a pathfinder for all other rationalization projects. It resulted in a proposal to reduce 85% of the application portfolio in this area and also in a standard process to consolidate all other applications.

We will now focus on the application rationalization for Traffic management on the Highways (*Road Traffic Management*). This business area deals with operational traffic management, incident management and the provision of traffic information. The work was done in 5 regional Traffic Management Centers (TMCs), one national TMC, and one Traffic Management Expert organization. In this area there are – as turned out later – approximately 130 applications e.g., traffic control systems, traffic control centers, Dynamic Route Information Panels, Entry Point Dosing devices and information systems for incident management and route information.

3.3 From models & cross-references to advice: the applied method

To arrive at an application portfolio rationalization proposal for Road Traffic Management, we followed a method. In describing the method applied, we will follow the earlier (section 2.3) described *5 Ways* of Seligman et al (1989).

3.3.1 The Way of Thinking and the Way of Modeling

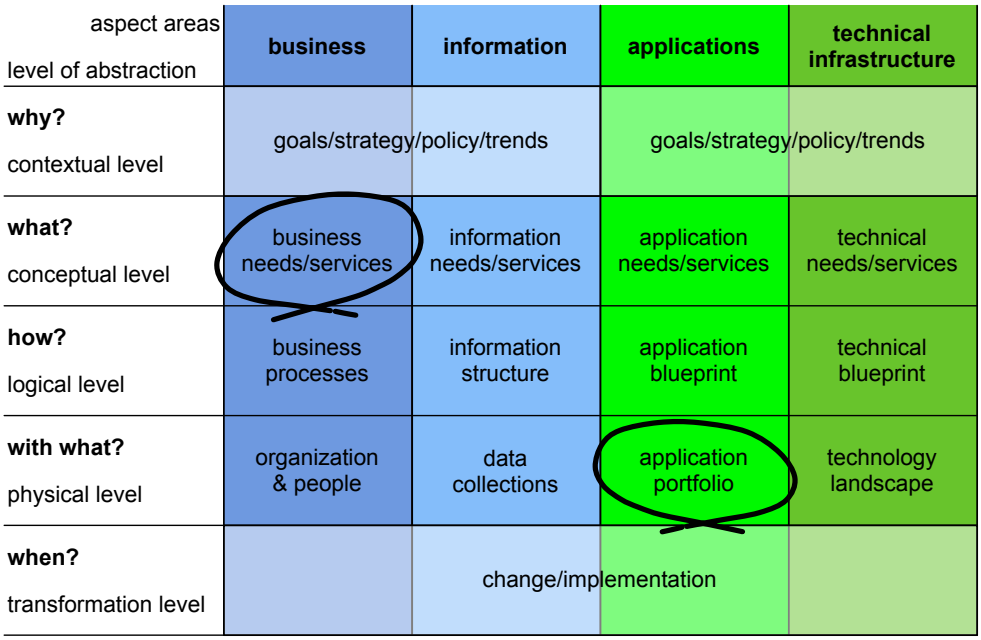

Figure 3.1. Concepts for application rationalization in IAF

We wanted to enable the RWS business in selecting the "right" applications from the application portfolio and also to spot opportunities for better application support. To understand the concepts which play a role in application portfolio rationalization, we started by positioning them in the Integrated Architecture Framework (IAF), as applied and adapted by Rijkswaterstaat (Fig. 3.1). IAF is used as an ordering framework for EAR deliverables and its interrelations, such as business function models, business object models, process models, Information models, data models, ISO standards, IEEE standards, and so on. One of the deliverables is the *application portfolio*, residing in the column Application at the Physical Level. Another key-deliverable is the DEMO Construction Model (CM), positioned in IAF in column Business and row Conceptual Level.

We will now briefly introduce the required concepts of the DEMO Construction Model (CM), using Fig. 3.2. A CM expresses the coherence (chain/ network) of business services, delivered by actors to other actors by executing transactions within a chosen scope. E.g. actor A01 executes transaction T01, which delivers a business service to actor A00. Actor A00 is called the *initiator* and actor A01 the *executor* of transaction T01. The execution of transaction T01 results in a new fact in reality. Another actor A07, for its responsibility in executing transaction T07, needs to know about ongoing and past transactions T01; this *information link* between actor A07 and (the fact bank of) transaction T01 is indicated by a dashed line. In the fact bank of T01 we find both the production facts and the coordination facts (e.g., status "requested", "promised", "stated", "accepted") of the instances of transaction T01.

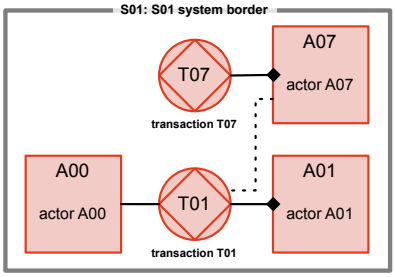

Figure 3.2. Typical constructs of a DEMO Construction Model

From DEMO-theory we also use the *distinction axiom*, which discerns three distinct abilities and corresponding actions of actors. Those distinct actions, which also can be made visible in the CM, are:

1 ontological or business actions (red-colored in the CM) bring about new original things, directly or indirectly in communication, e.g. engaging into commitments, taking decisions;
2 infological actions (green-colored in the CM) concern the content and meaning aspects of communication and information, e.g., sharing of thoughts, remembering and recalling of knowledge and reasoning;
3 datalogical actions (blue-colored in the CM) concern the form aspects of communication and information, e.g., syntax of sentences, the coding and decoding of messages, and the storing and transmission of data and documents.

The CM is independent of any organizational implementation, therefore we considered it a good instrument to describe the RWS business, especially when its organizational implementation was still moving on the scale from regionalized to decentralized. From the three actions mentioned in the distinction axiom, in our CM's we will focus on the business aspect, though now and then we will show a part of the infological aspect.

In order to find candidate applications for rationalization we wanted to relate the current application portfolio to the CM. We assumed we could thus find application portfolio rationalization opportunities (a) in applications that did not support any transaction or actor, (b) in duplicate applications with similar functionality supporting the same transaction and (c) in applications that had overlap in functionality because each supported some of the same and some different transactions.

Now IAF assumes always direct relationships between architectural deliverables in adjacent cells. As the mapping on IAF in Fig. 3.1 shows however, the CM and the existing application portfolio model are separated by the Information column, and they are in different rows as well. Therefore, should we be working in a greenfield situation, we would derive information needs as well as information creation from the RWS business as described by the CM, progress into abstract application services which would then evolve into concrete applications serving concrete datastores. For our goal of supporting the application portfolio rationalization this was deemed a too time consuming approach, and unnecessarily complex in order to achieve the desired results. Instead, we decided to directly model each application as supporting elements in the CM.

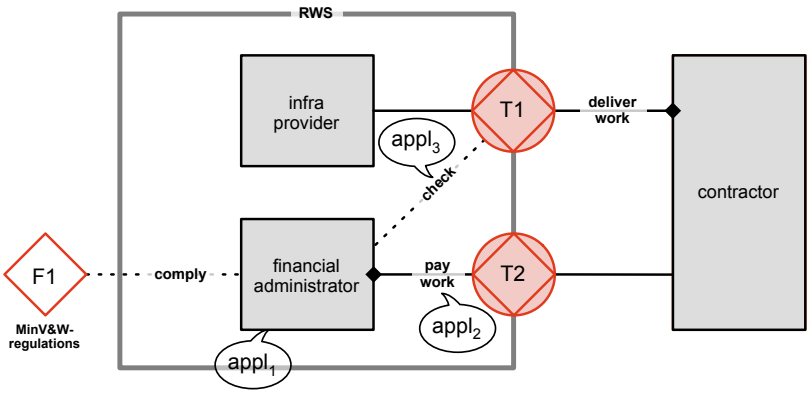

Figure 3.3. Applications supporting several CM-elements

We hypothesized applications had three options to support the business, as expressed in the CM (Fig. 3.3):

1 an application ($appl_1$) is supporting an *actor* in all of its responsibilities; e.g., a portal for the actor Financial Administrator;
2 an application ($appl_2$) is supporting (the execution of) a *transaction*; e.g., the payment of invoices;
3 an application ($appl_3$) supports the *information link*, representing inspection of facts in a transaction by an actor; e.g., to inform the Financial Administrator about the fact "Infraprovider has accepted work of contractor".

To decide which of the three options was most fruitful for our purpose, a validation should be executed as part of our way of working.

3.3.2 The Way of Working

We designed our way of working as consisting of the following steps, which will be described hereafter:

1 build and validate a DEMO Construction Model (CM);
2 create an application portfolio inventory;
3 connect applications to CM-elements, including validation;
4 order, select and prioritize rationalization of applications;
5 define next steps.

Ad 1: Build and validate a DEMO Construction Model

As a starting point we studied policy-oriented documents of RWS. We looked for statements about vision, strategy and the way of working in the primary processes of our domain. At RWS level, we used the business plan, handbooks and process models. For example, in the domain of Traffic Management we used the method *Area-oriented traffic management* (in Dutch: *Gebiedsgericht benutten*). That method describes how to produce a balanced and underpinned mix of traffic and infrastructural measures, derived from transport needs and traffic requirements within safety and livability constraints. As a test for completeness, we also used the organization handbook, including the organigram, and function profiles.

Using this, a first version of the DEMO Construction Model was drafted, showing at first only actors, transactions and their coherence. Wherever it was immediately clear that an actor needed certain information, we drafted the information links as well, so gradually a more complete DEMO Construction Model came into being. We say "more complete", because we did not perform a methodological completeness check for the information links by using DEMO's Process, Action and State Model.

We restricted ourselves initially to primary transactions. So e.g., the Asset Management (control & maintenance) for Traffic Management means would stay out of scope, because Asset Management as a whole was part of another domain to be analyzed for application portfolio rationalization.

Ad 2: Create an application portfolio inventory

It was decided early on that no large scale effort would be started to create an application inventory specific to the purpose of rationalization. The existing lists from different parts of the organization would have to suffice as a starting point, to be extended and detailed during the rationalization process itself. An extensive application portfolio list (containing over 2000 applications RWS wide) that had been made before, to support the creation of the RWS centralized IT Service Organization, would serve as the starting point. As a consequence the properties known of each application were a given, and primarily focused on a functional description and identifying the using and supporting organization units. Different versions of an application were not separately considered.

Specific to the domain of road traffic management there had previously been made a separate effort to describe the main applications in more detail, and model a course data flow description. Further, a visit to each of the Traffic Management Centers did enhance the usage data for the application portfolio, as well as add some extra entries to the application list. This knowledge was all integrated in the application architectural model.

The complete RWS application portfolio was categorized into domain specific applications, and those that were used in more than one business domain. The latter were generic applications such as word processing tools and project management tools. In the described rationalization of road traffic management applications only domain specific applications were considered, except for the area of traffic management systems management that is closely related to generic IT management.

Ad 3: Connect applications to CM-elements, including validation

One part of the Way of Thinking and the Way of Modeling – namely the method of connecting applications directly to the CM-elements actor, transaction or information link needed validation to ensure satisfactory results. This validation was done for a different business domain in a timeboxed effort to relate all applications (590) and transactions (133), taking max. 10 minutes per application. The result was that about 80% of all applications could be mapped onto a transaction; the other 20% could not be mapped based on what could be learned about an application in its given timebox. From this we concluded that the approach was efficient, delivered

acceptable results, and also that all well known applications could be related to a transaction. By choosing not to relate applications to information links or actors some subtlety may be lost, but it was felt that essential information was retained. The advantage of using a single method of relating applications to transactions was that the grouping of applications into clusters serving distinct parts of the business was unique. We did, however, make a distinction between applications that supported the production part of the transaction and those that implement storage and retrieval of information in the associated fact bank.

As far as the level of detail was concerned, we needed to have clusters of applications around transactions that had similar functionality, without strictly defining what that was. Our aim was to have manageable cluster sizes between 3 and 10 applications. This range was in part based on the expected amount of duplicate IT functionality between the 18 directorates and 5 Traffic Management Centers (TMCs). The transactions whose number of connected applications exceeded this range were more detailed until the right order size of connected applications was reached.

Ad 4: Order, select and prioritize rationalization of applications

At this stage we had a matrix of transactions supported by multiple applications, and applications that supported multiple transactions. In order to create workable application domains suitable for integrated discussion we had to assign each application to a single unique domain. This meant that in more than a few cases we had to define the "primary" supported transaction of an application and use that to classify the application. We also let ourselves be inspired by existing ideas about the structure of the application landscape.

For each application domain a team of experts would classify applications as either:

- Out of Scope, for applications that are embedded in a physical object such as a bridge or tunnel, that are specific to a certain device or reference CD-ROMs where data and application are tightly connected;
- Application will remain;
- Application will be phased out (either completely, or replaced by one or more of the remaining applications);
- Further research is necessary for this application, if the available time was not sufficient to reach a clear conclusion or if there were still ongoing developments that were of obvious influence on the decision.

In order to reach a decision per application and ranking between applications, some criteria were set beforehand for all domains and others were defined ad hoc per domain. Application use was important, because unification was a primary goal. Applications that were in use by one or two TMCs or directorates only would disappear, unless they supported a transaction unique to that TMC or were new and of such value that they needed to be rolled out company wide. Also, applications that were already centrally supplied and supported were prioritized over those that were locally built and maintained.

Finally, new applications (and running developments) would be favored over old – either because the old application was already meant to be replaced by the new one, or because new developments would be technologically better suited for

centralized hosting, and should be a good match to today's and tomorrow's business requirements.

Ad 5: Define next steps

The process described above should lead to a recommendation to the RWS board of directors. It was acknowledged that while this advice gave direction, many details still would be needed to be ironed out afterwards.

First the applications for which further research was deemed necessary should be decided upon. Secondly, there should be checks on whether the termination of applications would lead to unacceptable loss in functionality or data. Finally, during the implementation phase required functionality should be implemented in the remaining applications, and connections between applications should be rerouted.

3.3.3 The Way of Controlling

In the first phase of the project, the focus was on building corporate knowledge about the business, information exchange and applications for Traffic Management. The main Way of Controlling this process was bottom-up. A part of the EAR team, the *Dry domain team*, was assigned to cover the "Dry Areas", including Road Traffic Management. Over the course of approximately half a year, gradually models for business and information were built and the inventory of the application portfolio was brought up-to-date. The business and information models were built by architects from the Dry domain team and regularly validated by business experts and business management, e.g., from the national and regional traffic control centers. The inventory of the application portfolio was updated for Road Traffic Management by architects of the Dry domain team and validated by ICT-experts from the Specialist Department "Traffic Research Center" and the national and regional traffic control centers.

In the second phase of the project, the focus was on decision making for application portfolio rationalization for Traffic Management. That process was controlled mainly top-down while actively pursuing involvement and support. In each of four consecutive months a workshop was conducted with a broad representation for the Traffic Management field: a mix between management and operations, business- and ICT-experts, line and staff people, central staff and regional staff. Right from the beginning it was made clear that the result should be a proposal for application portfolio rationalization, to be presented by the coordinating director for Traffic Management towards the Board of Directors of RWS. Between the monthly workshops, dedicated working groups sorted out issues in specialized application areas and fed back their results in the monthly workshops. For this part of the project, Corporate Staff RWS took over-all process responsibility. The Dry domain team collected the results of the workshops and working groups, and analyzed the several proposals for application portfolio rationalization on mutual coherence and impact of change for business and information.

3.3.4 The Way of Supporting

Support of this process by (software) tools was as follows. Already in 2004 RWS made the strategic decision to gradually collect meta-data to enable better decision-

making about ICT-investments. For this purpose the Architecture-tool Metis was selected and implemented. During the Application Portfolio Rationalization-program, all results were recorded systematically and in coherence in Metis[1]. Of course we needed to record our CM with its actors and transactions. But also we needed other meta-data, e.g., about the organization ("who is fulfilling what actor-role") and the applications (including "which application is supporting what transaction"). In this way, we could perform impact-of-change analysis relatively easily.

Initially we also used Essmod[2] . With Essmod we could easily build CMs, make large and nice (A0) visualizations and create documentation. Later on, we customized Metis to let it produce comparable visualizations and documentation, which then could embed information about e.g. applications and functionary types too.

To enable our communication with all stakeholders, we had to choose our visualizations carefully. Just to give a few examples:

- the actor "road user" uses a result from RWS's primary business, namely a constructed road; however, at this moment that actor has no direct transaction-relationship (request – promise – state – accept etc.) with RWS, though this could change in the future with the introduction of road-pricing; to improve recognizability, we nevertheless added this actor in several visualizations;
- for several discussions it appeared to work better to use several layerings, e.g. primary processes – control – secondary processes or strategic – tactical – operational; the content of the CM did not change, but its manageability and ease of use increased;
- to simplify validation of the CM, we linked its actors to *functionary types* such as "road inspector"; a RWS-staff thus could easier verify whether e.g. a road inspector indeed cooperates with the incident manager and uses the indicated meteorological reports (meteo) and information about road quality.

3.4 Case-results: from models to rationalization advice

3.4.1 DEMO Construction Model for Road Traffic Management

We will now explain the CM for Road Traffic Management, sometimes also called Dry Traffic Management. In this explanation we will use italic for the names of actors and transaction, as they are used in the CM diagrams in Fig. 3.4 and Fig. 3.5. The first time we mention an actor or transaction, we will include between brackets its code used in the CM diagrams.

In our over-all CM (Fig. 3.4), we emphasized the coherence of the Dry Sector of RWS. For this Dry Sector, the *Director Dry Network (S001)* is integrally responsible for the Dry Infrastructure itself and its utilization. The *Infraprovider (S002)* will provide – by building and maintaining – the right infrastructure in the right location, time and quality. The *Traffic Manager (S003)* delivers *optimal utilization of existing and usable infrastructure (T023)*. *Advice and Support (S004)* supports the *Director Dry Network* with *advice on traffic- and infra-measures (T090)*.

[1] METIS™ is supplied by Troux Technologies, http://www.troux.com

[2] Essmod or Essential Business Modeler (EBM) is supplied by Essmod Company, http://www.essmod.com

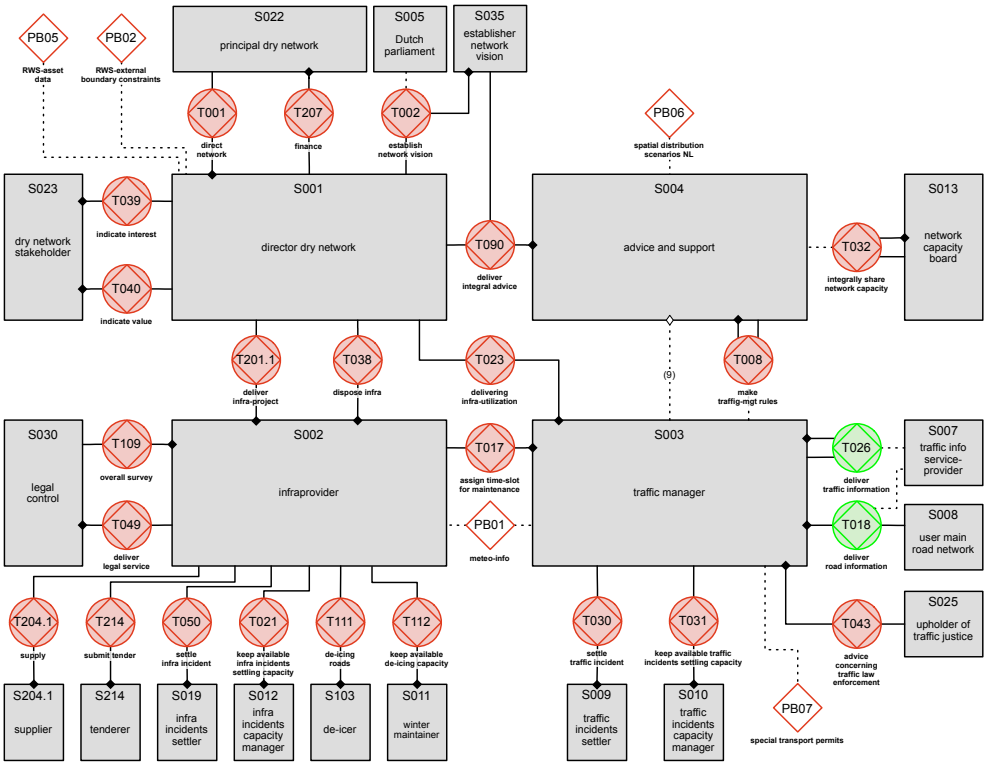

Figure 3.4. DEMO CM (v0.43) for Dry Sector of RWS

Very typical for a public institution is the role of the user of the products. RWS delivers infrastructure and services but, unlike in a commercial environment, no direct demand-supply relationship between user and supplier exists. Indeed, the cycle of demand-supply starts all the way from voter to the *Dutch Parliament (S005)* to political choices, which leads to issuing laws and regulations by the Ministry and its *Principal Dry Network (S022)*. RWS as agency of the Ministry executes those laws and regulations, in which they are controlled by the *Dutch parliament*. The interests of real users of the Dry Network are looked after by *Stakeholder Dry Network (S023)*, such as the municipal road maintenance authority, neighborhood group or motorist and car industry interest groups. And the day-to-day *users of the main road network (S008)* get access to *traffic- infra- and travel-information (T026, T018)*, as delivered to *Traffic Information Service Providers (S007)*. So in the end, the end-user of RWS-products mainly has an information-relationship with RWS; his requests are translated and prioritized by a chain of political representation, legislation, lobby mechanisms and traffic regulations.

When we follow the chain of services, we see the *Infraprovider* delivering infrastructural projects – which create new infrastructure, such as roads, tunnels and rush-hour strips – and also providing that infrastructure in a usable state to the *Director Dry Network*. The real designing, building and maintaining of this infrastructure is done by *suppliers (S204.1)*, who first *submit a tender (T214)*. A special example of this maintenance is executed by the *de-icer (T111)*, when he scatters salt

on icy roads. The capacity for that is reserved beforehand by the *winter maintainer (S011)*. Exactly the same pattern we see back for the *infra-incident settler (S019)*, e.g. repairing potholes, whose capacity has been reserved by the *infra-incidents capacity manager (S012)*. The execution of the work of the *Infraprovider* is restricted within legal boundaries, monitored by *Legal Control (S030)* by means of granting permits, e.g. for the well-point drainage required for road-construction.

Let's now turn to the *Traffic Manager* and his immediate context. *Traffic Manager* has to tune the use of the roads with the maintenance-needs of the *Infraprovider*. During his maintenance-planning the *Infraprovider* requests *a timeslot for maintenance (T017)* from the *Traffic Manager*. When the *Infraprovider*, at that moment e.g. represented by a road constructor, actually needs to maintain a section of road, the *Traffic Manager* has to release the infrastructure for that, blocking the road-section for traffic by applying a red-cross light signal and also allowing the maintenance team to physically block that section. When a traffic incident occurs, this will be settled by *traffic incident settler (S009)*, generally an ad hoc cooperative of among others police, fire brigade, medics, cleaner and salvagers. For the parties involved in that, capacity needs to be reserved by the *traffic incidents capacity manager (S010)* (by the way, on purpose we chose the plural *incidents*, to make the responsibility for cross-incident co-ordination explicit). This sometimes includes also agreements on financial compensation with commercial parties, e.g. the salvage company. Because of his practical knowledge where traffic offenses tend to occur, *Traffic Manager* from time to time advises on *traffic law enforcement (T043)*. The operations of *Traffic Manager* are directed by *traffic management rules (T008)*, as formulated by *Advice and Support*, and supported by access to external information, such as *meteo information (PB01)* and *granted permits for special transport (PB07)*.

Zooming in on Traffic Manager, the CM in Fig. 3.5 shows *SLA manager traffic manager (A017)* as central responsibility. To deliver his requested *infra-utilization*, the *traffic control has to be planned (T042)*, *traffic incidents have to be managed (T034)* and *special transports have to be accompanied (T028)*. In this area also the *traffic situation is observed (T009)*, e.g., by road inspectors, but also by citizens informing the RWS helpdesk. Based on that and also among others on the *traffic measures executed (T012)*, on *forecasted travel times (T027)*, on *prognosticized traffic supply (T010)*, both *traffic and road information* is delivered by traffic information dispatcher (A014). Traffic measures decision maker (A044) decides on applying traffic measures, also based on requests by Infraprovider and *traffic incident manager (S021)*. In his decisions he is also influenced by the *traffic control planning*, *situational traffic advice (T024)*, *network capacity sharing agreements (T032)* and of course also by the *meteo information* and the *traffic management* rules we saw earlier.

3.4.2 Connecting DEMO transactions to application portfolio

The domain at hand contained a total of 134 applications, separated into 14 application domains plus a category "unknown" for those (4) applications that were mentioned but whose function or even existence could not be confirmed. One domain, applications aggregating data for the purpose of management policy making (including software for model predictions), was excluded because it required a different workshop audience than was available. While the total number of applications in the traffic management domain does not seem large compared to the

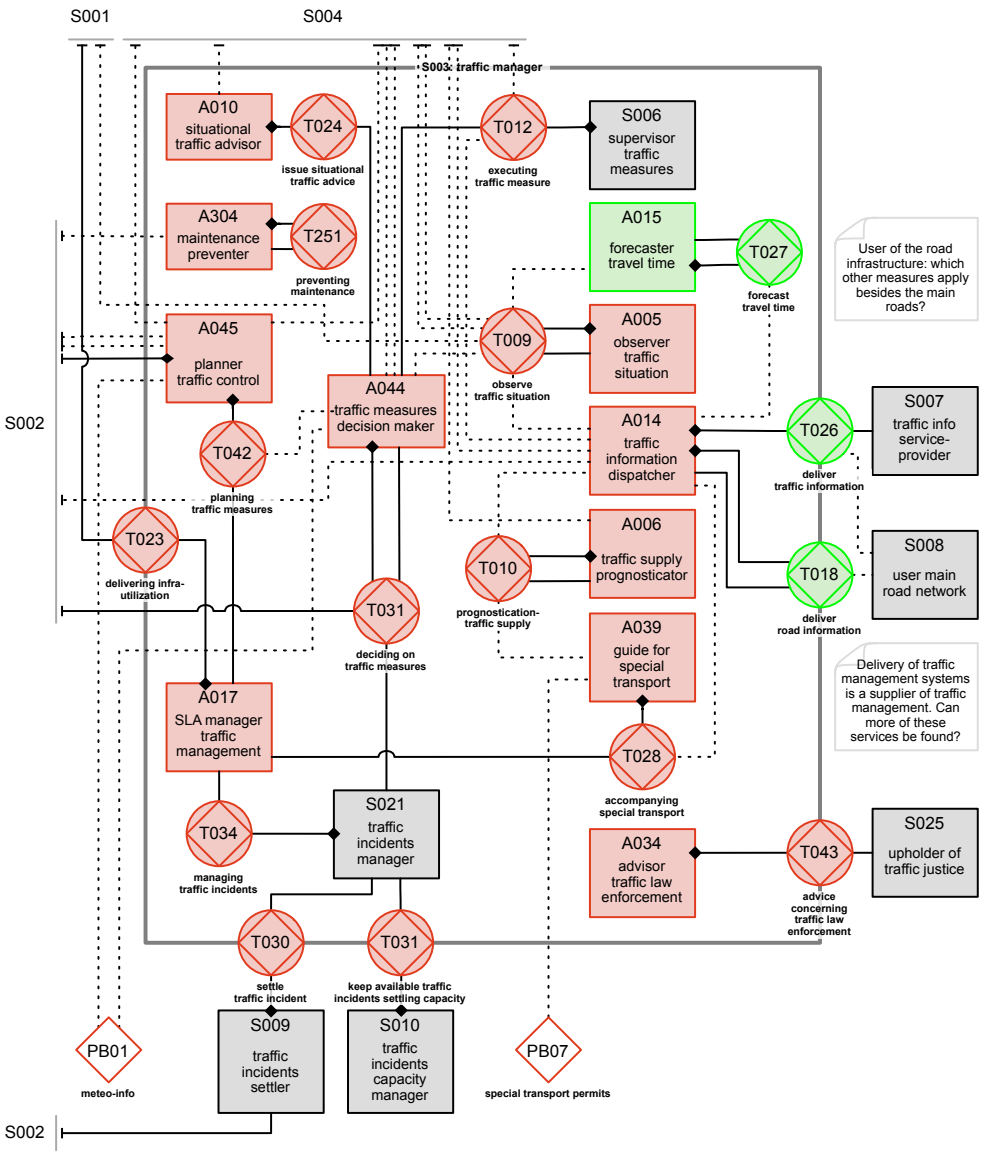

Figure 3.5. DEMO CM (v0.43) for Road Traffic Management RWS (part)

complete RWS application portfolio, it is a domain of high complexity. RWS' history of being one of the first European highway agencies to apply traffic management automation has led to many legacy applications, also with many interdependencies. Also, the creation of five autonomous traffic management Centers in the mid '90s contributed to the emergence of diverse application landscapes since then. Another complicating factor is that many applications were developed as stovepipes, having a strong interdependency from the operator's desk to the specific hardware at or near the highways.

All applications considered could be linked to at least one transaction; therefore no "IT without purpose was detected" – also meaning that for our purpose the CM

was sufficiently broad in scope. The 14 application domains could further be clustered along the lines of the top-level primary processes of RWS traffic management: Operational Traffic Management (89 applications), Traffic Information Providing (16 applications) and Incident Management (7 applications). The business process Road Maintenance Planning (8 applications) was added to provide for those applications that facilitated the coordination between Infraprovider and Traffic Manager. Finally, applications aiding in systems (configuration) management (18 applications) were put in a separate domain.

We found that when we directly related applications to transactions, it was necessary to distinguish between applications that were supporting the actual production (the performing of traffic management acts) and those that were supporting the infological and datalogical aspects of the transaction (deriving or storing of data). In order to be able to map all applications, a few infological transactions were added to the sofar ontological-only construction model (the green transactions in Fig. 3.4 and Fig. 3.5). This distinction enabled us to recognize that a system called Traffic Management Data Layer supports the datalogical aspects of a number of transactions.

A theoretical issue did remain, however, with an application aimed at creating an integrated control interface at the traffic operators desk. This too would support a number of (ontological) transactions, by means of front-end integration. Back-end functional units would however each still be attributed to a single transaction. Since all people involved in the rationalization project were familiar with the application, this was easily recognized and did not pose any practical problems.

Applications from the systems (configuration) management domain could not be directly related to the construction model of traffic management. These applications should be considered to be supporting the business of the IT service management (which was not modeled).

We found that applications in the meteorological area were all used to inspect a fact bank external to RWS. Each of the applications involved is actually supplied by the meteorological institute that supplies the data.

To gain further insight in the application portfolio, we performed several analyses, such as (1) how many applications are supporting a given transaction (2) how many transactions are supporting a given application, and (3) in how many Traffic Management Centers an application is in use. For a part of the application portfolio, we give an impression of the answers we found. Fig. 3.6 answers question 1: apparently most applications support 1 or 2 transactions; one application supports all (14) transactions. From Fig. 3.7 we see, answering question 2, that the majority of transactions is supported by at most 3 applications; one transaction is supported by 19 applications. Fig. 3.8 shows the answers on question 3; apparently 32 applications are in use at just a single TMC, meaning either that functionality is not automated in other TMCs or that functionality is duplicated in other applications; 12 applications were used in 2 TMCs, in part because – as appeared – bridges and tunnels only exist in 2 out of 5 regions; 10 applications are in use in all TMCs. This all helped to focus our attention towards duplication of application functionality and to arrive at an underpinned rationalization advice.

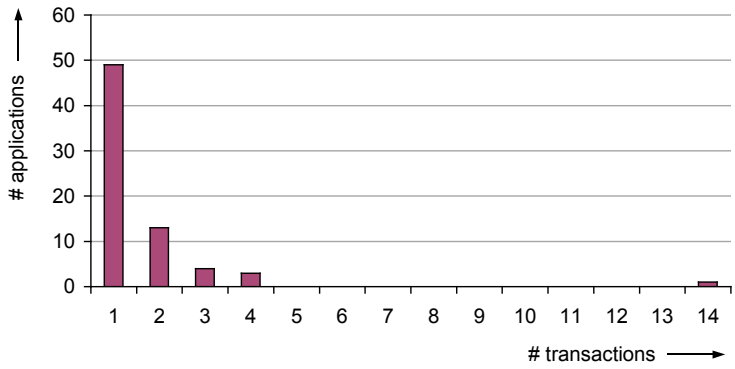

Figure 3.6. (1) Application support per transaction (Number of applications supporting N (1-14) transactions)

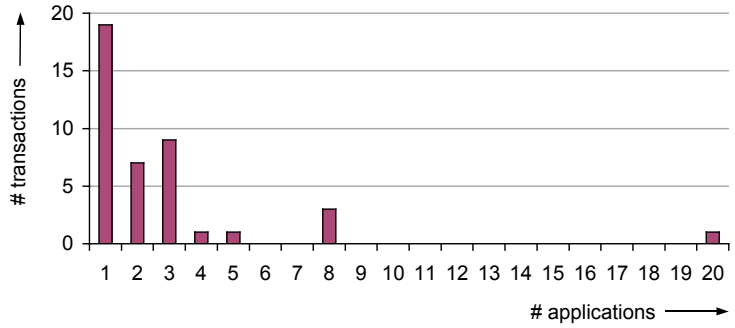

Figure 3.7. (2) # transaction supported by applications (Number of transactions supported by N (1-20) applications)

Figure 3.8. (3) Application diversity (use in # of TMCs)

3.4.3 The rationalization advice

As a first result to the Board of Directors it was mentioned that for the domain of Road Traffic Management we now have a well structured insight in which applications are used by what departments and TMCs and how this corresponds to other applications, processes and information exchange. Based on that, two important proposals were made, namely (1) on application portfolio rationalization and (2) on technical uniformization of the TMCs. For application portfolio rationalization, it appeared (Fig. 11) that 49% of the applications could be phased out, 37% is useful and necessary for good Traffic Management and 14% needed further investigation before taking a final decision. For instance, after discovering that for Meteo four comparable meteo-systems were used in the several regions, one solution was selected. Even across the borders of Road Traffic Management applications appeared to be "shareable", e.g., the application for Incident Management originating from Wet Traffic Management will now be used for Road Traffic Management as well.

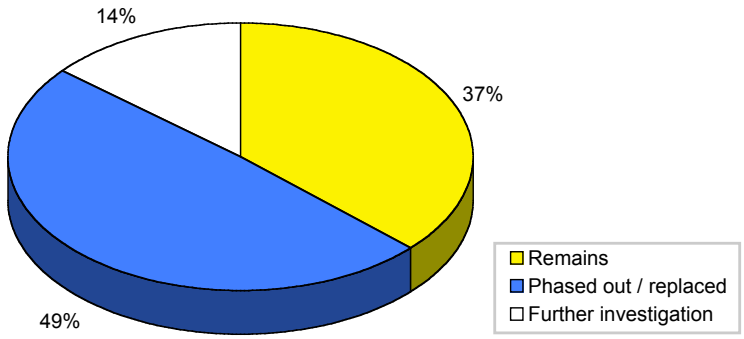

Figure 3.9. Summary application reduction proposal

For the TMCs it was advised to replace all 5 existing – different – TMCs by a set of 5 uniform TMCs, uniform both in operating procedures and in ICT. This should strongly reduce the ICT-complexity for Traffic Management, also enabling growth and change to be built on one basis instead of 5, including *distance operation* – traffic operator physically working in one TMC, but operating (part of) a distant TMC. Such a uniform TMC should preferably reuse existing concepts, more a *TMC of tomorrow* than a *TMC of the future*.

Both advices were strongly supported by all parties involved.

3.4.4 The Return On Modeling Effort (ROME)

In phase 1, "building CM and cross-references to application portfolio", we started to create a generic CM for Road Traffic Management by looking at the regions of RWS that manage and monitor the traffic. RWS has 5 different regions managed by a TMC, and also a TMC on national level. We used the TMC's procedures and reports on traffic management as input on actors and transactions. To refine our

view and obtain a stable CM, we spoke to 3 persons on average per TMC, in 4 TMCs each in a 2 hour workshop. In these workshops we refined the descriptions of actors and transactions. Then we could also validate, starting from a current application portfolio list, which applications are supporting the transactions. Using an updated model for the relationship between transactions and applications in the next interview, we were also able to validate the CM in 1/2 hour. In between, 2 consultants were maintaining the CM, the application portfolio data and the cross-references in Metis, which took roughly 10 man-days.

In phase 2, "decision making on the Application Portfolio for Road Traffic Mgt", 4 workshops with 30 experts were conducted, taking 4 hours for each workshop plus 1 day preparation per consultant. Between the workshops, the experts had to validate and complete the supplied lists, which took them roughly 1 day per expert. The consultants had to elaborate each workshop's results, which took each consultant say 4 hours for each of the 4 workshops, so 2 days per consultant. And also in this period, two consultants were maintaining the CM, the application portfolio data and the cross-references in Metis, which took roughly 10 man-days.

These investments, summarized in Table 3.1, resulted in a phasing out proposal of 49% of the application portfolio. The financial benefits are expected to be substantial, it will e.g. enable that for many applications only one expert is needed instead of 5 (namely currently one per region).

Table 3.1. Investments in Application Portfolio Rationalization Road Traffic Management

	DEMO-experts		other consultants		TrafficMgt-experts		total
Phase	#	# man-days	#	# man-days	#	# man-days	# man-days
1 building CM & cross-reference to appl-portfolio							
initial CM and discussion (8 days)	2	16					16
4 workshops ad 2 hours	2	2			3	3	5
prepare 4 workshops ad 4 hours/DEMO-expert	2	4					4
validation CM in 4 interviews ad 1/2 hour	2	0.5			3	0.75	1.25
maintaining CM, appl-portfolio, X-ref in Metis			2	10			10
subtotal man-days for Phase 1		22.5		10		3.75	36.25
2 decision making appl-portf Dry Traffic Mgt							
preparation ad 1 day pp for 4 workshops			5	20			20
4 workshops ad 4 hours			5	10	30	60	70
complete & validate lists, 1 day per TM-expert					30	30	30
elaborate workshops, 4 × 1/2 day per consultant			5	10			10
maintaining CM, appl-portfolio, X-ref in Metis			2	10			10
subtotal man-days for Phase 2		–		50		90	140
Total man-days ApplPortfRation DryTraffigMgt		22.5		60		93.75	176.25
as percentage of the total time spent		13%		34%		53%	100%

3.5 Conclusions

3.5.1 Conclusions at the level of this case

With a relatively low investment, say 175 man-days during half a year, we were able to build a well underpinned application portfolio rationalization proposal, saving 49% of all approximately 130 applications in use by a total of 300 staff in 5 regions and at national level, in a way that was suppported by all parties involved. The

benefit of that was not only cost savings, but even an improved use of existing application functionality – regions got access to each other's best practices. Existing knowledge available in the business organization could be used now, which also gave a broad buy-in for the application portfolio rationalization program. The attitude towards the program became more positive; whereas in the beginning the program was often seen as a "mission impossible", now many people are positive, seeing the considerable rationalization opportunities and results. It also positioned EAR and its models as strategic and tactical instrument for change in the RWS application portfolio.

In what respect did the method applied contribute to this, what was its added value?

First of all RWS now has a systematic overview and insight on business services and its support by the application portfolio. Using the DEMO CM as a basis, we were able to derive the *impact-of-change* of decisions concerning our application portfolio. This enables RWS to steer its improvement in a controlled way now and in the near future. For instance, we know now which applications can be removed without disturbing the business.

Linking DEMO's Construction Model to the application portfolio turned out to be a good *diagnostic instrument for current application duplication*. It opened the opportunity to detect different but similar applications, supporting the same business tasks. For example, for traffic data four data collection chains exist, historically originating from different information needs. This issue now got pinpointed and discussed, using questions such as (1) what are the underlying information needs in content and quality (e.g., reliability, availability, timeliness, accuracy), (2) to what extent do the several data collection chains needs comply with the quality criteria, and (3) to what extent are all four different data collection chains still required. This instrument for detecting application duplication even worked across RWS's classic organizational divisions, such as the distinction between the Wet and the Dry Area. For example, we detected sufficient similarities in Incident Management for the Wet and the Dry Areas, so that we could propose to let them be served by the same application in the future.

Using DEMO's CM also helped as a *diagnostic instrument for organizational responsibilities*, making complex things better visible and manageable. For example, Traffic Manager needs data about road construction works, as executed by Infraprovider, in order to plan its traffic measures. From the CM it became very simple visible that the data on road construction works are also the responsibility of Infraprovider, and that Traffic Manager needs "just" a query-functionality on that, instead of building own applications. In a sense this was not new, but now it became clear and manageable for all stakeholders.

DEMO's CM also appeared to be a good *structuring instrument* for the appliation portfolio programma. It enabled us to derive an objective partitioning into sizeable application domains.

DEMO's CM helped us also to *identify and underpin the need for (better) applicative support*. For example, the control loop for applying traffic measures, which has to be closed by also demonstrating the effect of applied traffic measures, could be significantly better supported by IT.

What were critical success factors in applying the method?

First of all, it is vital to have a powerful sponsor. In our case the CIO understood the meaning of enterprise ontology, and the need to model the business transactions of RWS. He "sold" the idea wherever he could.

Role and service based thinking is not natural for everyone – communication of this requires time and effort. Some people think more in processes than in transactions / services and in "types of official" instead of roles, and it takes time to see that one official, e.g., *road inspector*, fulfills several actor roles, such as viewer, road cleaner and traffic regulator. At the same time we needed the abstraction of the actor roles as a stable anchor point for connecting applications; names of types of official are more subject to change than actor roles and we believe information needs to depend on actor roles. Another example is that we envisioned an important end-user of RWS-products, namely the user of the main road network, as an information consuming actor, not as a business actor with whom RWS executes a transaction. For some colleagues this seemed contradictory with RWS's strategic spearhead *user orientation*, while we saw this as means to clarify exactly what we mean by user orientation in this relationship.

Applying the method is not a mechanical process, it requires good consultancy skills and subject matter expertise. E.g., when connecting applications to business transactions it appeared that quite a few applications support more than one transaction; to get this managed we identified *discussion domains*, using gut feeling and implicit knowledge.

Good tooling to support the method is required. Tooling can efficiently implement traceability and allows for analysis of impact-of-change. Especially when models such as the CM and the application portfolio are embedded in a greater whole of models (information models, data models, technical infrastructure services) related to each other, this becomes more and more important. Also tooling made it possible to model only once and then to build on one or more models several visualizations and views for the several stakeholders, target groups and messages.

What did we experience as limitations of the method applied?

First of all, we could perfectly link applications used in our primary business to the DEMO CM. It was however not so easy to link our generic applications, such as the support for Asset Management or the Traffic Management Data Layer.

For a first order rationalization of the application portfolio – phasing out or replacing complete applications – this method worked. However, it was felt that for more radical architectural improvements, such as the introduction of Service Oriented Architectures (SOA) or the introduction of one corporate data warehouse, the method needs extension. Such an extended method could start with the DEMO transactions delivering Business (B-)services, and use that to identify Information (I-) services and Application (A-)services. In such a way one line of reasoning can be followed from a Service Oriented Enterprise (SOE) to SOA. This could start simple by first deriving I-services and use that for a data consolidation, based on understanding of the meaning of the data. Future extensions of the method should also take SOA principles and technology into account, such as the notion of Software As A Service (SAAS), choices for a platform (e.g., browser, client-server) and the use of an Enterprise Service Bus (ESB).

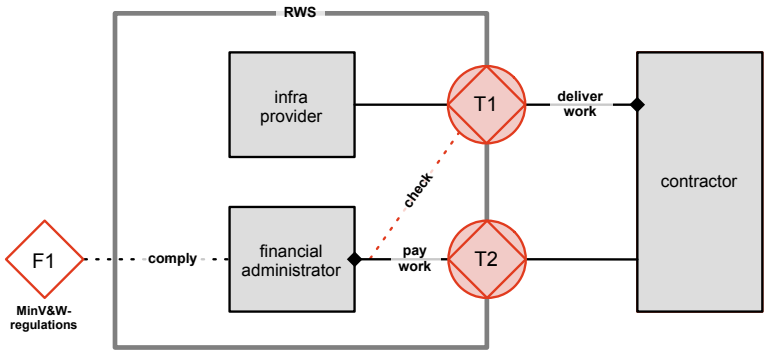

Figure 3.10. Alternative notation DEMO information link

We would find it useful to model two extra constructs in the DEMO CM, that are currently not part of the method. For example, we modeled the *user of the main road* as an information consumer only, not as a business actor, which for some felt contradictory to RWS's strategic spearhead *user orientation*. This triggered a discussion whether it would be useful to introduce, next to the transaction link and the information link, another link which we called the *uselink* – generalizable to *beneficiary link* – expressing that an actor uses (benefits from) a transaction-result. Also we discussed about the information link in the DEMO CM. Many times we know already at the moment a DEMO CM is constructed if an information link is used by an actor in its role as initiator, as executor or both. Then we would like to be able to express that more specific in the CM, e.g., by letting the information link point to the initiation link, the execution link or the actor, respectively. For example, Fig. 3.10 now clarifies that the information link to T1 is used by the actor *Financial Administrator* in its role as executor of transaction T2, whereas Fig. 3.3 left open the possibility that *Financial Administrator* uses the information link to T1 in its other roles.

3.5.2 Conclusions on the level of the action research

Compared with the case ING Service Center Securities (Chapter 2), we now used a complete DEMO CM, including actors, transaction links and information links. This opened up the possibility to connect applications to each of the three CM-elements. When testing those three options, we found that connecting applications to transactions could be done for 80% of the applications to transactions in 10 minutes. This confirms the intuitive choice in the ING case to connect applications to transactions indeed.

The DEMO CM appeared to be *efficient* in creation and use. After a short explanation, typically of 1/2 or 3/4 hour, it could be read and audited by subject matter experts, though for some experts the learning curve compared with reading a process model took longer. It was estimated (though not proven) that making the CM took considerably less time than making a process model. This confirms estimations from other sources (Dietz, 2006) that the making of a CM can be done in less than 10% of the time needed to make a process model, because it stays on the business level (abstracting from the infological and datalogical level) and because it shows

transactions only, compressing coordination acts such as request, state, promise and accept.

The DEMO CM also appeared to be *effective*. The CM clarified organizational responsibilities, especially since it is independent of any organizational implementation. So the communalities between Dry and Wet Traffic Management could be clarified, producing the reuse of processes and applications for Incident Management as benefit. And it made clearly visible that the Infraprovider is responsible for providing data on road construction works, even though Traffic Management is the main user.

The usability of the CM for clarifying organizational responsibilities confirmed our earlier findings in the ING case. In the ING case however we only used the list of transactions for reassigning responsibilities to the new organization. Here we also found that knowing the information links helped in that. This raises the following question: how could a complete DEMO CM support the splitting of organizations? What value would that add, when compared to using transactions only?

Acknowledgments

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4

Towards Evidence Based Splitting of Organizations

Case RWS-Deltares Water quantity (RD-1)

Abstract As part of the founding of a Dutch research institute for Delta Technology (Deltares), in 2007 parts of the Dutch Agency of Public Works and Water Management (Rijkswaterstaat) concerning Water quantity had to be split off. Using actors from Enterprise Ontology as organization building blocks on one hand and criteria from organization science on the other hand, an expert-meeting was presented the organization-splitting choices. The experts were requested to construct their own free-format (gut-feeling) organization choice, as well as to choose from predefined alternatives, based on the *High Internal Cohesion / Low External Coupling* criterion, calculated using the min-cut algorithm from graph-theory. The gut-feeling alternative appeared to be close to the (non-trivial) calculated organization alternative; where differences occurred, *separation of functions* appeared to be the main reason. Also, business service dependencies appeared to determine organization-splitting far more dominantly than information dependencies.

4.1 Introduction

In Chapters 2 and 3 we concluded that a DEMO Construction Model (CM) (1) gives clear organization building blocks for splitting organizations, (2) helps to clarify organizational responsibilities also by its information dependencies and (3) requires a modest effort to be drawn up. What would happen if we were using a complete CM and all its embedded knowledge in splitting organizations? What effort would that cost and would it be worth it?

As we saw in Chapter 1, in finding an adequate organization split we need to look both at criteria and at organization building blocks. Dietz (2006) proposes to use *actors*[1] according to an Enterprise Ontology as organization building blocks. Mulder (2006) actually tested such use of actors, letting the criteria for organization design appear bottom-up while discussing the positioning of actors in departments. As was shown in the ING-case (Chapter 2), Arnold et al (2005) added to this method the test on previously defined situational criteria, at the same time using more models than the CM.

[1] We will use the term actor, where Dietz (2006) uses the term actor role.

In this chapter we extend the method to include the testing of previously defined *general* criteria. The extended method is applied in a real-life case study in splitting an organization by an expert-meeting in a Group Decision Support (GDS) room. The participating experts were presented a choice in assigning organizational building blocks, using actors from a CM. We summarized general criteria from organization science and system theory and tested its use in the actual expert choices. Especially we tested an operationalization of the *High Internal Cohesion / Low External Coupling* (HICLEC) criterion, as introduced into IS development by Stevens et al (1974) and into organizational studies by Weick (1982). Explicitly using the knowledge on business and information dependencies embedded in the CM, we used the min-cut algorithm from graph theory to calculate organization alternatives, varying the strength of business service dependencies compared with information dependencies. We found that business service dependencies determined the organization splitting far more than information dependencies. We also found that (non-trivial) calculated organization alternatives appeared to be close to the gut-feeling alternative with *separation of functions* as the main reason for difference.

The remainder of this chapter is structured as follows. First we will explain the research design applied, from its position in the research program until the level of an individual case. For each individual case in the program we discern an intervention- and a measurement-phase; in this case-study we describe the intervention-phase. Then we introduce the actual intervention in the case Rijkswaterstaat- Deltares[2]: what was its context, how did the models and criteria specific for its situation look like and how was the expert-meeting constructed? After that, we discuss the results of the intervention: how was the expert-meeting conducted, which of the prepared alternatives were chosen and what were the underlying hypotheses? Finally we provide conclusions as well as directions for further research.

4.2 Research design

In this section we will first position the individual case study in the action research cycle. Next we will introduce the basic concepts of the DEMO Construction Model (CM). From organization and system theory literature we then summarize general criteria, such as the HICLEC criterion. In operationalizing this criterion, we bring together the CM concepts with the min-cut algorithm from graph theory. Finally we explain the structure of the expert meeting used to actually test our criteria.

4.2.1 Position of case study in research program

Where does this case-study fit in the action research cycle? As we saw, Dietz (2006) proposes to use *actors* according to an Enterprise Ontology as organization building

[2] Rijkswaterstaat is the Dutch Agency for Public Works and Water Management; this Directorate-General is the implementing organization of the Ministry of Transport, Public Works and Water Management. Deltares is a Dutch-based international institute for applied research and specialist consultancy in the field of water and the subsurface. For further details, see section 4.3.

blocks, and Mulder (2006) actually tested such use of actors. In the case of Mulder, the criteria for organization design were listed bottom-up while discussing the positioning of actors in departments, while in the ING-case (Chapter 2) we added to this method the test on previously defined situational criteria. In the ING-case we used more models than the CM, while the CM itself was not complete – transactions only were listed, without transaction-coherence and coupling with actors. In the RAPR-case (Chapter 3) we explored the value and effort of making a complete CM.

In this case-study we extend the method by a test of previously defined *general criteria*, a role played by *professional principles* as introduced in Chapter 1. These professional principles can be both functional and constructional; from the professional constructional principles, we are especially interested in the *organization construction* rules (see Fig. 1.5). As organization building blocks we use this time a complete CM, and no other models, thus strictly controlling the input of this case. We apply this method in an intervention, the actual splitting of an organization by an expert-meeting in a Group Decision Support (GDS) room.

This case-study should have results on two levels, a case-result and a research result. The intended case-result is an adequate splitting proposal, including an underpinning why that proposal is advisable. This splitting proposal will in turn be the basis for drafting SLA's and for migration planning. The intended research-result consists of two parts, namely (1) an inductive part, in which we explore which professional principles and especially organization construction rules have been applied, why and with what effort, and (2) a deductive part, in which we test the well-known general system construction principle *high internal cohesion, loose external coupling* (HICLEC) as hypothesis. In our deductive work, we will follow Popper (1959) in his advancing empirical falsification; therefore we use the term falsification instead of verification.

4.2.2 Using DEMO modeling in the organizational building blocks

We will now briefly introduce the required concepts of the DEMO Construction Model (CM), using Fig. 4.1, which is identical to Fig. 3.2. A DEMO Construction Model expresses the coherence (chain/network) of business services, delivered by actors to other actors by executing transactions within a defined scope. E.g. actor A01 executes transaction[3] T01, which delivers a business service to actor A00. Actor A00 is called the *initiator* and actor A01 the *executor* of transaction T01. The execution of transaction T01 results in a new fact in reality. Another actor A07, for its responsibility in executing transaction T07, needs to know about ongoing and past transactions T01; this *information link* between actor A07 and (the fact bank of) transaction T01 is indicated by a dashed line. In the fact bank of T01 we find both the production facts and the coordination facts (e.g., status "requested", "promised", "stated", "accepted") of the instances of transaction T01.

In terms of a DEMO CM, making an organization-split is the assigning of actors to separate organizational units. Parnas (1972) states that in modularization the modules should be structured in such a way that changes in reality influence the modules in an isolated way, so that modules are islands of stability. In a DEMO CM

[3] We will use the term transaction, where Dietz (2006) uses the term transaction type.

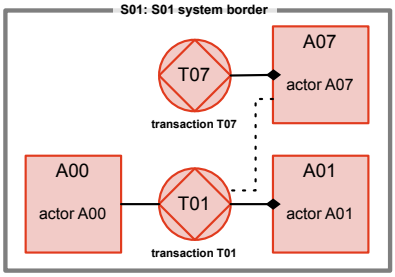

Figure 4.1. Typical constructs of a DEMO Construction Model

actors comply with Parnas' *information hiding* principle, because they have a relatively simple outside interface – a new fact brought about in reality – and potentially hidden complexity on the production process needed to produce that fact.

4.2.3 General criteria for splitting organizations

To find general criteria for splitting we start by a bottom-up analysis of scripts of several case studies available, in which architecture and ontology played a role. According to the *grounded theory* approach (Glaser and Strauss, 1967), this will ensure that the general criteria we search for actually have been used in practice. We complete this by a brief top-down analysis of organization science and systems theory literature in general.

As case-studies we used ING Securities (Chapter 2, Arnold et al (2005)), ROOD (Mulder, 2006) and Lehnkering (Graaf, 2006). The ING and ROOD cases both start from an Enterprise Ontology. The cases ING Securities and Lehnkering made its principles clear beforehand, while in the case ROOD those emerged bottom-up from the discussion on reorganization. ROOD and Lehnkering did not specifically aim to split one organization in two parts; instead, they tried to find any logical clustering of organizational roles, resulting in multiple clusters and departments.

ING Service Center Securities (SCS) faced decisions on where to execute and how to steer its operational processes for Securities. Especially the difference between centralized and decentralized execution got the attention. In the AS IS situation most of the labels had end-to-end processes in place to serve securities-clients and give them access to (most of the time: local) exchanges, brokers, clearers and settlers. In the TO BE situation the challenge was to bring "as much processes as possible" on a central level, called the Common Factory, thus reducing redundancy in the country-organizations, called the Local Factories. Situational principles had been formulated beforehand. A list of transactions had been used as unit of assigning to Common resp. Local Factory.

Mulder (2006) describes in his case ROOD (Regionale Operationele Ondersteunende Diensten = Regional Operational Supporting Services) a reorganization of a region in the Dutch police force. In this case, a DEMO Construction Model is drawn up to serve as a common language in the reorganization process. During a group support session, for each of the transactions both managers and experts were requested to vote "belongs to new ROOD" (yes/no). The criteria used by the managers and experts to say yes or no originated bottom-up during the discussions.

In his case study on the international logistics provider Lehnkering Logistics B.V. Graaf (2006) has formulated what he calls "architecture principles" for the scoping of outsourceable lots and applied this on Lehnkering to actually find those outsourceable lots. Many of those principles were found bottom up by interviewing experts, some were derived from literature.

From organization and systems theory literature we selected Williamson (1987) because of his emphasis on transactional and contractual relations, Sitter (1994) who states several organizational design principles and Galbraith (1973) who elaborates the influence of business and information dependencies. We also incorporate the criteria earlier mentioned from Parnas (1972), Stevens et al (1974) and Weick (1982).

Williamson (1987, p 73) orders transaction types by two dimensions namely (1) frequency of buyer activity (recurrent or occasional) – and (2) asset investment characteristics as seen by the supplier (nonspecific, mixed or idiosyncratic). He uses this mainly to determine the preferred way of governance for those transaction types (market, trilateral, bilateral/unified). Then (p 97) he connects his transaction typology to the problem of efficient boundaries, as defined by Ouchi (1981): "One way of answering the question of whether drawing the boundary of the firm one way rather than another makes any difference is to ask a series of related questions...".

Modern SocioTechnique (MST), as described by Sitter (1994) and Amelsvoort (1999), claims to be a method to integrally design an organization which can function adaptively in a changing environment. MST starts top-down from a Product structure and builds Control and Information bottom-up – the PCI-model – and it prescribes design- and design-sequence-principles. Those design-sequence principles are: (1) start with a strategic orientation; (2) first design Production structure, then Control structure; (3) design the Production structure top-down; (4) design the Control structure bottom-up; (5) finally, design the Information and communication structure and other supporting systems. The design of the Production structure starts from product-market combinations via product streams to ultimately independent groups of employees, the self-managing teams. The design of the Control structure starts to assign regulating tasks as much as possible to self-managing teams; where this is not possible, steering is assigned to the higher levels of operational group resp. business unit. For our problem of organization splitting, the design of Production structure according to MST is relevant. In designing this Production structure – *the grouping and coupling of executing functions in relation to order types* – Sitter (1994) discerns three parameters which have to be balanced, namely (1) functional concentration (2) specialization in execution and (3) splitting in execution. Take for example *dish-washing*, then the work could be grouped by order type (dishes, cutlery) or by executing functions (prepare, clean etc). With a minimum functional concentration (parameter 1), the dish-washing is split over two units, one taking the dishes and another one dealing with the cutlery. For every executing function, the execution can be specialized (parameter 2) in *preparing*, *supporting* and *making*, in which preparing and making are order-bound and supporting is not order-bound. Finally the executing function can be split into steps and assigned to different units (parameter 3), e.g. the executing function *dish-washing the dishes* can be split up into the tasks *collecting dishes*, *cleaning dishes*, *drying dishes* and *storing dishes*, all assigned to different teams.

We now summarize the discussed professional functional principles and the organization construction rules in Table 4.1 and Table 4.2. We have expressed all organization construction rules we found in terms of a connection between actor roles. The rules have been formulated rather strong, in terms of reasons to keep actors together. Take e.g. PC04 *keep actors together, when . . . they use the* same language / culture. This will of course never be the only reason to keep actors together, this heuristic will be traded-off against other criteria. In Appendix C we explain and illustrate the selected criteria more extensively. In Appendix D we explain which criteria we did not include on purpose, though some literature suggested that it should be included.

Table 4.1. Professional functional principles

code	name of principle	brief explanation
PF01	better quality of operations	aim at smooth, error-free, efficient operations
PF02	more flexibility in service levels	offer same service with different service-levels
PF03	accelerated operations	speed up operations, shorten customer response time
PF04	accelerated time-to-market	bring new products faster to the market
PF05	lower operational costs	
PF06	increased turnover	
PF07	client centricity	customer-intimacy, as experienced by customer
PF08	customer ownership	internal focus on customer-intimacy
PF09	multi-channel offering ability	offer customer several channels & let him choose

The general criteria mentioned (PF01-PF09 and PC01-PC10) should be tested in the organization-splitting case study, except for the criteria PC09-PC11. Indeed, rules PC09 and PC10 can directly be derived from the DEMO CM and therefore didn't need to be tested by the expert-meeting. And as we will see, these two criteria play a special role in the operationalization of the HICLEC-criterion (PC11).

Galbraith (1973) reduces his four organization-design strategies (1. Slack Resources; 2. Self-Contained Tasks; 3. Vertical Information Systems; 4. Lateral Relationships) ultimately to a trade-off between two strategies: either build in / accept slack in cooperation relationships or strengthen the information-relationship. This inspired our curiosity: how important would those cooperation-relationships (freely translated by us to transaction-relationships) be compared with information relationships in deciding about the organizational split? We suppose Galbraith considered information to be an important organization-design variable, because implementing information relationships at that time (1973) was very costly. It could

Table 4.2. Organization construction rules

code	Organization construction rule: keep actors together, when ...
PC01	... their mutual *interface* cannot well be standardized, due to *complexity*
PC02	... their mutual *interface* cannot well be standardized, due to *frequent change*
PC03	... they *cannot have a supporting role* for other actors
PC04	... they use the *same language / culture*
PC05	... they operate under the *same regulatory, legal and tax-regime*
PC06	... they more or less work *on the same case / deal with the same event*
PC07	... the *risk to fail* (in banking sector: *operational risk*) of a split is unacceptably high
PC08	... they need *comparable competencies*
PC09	... a *(business) transaction-relationship* exists between them
PC10	... an *information-relationship* exists between them
PC11	... they have *High Internal Cohesion and Low External Coupling* (HICLEC)

be different today, since the costs of implementing information relations are considerably lower, caused by emerging standards and widely available cheap and reliable ICT-infrastructure.

We therefore liked to test the following *BI-hypothesis: Business dependencies are more important than Information dependencies, when deciding about organizational splits*. We did that by calculating several organization-alternatives in which the (business) transaction- and information-relationships got different weights. During the expert-meeting, the experts were asked to choose which calculated organization-alternative they preferred, thus implicitly choosing for a certain weight-ratio between transaction- and information-relationships. This procedure is an application of the so-called *conjoint analysis*, also called multi-attribute compositional models or stated preference analysis (Swanborn, 1987).

4.2.4 Operationalization of the BI-hypothesis and the HICLEC-criterion

The BI-hypothesis is made operational in the following way.

1 We assigned a uniform weight to each transaction and information relationship in the DEMO CM. A simple example is "all Business transaction relationships (B) get the weight 9, all Information relationships (I) get the weight 1"; for short, we code this as BI=91. In our operationalization we used the quite distributed values BI=91, 55 and 19.

2 We interpret those weights as follows (see Fig. 4.1). A high weight of a *business transaction relationship* between actor roles A00 and A01 is an indication that those actor roles A00 and A01 should stay together in one organization / department. A high weight of an *information relationship* between actor role A07 and the fact bank of transaction T01, we interpret as an indication that the actor roles A07 and (the executing actor role of T01 =) A01 should stay together in one organization / department. The underlying assumptions are (1) that infor-

mation in an information link mostly deals with the production information of the transaction, not its coordination information, (2) that production information of transaction T01 is created by its executor A01, not by its initiator A00, and (3) that coordination information is created as much by initiator A00 as by executor A01.

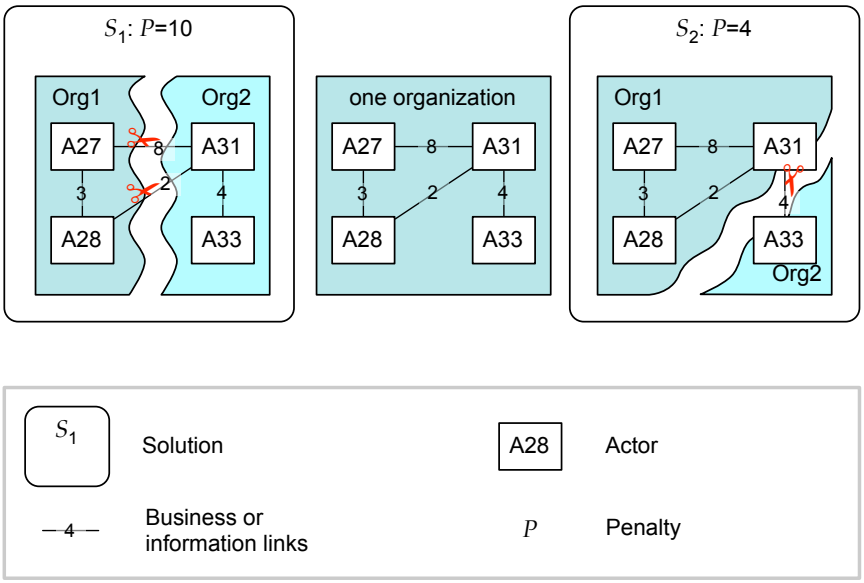

Figure 4.2. Penalties in Organization Splitting

3 A certain organizational-splitting solution S, which splits the organization in two parts – say Org1 and Org2 –, is fully characterized by the collection of actor roles that reside in Org1 and in Org2. We consider a relationship between actors to be broken if those actors reside in different organizations. Now we can define the *penalty function* P of solution S, $P(S)$, as the sum of weights of broken relationships in Org1 and Org2 in solution S. As an example, see Fig. 4.2: in solution S_1, the relationships A28-A31 and A27-A31 have been broken, therefore $P(S_1)$ = weight of relationship (A28-A31) + (weight of relationship A27-A31) $= 2 + 8 = 10$; in solution S_2 only the relationship A31-A33 has been been broken, therefore $P(S_2) = 4$.

4 Now we use the HICLEC-criterion (PC11): we consider the split better if and only if the penalty P of the splitting-solution is lower. The optimal organization therefore would be the one with the minimum penalty, given that a split has to occur anyhow (the one-organization alternative is excluded). This restating of the problem is known in graph-theory as the *min-cut problem* and a *min-cut algorithm* exists to solve it (Ford and Fulkerson, 1956). For each weight-distribution (such as BI=91, BI=55), the optimal solution (i.e., the one with the minimal penalty) can be calculated, also using Gomory-Hu trees (Gomory and Hu, 1961). In a Gomory-Hu tree one can find the minimal cuts between all node pairs – not only the optimal ones –, which allows for a choice between ranked

alternatives. See Appendix E.1 for a brief explanation of the min-cut algorithm and the Gomory-Hu trees applied.

5 Finally it must be possible to state in advance that certain actors should stay within Org1 or Org2 and to state that as a boundary constraint for further optimizations.

4.2.5 Planned structure of the expert-meeting

In the expert-meeting the following steps have to be executed (Fig. 4.3):

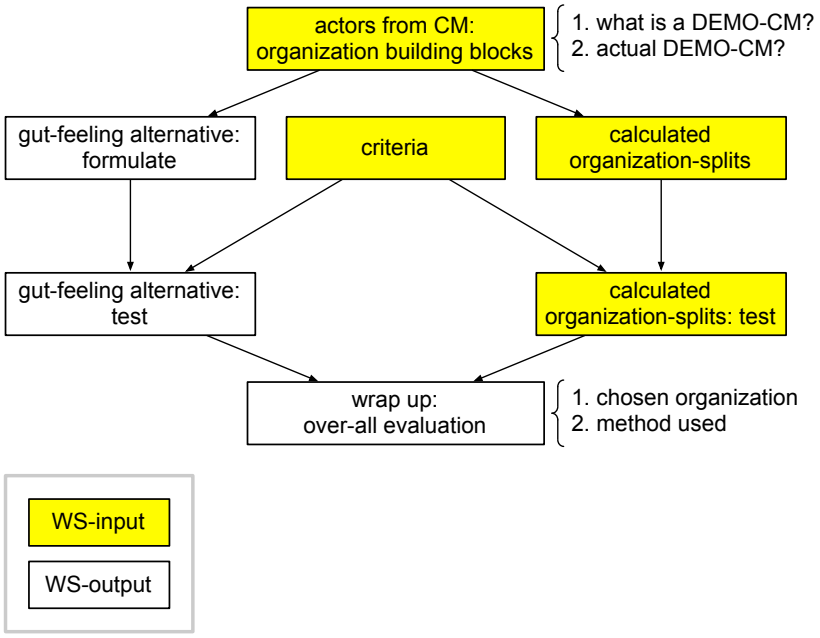

Figure 4.3. Structure of the expert-meeting (planned)

1 After an explanation of the Construction Model for the area of splitting, the experts formulate their gut-feeling alternative. No other alternative is presented in advance to prevent influencing the experts.

2 Then the gut-feeling alternative is tested by both situation-specific and general criteria.

3 After explanation of the calculated organization-alternatives, the experts express their preference and test the alternatives against the same criteria as the gut-feeling alternative.

4 Finally the experts answer questions on the way of working, such as:

- How understandable were the concepts of the DEMO CM for you (actor, transaction, information link)?
- What was your opinion on the calculated organization-splitting alternatives? Did it bring you new insights, preferences etc.?
- In what respect did this approach help to underpin organization- and sourcings-decisions?

- What would be necessary to successfully apply this approach to other areas? Consider e.g. improvements of criteria, improvements of the DEMO CM, suggesting other alternatives.
- What did you think of this meeting and what message do you have for the researcher?

4.3 The intervention: case Rijkswaterstaat – Deltares Water quantity

Rijkswaterstaat (RWS), the Directorate-General for Public Works and Water Management is the executive branch of the Ministry of Transport, Public Works and Water Management (V&W). Under the command of a departmental Minister and State Secretary, it constructs, manages, develops and maintains the Netherlands' main infrastructure networks. RWS aims to prevent flooding, ensure adequate good quality water, ensure safe & unimpeded movement on roads and waterways and generate reliable information in a user friendly format. RWS has an annual expenditure of approximately € 4 billion, number of staff approximately 10,500, 17 departments and 160 offices in the Netherlands.

From mid-2007, the Netherlands will gain an institute for applied research and specialist consultancy named Deltares (Dlt) (Deltares, 2007, website). Its goal is to improve the habitability of vulnerable delta areas, contributing to the sustainable management, use and design of densely-populated deltas below sea-level. Deltares wants to be in the international top flight in the field of water and the subsurface. It will use an integrated approach to develop innovative solutions. Deltares brings together Dutch knowledge, experience and specialists in the area of water and the subsurface. The Deltares workforce will be 700 to 800 FTEs in the initial stages. Turnover is projected at € 80 million a year.

Deltares will bring together WL | Delft Hydraulics, GeoDelft, parts of TNO Built Environment and Geosciences and parts of specialist services of RWS. At the time of this case-study, it had to be decided and validated which responsibilities of RWS exactly had to be split off from RWS and added to Deltares.

To guide us in the choice for an area for our case study (which area, which size, when, who to involve) we had to balance the following considerations:

- what is the "right size" of the area for the case study; the good choice here would make it sufficiently interesting and relevant for the RWS-/Dlt-policy makers as well as feasible in time;
- political visibility: to what extent and in which phase do we want what attention from what stakeholders to this case study; e.g. the right moment could enable a fruitful discussion between management and Works Council about a major BPO or IT-outsourcing proposal;
- availability of material; during the case study we would have to use existing DEMO CM-models of Rijkswaterstaat, tested by subject matter experts, and also existing situational principles, process requirements and content requirements.

Water quantity has been chosen as the area of our case-study. The area is responsible for the hydrological and morphological state of the Dutch national waters. This covers a wide range of activities, varying from quite operational (such as operating sluices/locks, Storm Surge Warning Service, measuring and reporting water

heights, controlling dikes) to very sophisticated (modeling hydrology and morphology, and integral consulting on all these activities).

For the area Water quantity, a DEMO Construction Model validated by subject matter experts was available. The model emerged from an application consolidation project, in which it was used to structure the current application portfolio, seeking for rationalization-opportunities. The model contains 43 (elementary) actors, 59 transactions and 69 information links.

RWS-experts in advance chose the following boundary constraints for organization splitting, and therefore for the graph-construction:

- RWS-BED: all operations of construction works (such as sluices, locks and storm surge barriers) should remain with RWS;
- DLT-MOD: all modeling of hydrology and morphology of national waters should go to Deltares.

We assigned quite distributed values as parameters for the graph-construction, namely BI=91, BI=55 and BI=19. Using the Gomory-Hu trees for all possible min-cuts, we found three calculated splitting-alternatives, named by us α (small RWS), β (intermediate) and γ (small Deltares). Alternative α appeared to consist of RWS-BED only, and therefore was nicknamed "small RWS". Likewise alternative γ consisted of DLT-MOD only, and therefore was nicknamed "small Deltares". Alternative β brings all modeling, all consulting services and the SLA-management for hydrology and morphology to Deltares. Both the alternatives α and γ are – from a business perspective – trivial, because they simply reflect the boundary constraint the business intended anyway. The alternatives α and γ appear as min-cut alternatives for all chosen values of BI (19, 55 and 91). Alternative β appears for BI=91 only, as second choice (penalty $P = 11$); the first choices for BI=91 were α and γ (both $P = 4$). The participants of the expert-meeting were asked to express and underpin their preference for organization-alternative α, β or γ, of course without knowing the values of the BI-parameters underlying those alternatives.

RWS introduced 9 strategic principles and 16 business principles, Deltares introduced 5 principles. Two examples of these situation-specific criteria are:

- DR01 = better focus of RWS on network management (its core-business);
- DR05 = Deltares should be an authoritative knowledge-institute in Europe.

For the expert-meeting we invited approximately 20 persons, representing the following four groups:

1 subject matter experts, such as RWS-management and business staff;
2 subject matter and ontology experts from Enterprise Architecture RWS (EAR);
3 ontology-experts and
4 organization scientists.

This variation in expertise should enable us to perform several analyses such as:

- to what extent is it possible to propose meaningful organization-alternatives, possessing ontology-knowledge only?
- how much do the evaluations of subject-matter experts differ, depending on whether they have ontology knowledge or not?
- to what extent do organization scientists share the opinion of the group – they don't share the ontology-view or the subject matter knowledge, but they have experience with organization design, so with the underlying general criteria (professional functional principles and organization construction rules)?

To enable these analyses we used a Group Decision Support Room, in which all argumentation, comments and scores could be systematically collected and sorted by group. Also it should enable us to direct the facilitation of discussions (Mulder et al, 2005).

The duration of the expert-meeting had to be limited to 4 hours. A complete scoring of all actors and organization-alternatives on all (42) criteria was not considered feasible. Therefore planning steps were added to select the top 7 from the 42 criteria and to select 8 more or less representative actors.

4.4 Results of the intervention

On January 29th, 2007 08:30-12:30, the expert-meeting on splitting RWS-parts concerning Water quantity to Deltares has been held, supported by the GDS-system MeetingWorks, which collected all contributions of participants electronically.

The longlist of (42) criteria had been sent before the meeting to the experts to comment on that; comments were received neither before nor during the workshop and no new criteria appeared. In the step to select the shortlist (top-7) criteria from the general criteria only PC07 (*keep actors together when . . . the risk to fail (in banking sector: operational risk) of a split is unacceptably high*) got selected; all other shortlist-criteria were situation-specific.

In the testing of the gut-feeling organization-alternative 8 out of 43 actors were selected: 2 for which all agreed to keep the actors at RWS, 2 for which all agreed to move the actors to Deltares and 4 from a middle group on which opinions differed.

Due to time constraints the step "test calculated organization-splits on shortlist-criteria" could not be executed.

In drafting the gut-feeling organization-alternative everyone agreed on the boundary constraints RWS-BED and DLT-MOD. Most participants agreed that Advice-roles belong to Deltares and that data-gathering should remain at RWS. On information supply the opinions differed; a small minority positioned suppliers of information and drafters of information strategy in Deltares. Control functions (morphological and hydrological) were mainly placed in RWS, though a small minority put the quality control for these functions in Deltares: "don't test your own meat" (*separation of functions*). Also a new actor role was discovered, named "establisher required Delta-knowledge".

In the comments given several characteristics of RWS and Dlt emerged, which we consider the basis for additions to enterprise-specific principles. For RWS, the catchwords control, directing, coordination demand-side, executor of policy & steering and control data were identified. For Deltares, these were specialized consultancy, execution, knowledge-supplier, trusted advisor, models and model data, specialized statistical analyses, strategic knowledge function and knowledge on current state of affair watersystems.

Let's now turn to the choices for the calculated organization-alternative. The calculated organization-alternative β was preferred and got report-mark 6.2 with a variance 36% (see Table 4.3). Because this alternative appeared with BI=91 only, our *BI-hypothesis* "Business dependencies are more important than Information dependencies, when deciding about organization-splits" could not be falsified.

Table 4.3. "Give over-all report mark (1=bad, 10=excellent) to organization-alternative"

Organization-alternative			Average rating	Variance
α	"small RWS"	(BI=19, 55 or 91)	2.2	32%
β	"intermediate"	(BI=91)	6.2	36%
γ	"small Deltares"	(BI=19, 55 or 91)	5.4	55%

How close was the gut-feeling alternative to the calculated organization-alternative β? Four actors were differently positioned, which could be explained mainly by separation of functions. We then recalculated graphs to see if different BI-weights could generate the gut-feeling alternative. The answer is no: only for one out of four actors this made a difference; the other three actors could not "switch organization" for any BI-weight. From the prepared general criteria, we noticed the application of two of them. The term "need to know" as in "Deltares needs to know the state of the water systems" we saw as PC10 "keep actors together when ... an information-relationship exists between those actors". And sometimes specific expertise was mentioned, which pointed to PC08 "keep actors together when ... they need comparable competences".

Some criteria arose that might have a more general value, e.g. "best fit with purposes of organization", "separation of functions", "keep responsibility with the one who is doing the job" and "determine information needs always by the demand-side". On "establishing information strategy always by the demand-side" discussion arose; some argued that information strategy deals with *how* information will be supplied, and subject matter expertise of the supplier should play an important role in that, e.g. in the choice of means for monitoring and data collection.

The participants appreciated the way of working in this expert-meeting. The offering of the calculated (α-, β-, γ-) alternatives helped to get more clarity on the motives of the preferred organization-split. Also the contribution of non subject matter experts was valued e.g., their comparison of the RWS-Dlt-relationship with the relationship between an airline and the National Airspace Laboratory (NLR).

The results of the scoring of the gut-feeling alternative were consistent with the scoring of the selected actors on the shortlist-criteria. We further noticed that subject matter experts scored outspokenly and homogeneously (low variance). Also we noticed that the method experts more often abstained from voting, explaining that more subject matter insight was required.

A method-expert suggested to better order the list of criteria, e.g., to add the categories function-/ product-requirements, performance-indicators (such as lead time or MTBF) and some organization construction rules (such as technical coherence and failure sensibility).

What effort was required to prepare, keep and elaborate this organization splitting workshop? The investment for using the existing CM for Water quantity to this end was 10 domain expert days, 10 consultant days and the use of Group Decision Support facilities.

In *preparing* the next workshop the following improvements could be made:

- make the criteria SMART in a small group before the expert-meeting;
- test the DEMO Construction Model in a smaller group, especially on the places where discussions on organization-splits can be expected; for this "borderline" actors, put effort in more precisely defining the (direct object of the) transaction-result; e.g. is *A027 Supplier statistics* the supplier of standard statistics or of specialized statistics? is *A024 SLA Manager information supply* serving the demand-side or the supply-side or both?

During the next workshop the following improvements could be made:

- start with an explanation on the strategic directions of RWS and Deltares;
- then explain consequences for making an organizational split, e.g. "cooperation and allying over the split remain necessary", "introduce SLA's on the split";
- let the splitting of the organization be done top-down, so first at the level of aggregated actors; where the scores on aggregated actors are not unambiguous, drill down to the level of elementary actors; use the time thus saved for more interaction and discussion;
- the question "should this actor go to Deltares or stay with RWS?" is too restricted; indeed an actor role can next to *sequentially* and *concurrently* also be fulfilled *collectively* (Dietz, 2006, p 125), so introduce the option of collective fulfillment of roles;
- let the participants first score the actors with business roles, then the actors with informational roles; then participants will be better aware of their assumptions and score more consistently.

4.5 Conclusions and further research

4.5.1 Conclusions on the level of this case

The half-day expert-meeting was considered productive and effective by the participants. Vagueness in criteria and strategic starting points of Rijkswaterstaat and Deltares were revealed and discussed. The use of actors from the DEMO Construction Model as organizational building blocks – which was new for about 50% of the experts – was generally clearly understood and appreciated. The discussion got an objective basis, responsibilities and dependencies became clear and also new actors were discovered. The pre-calculated organization-alternatives (graphs) improved the effectiveness of the discussions on the organization-split. E.g., the roles of RWS and Deltares and the underlying situational principles became articulated more clearly than those achieved by the gut-feeling exercise.

The (non-trivial) calculated organization-alternative came close to the gut-feeling alternative. The min-cut algorithm delivered 3 organization-alternatives, of which 2 were the trivial ones, namely the smallest ones fulfilling the minimum boundary constraints of actor-roles remaining in an organization. The deviation of the β-alternative to the gut-feeling alternative could be explained almost fully by the criterion *separation of functions*.

What can we say about our *BI-hypothesis* "Business dependencies are more important than Information dependencies when deciding about organization-splits"? The (non-trivial) calculated organization-alternative β appeared only when giving

Business transaction relationships a far higher weight than Information relationships (BI=91 and BI=90). As soon as information links were assigned a higher weight (BI$\geq$92), then only the trivial organization-alternatives appeared. This case-study therefore was not able to falsify our hypothesis.

No calculation of organization-alternatives with whatever uniform weights for business transaction and information relationships could exactly produce the gut-feeling alternative. Therefore we now have demonstrated that it is impossible to provide a completely calculable advice on organization-splitting that is (1) based on the uniform strength of business transaction and information relationships and (2) that also is recognized by experts as good. On the value and the power of discernment of the general criteria (professional principles), from this case-study conclusions can be drawn only for PC09, PC10 and PC11. Because of time-constraints, the expert-group had to select the criteria that they felt to be most important. From the general criteria only one out of 18 was selected. Its score did not differ noticeably from the scores on the other (situation-specific) criteria in positioning an actor on either side of the gut-feeling organization-split.

4.5.2 Conclusion on the level of the action research

We consider our case study an example of Situational Method Engineering (SME), as introduced by Kumar and Welke (1992). SME is characterized by (1) definition of *reusable method chunks* by re-engineering existing methods and models as well as by capturing new ideas, experience and best practices; and (2) engineering of new *situation-specific methods* by assembling method chunks stored in the repository. From existing method chunks of Mulder (2006) and Arnold et al (2005), we reused (a) the use of actors from a DEMO Construction Model as organization building blocks (b) the use of a Group Decision Support Mechanism. We added to this (c) the use of general criteria (professional functional principles and organization construction rules), (d) the operationalization of the HICLEC-criterion on business transaction and information links, and (e) the use of the min-cut algorithm from graph theory. Situation-specific in the method applied is among others the goal of organization-splitting, which caused us not to ask for optimal multi-clusters, but to request a binary choice ("stays with organization X" versus "goes to organization Y").

We have discovered that theoretically underpinned organization-alternatives can be calculated that look plausible in the real-life situation. The calculated alternative need not be the best; many criteria can play a role that cannot be expressed in terms of the starting point, the DEMO Construction Model. The calculated alternatives represented in graphs at least give the insight in which penalties are paid in terms of broken or hampered business transaction or information relationships. These penalties can then be explicitly weighed against the other criteria. Summarizing: if someone wants to deviate from the calculated alternative, he now will be aware of the penalties of that deviation, which enables him to make conscious trade-offs.

4.5.3 Future research directions

To validate the *BI-hypothesis* "business dependencies are more important than information dependencies when deciding about organization-splits", replication of this research is necessary with variation in organization types and sectors.

To test the value and the power of discernment of the general criteria (professional functional principles and organization construction rules), these criteria have to be used again in future case-studies in a way that guarantuees scores on all criteria. At the same time the research design for those case-studies have to stay open for discovering new general criteria.

Another interesting question is what would happen when we apply other criteria and other algorithms to the graphs instead of the min-cut algorithm. E.g., in social networks the criterion of *betweenness* (Girvan, 2002) and *modularity* (Newman, 2002) appeared to be successful in predicting the structure of communities; could this also be applied to the question of organization-splitting? A first test on a fictitious example showed that in certain cases modularity for two clusters renders the same organization split as the minimum penalty criterion (see Fig. E.14).

Finally, mainly because of time constraints we have offered experts the restricted binary choice ("should this actor stay with organization X or move to organization Y"), resulting in two organizational clusters. We might broaden the question to an open choice ("what actors have close transaction- / information-relationships"), resulting in multi-clusters, which then could be translated to departments or separate legal entities in the split organizations.

Acknowledgments

We want to acknowledge Richard Jorissen, acting managing director Rijkswaterstaat / National Institute for Coastal and Marine Management (RWS/RIKZ), and Hero Prins, corporate change-manager Deltares, for their sponsorship of the expert-meeting. Karin Middeljans and Kees Buursink generously made available all relevant materials of the Enterprise Architecture Rijkswaterstaat (EAR) team. And Wim Vree, Hans Mulder, Bart Kusse and Martijn Faay supported us greatly in preparing the expert-meeting and analyzing its results.

5

Enterprise Ontology Based Splitting and Contracting of Organizations

Case RWS-Deltares Water quality (RD-2)

Abstract As part of the founding of a Dutch research institute for Delta Technology (Deltares), in 2007 parts of the Dutch Agency of Public Works and Water Management (Rijkswaterstaat) concerning Ecology, Water quality and Emissions had to be split off and cooperated with thereafter. We tested a method to make underpinned choices on the organization split and to ensure completeness in contracting. Using actors from Enterprise Ontology as organization building blocks, experts were requested to construct their own gut feeling organization split and to systematically list contracting items on the subjects (a) ownership of assets (b) quality of business and information services and (c) critical chain-dependencies. The proposed organization split is, confirming an earlier experiment, (1) quite close to graph theory based calculated alternatives and (2) far more determined by business dependencies than by information dependencies. The listing of contracting items helped to determine subsequent implementation steps, e.g., ensuring mutual information supply and formulating performance indicators, in a fast way and supported by the stakeholders.

5.1 Introduction

In the previous chapters we have focused on the question how to decide on the organizational split. We will now look for other possibilities to validate or falsify our *BI-hypothesis* that *Business dependencies determine organization-splitting far more dominantly than Information dependencies*. Next, we want to see whether we could precalculate plausible organization alternatives, using other measures for organizational coherence. Lastly, we would like to try again to measure the value of the general splitting criteria, especially the organization construction rules.

There is another question to be investigated: *how should parties cooperate after the organization-split*? The delivery-chain has to stay intact, given that the (extended) enterprise keeps producing the same final results. This calls for clear mutual agreements in every link of the delivery-chain, certainly when crossing organizational borders. Many of these agreements should eventually materialize into a contract commonly referred to as a Service Level Agreement (SLA). On what items should agreement be created?

Existing literature on SLAs provides generic items for contracts, such as definitions, contact persons, duration and termination, change and revision, ownership

and risk, pricing, allowances, force majeure and disputes. The core of an SLA is agreement on the services purchased and delivered, which is different in every situation. However, little literature exists to help in specific situations.

We propose a method that is tested in a real-life case study and that ensures completeness in the items for specific contracting. In its way of thinking, experts use an Enterprise Ontology as defined by Dietz (2006) to systematically list (a) ownership of assets (b) quality of business and information services and (c) critical chain-dependencies. In its way of working, the method includes identifying the Enterprise Ontology, deciding on splitting criteria, drafting a gut feeling organization alternative and comparing it with calculated organization alternatives. We found the listing of contracting items helpful in determining the next steps in implementation, e.g., ensuring mutual information supply and formulating performance indicators. Also we found, confirming an earlier experiment (Chapter 4; Op 't Land (2007)) (1) the gut-feeling organization split to be quite close to graph theory based calculated organization alternatives and (2) the Business dependencies determining organization-splitting far more than Information dependencies (*BI-hypothesis*). Overall the method led quickly to collective conceptualization and underpinned decisions on the main part of the optimal organization split against modest costs.

The case study was conducted at Rijkswaterstaat (RWS), which is the Directorate-General for Public Works and Water Management in the Netherlands. Under the command of a departmental Minister and State Secretary, it constructs, manages, develops and maintains the Netherlands' main infrastructure networks. RWS aims to prevent flooding, ensure adequate good quality water, ensure safe & unimpeded movement on roads and waterways and generate reliable information in a user friendly format. RWS has an annual expenditure of approximately € 4 billion, number of staff approximately 10,500, 17 departments and 160 offices in the Netherlands.

From the end of 2007, the Netherlands will get an institute for applied research and specialist consultancy named Deltares (Dlt) (see Deltares (2007, website)). Its goal is to improve the habitability of vulnerable delta areas, contributing to the sustainable management, use and design of densely-populated deltas below sea-level. Dlt wants to be in the international top flight in the field of water and the subsurface. It will use an integrated approach to develop innovative solutions. Dlt brings together Dutch knowledge, experience and specialists in the area of water and the subsurface. Dlt workforce will start at 700-800 FTEs. Turnover is projected at € 80 million a year.

Dlt will bring together WL | Delft Hydraulics, GeoDelft, parts of TNO Built Environment and Geosciences and parts of specialist services of RWS. At the time of this case-study, it had to be decided and validated which responsibilities of RWS exactly had to be split off from RWS and added to Dlt.

The remainder of this chapter is structured as follows. First the research design outlines the problem statement, introduces the way of thinking and embeds this in a way of working. Then we describe the actual intervention in Rijkswaterstaat (RWS) and Deltares (Dlt), followed by a discussion of its results. Finally we provide the conclusions, as well as directions for further research.

5.2 Research design

5.2.1 Problem statement

The research program "Applying Architecture and Ontology to the Splitting and Allying of Enterprises" (Op 't Land, 2006) aims at finding validated organization construction rules, whose application leads to adequate splitting and allying of enterprises. We define an *enterprise* as a goal-oriented cooperative. *Adequate splitting* includes enabling cooperation of organizations after the split. Splitting and allying are two sides of the same medal: once the work for an enterprise is split over parties, they have to ally in order to stay that "goal-oriented cooperative". So we deal with (1) where to split the enterprise and (2) how to cooperate over the split.

Informally speaking, when we say *splitting enterprises*, we mean the activity that results in assigning roles and responsibilities to a separate organizational entity. Take for example the operation of constructions – such as sluices, locks and flood control dams – by RWS, for which Fig. 5.1 shows the Construction Model (CM) from the DEMO method (Dietz, 2006). In this CM, the actor *construction operator* (A01) operates the construction with different qualities (QoB: Quality of Business) for different initiators, each having their own purposes: the *captain* (A02) wants a fast and safe transit, the *incident manager* (A03) wants to be supported in his solving an environmental or shipping traffic incident and the *water manager* (A04) wants to control the water level to prevent flooding. Some of the transports need a (water transport) license, applied for by *captain* (A02), granted by *license granter* (A05) in the transaction *grant license* (T05) and to be checked – indicated by the dashed line from A01 to T05 – by *construction operator* (A01), before he allows to pass the captain with his transport. In his work, A01 depends on the services of *deployer dry traffic measures* (A044) who e.g., brings the dry traffic timely to a halt. A possible organization split, and this is purely hypothetical, could be that RWS would consider outsourcing the role of the construction operator.

Where does this case-study fit in the action research cycle, defined by Avison et al (1999) as a repeating cycle of intervention, measuring, evaluation and improvement? As we saw earlier, Dietz (2006) proposes to use *actors* according to an Enterprise Ontology as organization building blocks, which was actually tested by Mulder (2006). In the case of Mulder, the criteria for organization design were listed bottom-up while discussing the positioning of actors in departments, while in the ING-case (Chapter 2) we added to this method the test on previously defined situational criteria. The latter case-study of Op 't Land (2007, see Chapter 4) extended the method by applying the well-known construction principle *high internal cohesion, loose external coupling* (HICLEC) to produce a calculated organization split, using the min-cut algorithm from graph theory. Also it expressed the expectation that a splitting proposal will be the basis for drafting SLAs.

The moment an organization split is introduced, including a contract such as an SLA, this has consequences, e.g., (1) the mutual expected performance should be made Specific, Measurable, Achievable, Relevant and Time framed (SMART) and (2) the SLA should be managed from two sides of the contract. On what items should there be agreement, to still let the split organization work like one delivery chain? Using the hypothetical splitting example for the actor *construction operator* (A01), a first brainstormed list of specific items for contracting looks like this:

QoB quality indicator	customer/target group		
	captain	incident manager	water manager
service time	all weekdays sunrise-sunset	24×7	24×7
delivery time	½ – 4 hours	½ hours	½ hours

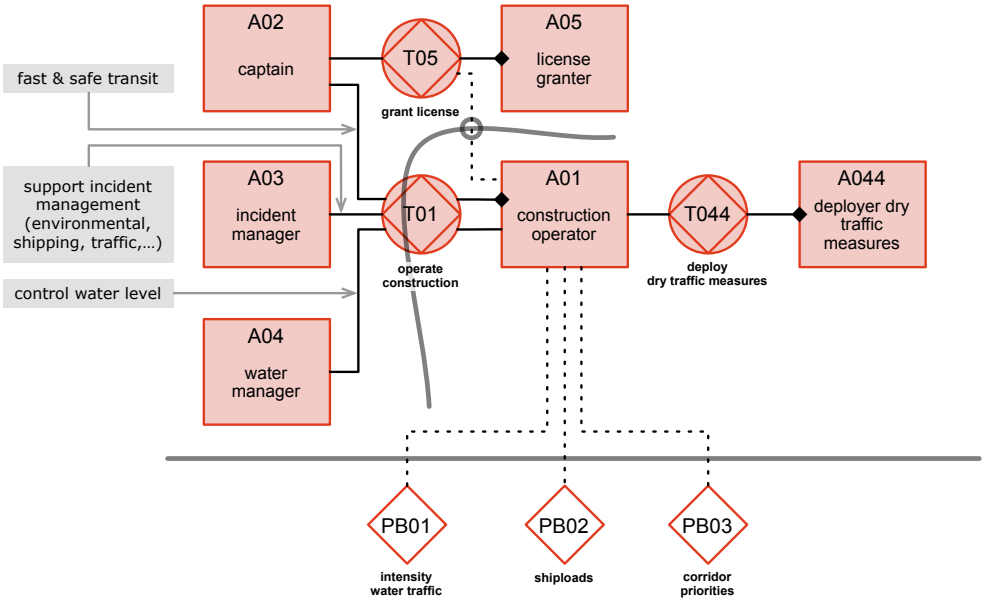

Figure 5.1. Operation of constructions by RWS (DEMO CM)

- what exactly (SMART) does A01 deliver to its 3 initiators (when, how much, how good)?
- who will measure the performance of A01?
- to whom of its 3 initiators will A01 give priority, if necessary?
- what options are available, in case of failure or default of A01?
- how to financially settle with A01?
- who will own the first construction operating devices for A01 and who will own its improvements or replacements?
- is A01 free to choose his maintenance suppliers?
- what if RWS wants to ask another party to play A01's role?

What guidance does literature on SLAs offer in finding items for contracting? Business Issues (2007) summarizes generic items for SLA-contracts, such as definitions, contact persons, duration and termination, change and revision, ownership and risk, pricing, allowances, force majeure and disputes. Many of these items mentioned have a legal character. However, the heart of an SLA is the service catalogue, and this is not a legal document (Putt, 2004). From Business Issues (2007), the items on service catalogue, ownership of results and means and also on dependencies and force majeure are situation and service specific. Still we want to have more guidance in dealing with issues such as:

- completeness: how can we know we have taken all relevant services into scope?

- detail: did we describe sufficiently the services to be contracted?
- scope: to what extent should chain-dependencies be included in the SLA?

We expect the DEMO Construction Model (CM) to contribute in making agreements on specific services and dependencies. Indeed, such a CM expresses the coherence (chain/network) of business services, delivered by actors to other actors within a defined scope. How can we translate now the concepts used into a method to systematically list items for contracting, such that the splitting proposal can serve as a basis for drafting agreements?

5.2.2 Proposed method: Way of Thinking

Assuming the organization-split between two organizations Org1 and Org2 has already been decided upon, we propose the following way of thinking to systematically discover specific items for contracting. In the remainder of this subsection we will introduce and elaborate three subjects for that. In the next subsection we will develop this into a way of working, embedding it in an over-all approach for organization-splitting. For three subjects (see Fig. 5.2) we will use the DEMO CM as a stepping stone:

a) ownership of assets – i.e. all business and information results and means – of the organization-part to be split off;
b) content, quality and shape of business and information services on the organization split;
c) for critical service-deliveries, also the dependency of suppliers should be described in the same way as in subject b.

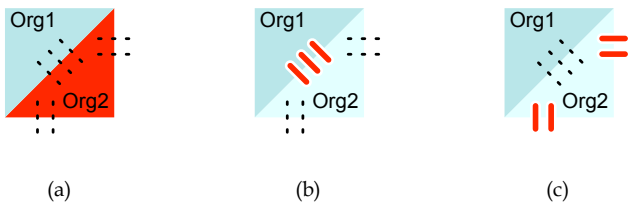

Figure 5.2. Subjects for contracting

Subject (a): ownership of assets

In this subject we explore the ownership of all assets – i.e. all business and information results and means – of the organization-part to be split off (Org2). These assets comprise:

- the business and information results of each Org2 transaction, including its interface-transactions with Org1 and other parties;
- all means – including personnel and fitting – used to produce said business and information results, for the full life-cycle of those means; so from initial acquiring via repair and improvement to dismissal and replacements.

The goal of exploring this subject is to underpin financial settlement of the split, simplifying future exits and enabling future re-outsourcing or future re-insourcing

by making clear agreements, also on ownership of future investments in personnel and fitting. With the results of the exploration, Org1 and Org2 can make choices in ownership after the split. For the operation of Org2, at least the right to use the means is necessary. Common questions to decide if that right to use is sufficient or that it should be extended to ownership include:

- do legal constraints apply?
- are the means explored very specific and unique or generic and common?
- what risks (e.g., financial, technical and political) are expected by renouncing ownership? E.g. in the public sector, ministerial responsibility can be a reason to keep ownership, even when this is financially not favorable.

Let's illustrate the use of this subject by the case of signposting the Dutch main roads. For 110 years the Dutch ANWB managed those road signs. In 2004 the call for tender for this task by RWS was won by Tebodin. Using subject (a), we can now sum up assets for which ownership has been discussed:

- the road signs (material result of business transaction);
- data on road signs – including the available format for ANWB, RWS and Tebodin before, during and after the outsourcing – including e.g. their design / scale drawings, where they are located and when they have been inspected with what result;
- specific means for use, control and maintenance of road signs, e.g. the personnel (specific / unique competencies), material means (specific equipment for (de)mounting road signs) and immaterial means (method of preparation specific coating for road signs, all software used for administration of road signs including the escrow / backups of the software and its data);
- as a special subcategory of immaterial means: the documentation for all means, e.g. personnel files, maintenance manuals, proofs of purchase and guarantees, user manuals for operating road signs and software.

Subject (b): Business & Information services on organization split

In this subject we explore the behavior of the organization-part to be split off (Org2), as experienced on the organization split with Org1. On the spot of the organization split, we will specify content, quality (including when, how much and how good) and shape of the mutual business and information services. Practically this means:

- for each (business) transaction in the CM on the organization split, add to the description of its business result from subject (a) the Quality of Business (QoB) and shape;
- for each information link in the CM on the organization split, describe its content, its Quality of Information (QoI) and the format of communication.

Goal of exploring this subject is to clarify mutual expectations and obligations during operations. Also it enables choosing priorities in steering these operations. A common strategy is to choose from the QoB/QoI say 8 or 9 Key Performance Indicators (KPIs), on which steering of both Org1 and Org2 will concentrate. Those KPIs should be made SMART, e.g. to also serve as a basis for bonus/malus fees.

One could argue that for each transaction and each information link it would be good to specify QoB resp. QoI. We deliberately left this out, because those other QoBs/QoIs are the internal concern of the newly shaped organizations Org1 and Org2; this needs not be solved at contracting time between Org1 and Org2.

For all services on the organization split, we document the shape of the results. For business transactions with a material result this means the specific shape of that material result. For business transactions with an immaterial result and for the information links this means its format for recording and communication, e.g.:

- will the results be recorded on microfiche, in a document management system, in a database, in a paper-based archive;
- will the results be exchanged in paper documents or in electronic messages; if the latter: which format, which protocol.

We will illustrate the use of this subject for the operation of constructions (Fig. 5.1). Suppose, again purely hypothetical, that RWS would consider outsourcing the role of the construction operator. Then using this subject, the CM unveils the need to become specific for the QoB for transaction T01 operate construction, e.g. on service times and delivery times for the different customer / target groups. Also we detect from the CM that the information on granted (water transport) licenses (from T05) needs to stay available for A01, even now A01 will be going to reside in a different organization than RWS.

Subject (c): critical chain dependencies

In this subject we explore the critical chain dependencies from the newly shaped organization Org2. On the interface of Org2 with its suppliers we will specify – just as in subject (b) – content, quality (including when, how much and how good) and shape of the mutual business and information services. Only now we will restrict ourselves to those suppliers which are considered critical by Org1.

From the perspective of Org1, we talk about 2nd order QoB and QoI. When Org1 and Org2 would have been different organizations starting cooperation, Org2 would generally continue taking care of this and Org1 would not be interested to interfere. In the case of organization splitting however this works differently; indeed, before the organization split Org1 had a full say on suppliers and their qualities for Org2. So it should be part of the conscious choices of Org1 what freedom it will allow to Org2 in the future.

Generally speaking, the KPIs in the agreement between Org1 and Org2 will guide discerning what is considered "critical". For Org2's critical supply-relationships specific steering measures can be defined. The agreement between Org1 and Org2 could give Org2 some freedom: "Org2 can negotiate and contract its critical suppliers autonomously, restricted only by principles $P_1 \ldots P_n$, to be decided upon by Org2" or keep Org1 close on the steering wheel "Org2 should inform Org1 of all intentions to negotiate and contract for critical supply x; Org1 will then situationally decide which degree of autonomy is granted to Org2 in this case".

In the example of the operation of constructions (Fig. 5.1) we noticed the dependency of *construction operator* (A01) on the *deployer dry traffic measures* (A044). Let us assume that, for the sake of safe and unimpeded water and dry transport, RWS considers this dependency critical. Then the QoB of transaction *deploy dry traffic measures* (T044) should be specified and related to the KPIs of construction operator (A01). And the degrees of freedom for subcontracting T044 by A01 should be part of the agreement between the new organization of A01 and RWS.

5.2.3 Proposed method: Way of Working

We will now elaborate a way of working for splitting an organization (Fig. 5.3). For the part that deals with finding items for contracting, this builds on the way of thinking of the previous subsection. For the part that deals with calculating organization-splits, it builds on and expands Op 't Land (2007, see Chapter 4), which we will now summarize first.

We consider "cut" relationships in terms of the CM – so "cut" business transactions and "cut" information links – a measure for the complexity of future cooperation. Using weights (e.g. Business transaction: 9; Information link: 1, for short BI=91), we calculated optimal organization splits to enable off-line comparison with the expert constructed gut feeling organization split. This enabled us to test again the *BI-hypothesis*, which states that *Business dependencies determine organization-splitting far more dominantly than Information dependencies*. We used two measures (see appendix A for a more detailed discussion of these measures):

- minimal Penalty (minP; penalty = sum of weights of broken relationships) as measure for effort of transition and steady state;
- maximum Modularity (maxM), a good predictor and detector for community structures in networks (Newman, 2002); modularity $\in [0,1]$ measures internal cohesion of a clustering in a graph, 0 meaning a random graph and 1 meaning complete disjoint clusters.

Measure minP has been used earlier by us in case RD-1 (Chapter 4); application of measure maxM is new.

The way of working should deliver two results for the customer, namely (1) a *splitting proposal* and (2) *items for contracting*, and one research result, namely (3) *test results of the method*. The splitting proposal (1) contains the chosen organization split in terms of actors participating in one of the two organizations *Org1* and *Org2*, including an underpinning for that choice. In the items for contracting (2) we find back the results of the way of thinking discussed in the previous section, namely (a) ownership of assets (b) quality of business and information services on the organization split and (c) critical chain-dependencies. Of course the intended approach should be tuned at beforehand with management, to test how this can optimally help to support cooperation and to let the results fit in the foreseen contracting and the organizational change process. To achieve this, we designed 4 meetings, namely on criteria (crit), Construction Model (CM), Organization Split / Ownership of Assets (OS/OA) and Business & Information Services / Critical Dependencies (BIS/CD).

The OS/OA-meeting, preferably with Group Decision Support, is positioned as a core activity. Participants of this meeting should be senior management and broad subject matter experts from Org1 and Org2, as well as ontology experts who have helped prepare the CM for the Org1-Org2-area. In this meeting, especially brainstorming and choosing is executed. Specifically, a gut-feeling splitting proposal is created on the level of individual actors, which is subsequently tested against general and situation-specific criteria. Now we know where the organization split will come, we also can list preferences on the ownership of assets.

In the BIS/CD-meeting, populated by a small group of say 4 managers and broad subject matter experts, the splitting proposal from the OS/OA-meeting is compared with calculated splitting alternatives. As Op 't Land (2007, see Chapter 4)

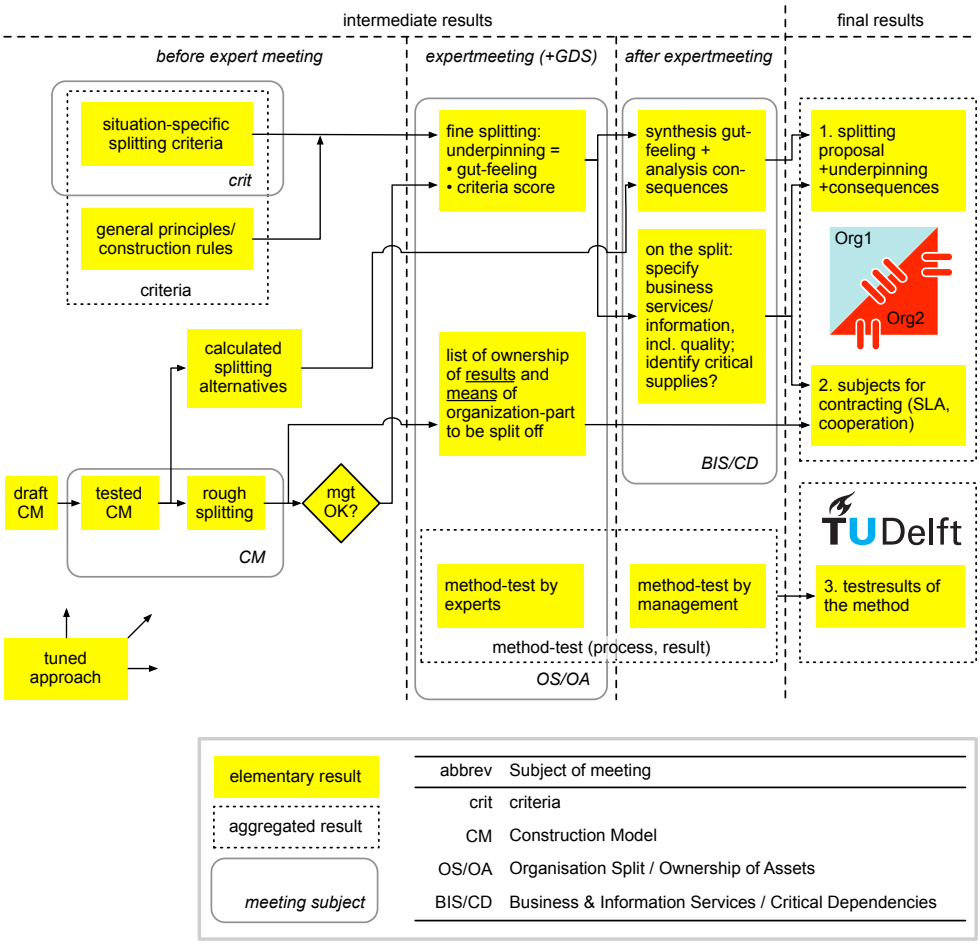

Figure 5.3. Organization-splitting: way of working

states, "that calculated alternative need not be the best; many criteria can play a role (...) if someone wants to deviate from the calculated alternative, he now will be aware of the penalties of that deviation, which enables him to make conscious trade-offs." Also the group will draft specifications of business and information services on the organization split and maybe on other critical parts in the delivery chain.

As a preparation of the OS/OA-meeting we had the CM-meeting, in which a small group of say 4 managers and broad subject matter experts test the CM and prepare a rough splitting proposal, say to the level of CM "aggregated actors". The background is purely practical: we want to save time and energy for the OS/OA-meeting, so no time should be spent there for what is considered an obvious choice "goes to Org1 ↔ goes to Org2". For sure, this "obvious" rough split is checked by the management of the Org1-Org2-area before the OS/OA-meeting. Also the tested CM is used to off-line calculate splitting alternatives.

The crit-meeting should, with a comparable small group, draft situation-specific criteria for the splitting. Often rough ideas from mission, vision and strategy of

Org1 and Org2 exist. However, to serve as criteria during the OS/OA-meeting those criteria should be made unambiguous and also as SMART as possible. Also general principles and construction rules from organization and systems theory could be preselected.

To finally find the benefits and limitations of the method, we want to test the drafted way of working as a whole by 2 actions:

1 the experts are asked at the end of the several meetings questions such as *How does this approach help to make underpinned organization splits?*, *How does this approach help to systematically find items for contracting?* and *What should be necessary to apply this approach to other areas of Org1-Org2?*;
2 the management responsible for this part of Org1-Org2 is asked, at the moment of delivering the 2 results for the customer, to evaluate the way of working as a whole and the added value for the over-all organizational change process.

5.3 The intervention: case Rijkswaterstaat – Deltares Water quality

In the choice for an area for our case study (which area, which size, when, who to involve), we balanced several considerations:

- what is the "right size" of the area for the case study, making it sufficiently interesting and relevant for the RWS-/Dlt-policy makers and at the same time feasible in time;
- political visibility: to what extent and in which phase did we want what attention from what stakeholders to this case study; e.g., the right moment could enable a fruitful discussion between management and Works Council about a major BPO or IT-outsourcing proposal;
- availability of material; during the case study we would have to use existing CMs of RWS, tested by subject matter experts.

Ecology, Water quality and Emissions (EcoWaqEmi) has been chosen as area of our case-study. This RWS-area is responsible for the control and monitoring of the chemical and ecological state of and the restriction of emissions in the Main Water System (MWS). This covers a wide range of activities, including modeling the effects of emissions on water quality and ecology, measuring and reporting water quality and ecology, upholding laws, regulations and issued emission licenses, controlling dikes, operating sluices/locks, integral consulting and long-term expertise development.

For this EcoWaqEmi-area, a CM validated by subject matter experts was available. The model emerged from an application consolidation project, in which it was used to structure the current application portfolio, seeking for rationalization-opportunities. The model contained 51 (elementary) actors (summarized in 11 aggregated actors), 63 transactions and 112 information links.

Table 5.1 shows the attendance for the 4 designed meetings, held from June 7 to July 6, 2007. The experts, totally spending little over net 100 hours, originated from 4 target groups, namely:

- group 1R: subject matter experts RWS, such as RWS-management and business staff;
- group 1D: subject matter experts "Deltares", mainly from TNO and WL | Delft;

- group 2: subject matter and ontology experts from Enterprise Architecture RWS (EAR);
- group 3: ontology-experts.

To direct the facilitation of discussions and to enable target group differentiated analyses, we used a Group Decision Support Room, in which all argumentation, comments and scores could be systematically collected and subdivided by group.

Table 5.1. Attendance of expert-meetings

Duration meeting (hours):		1.5	3	4	2.5
Group meeting:		**crit**	**CM**	**OS/OA**	**BIS/CD**
1-R:	Subject matter expert RWS		6	5	1
1-D:	Subject matter expert "Deltares"	4	3	5	2
2:	Ontology & subject matter expert (EAR)		1	3	
3:	Ontology expert			2	
	Total of experts attending	**4**	**10**	**15**	**3**
	Total of expert-hours spent	**6**	**30**	**60**	**7.5**

Table 5.2 shows the investment in consultancy time, necessary to design, execute and elaborate the 4 designed meetings.

Table 5.2. Investment in consultancy time (man-days)

Duration meeting (hours):	1.5	3	4	2.5		
Task meeting:	**crit**	**CM**	**OS/OA**	**BIS/CD**	**over-all**	**total**
preparation: agenda, posters, invitation, ...	1	1	1	1		4
execution: facilitation, note-taking	1	1.5	1.5	1		5
calculate splitting alternatives, evaluate formal quality (penalty, modularity) gut feeling alternative	0	0	2	0		2
basic reporting (≈ elaborated Post-its)	1	1	1	1		4
extended reporting (meeting report & validation)	2	2	5	2		11
final reporting					19	19
Total investment in consultancy time (man-days)	**5**	**5.5**	**10.5**	**5**	**19**	**45**

5.4 Results of the intervention

After the first two meetings (crit, CM), the management could make a rough organization split. From the 11 aggregated actors, 5 were positioned completely in RWS (together called RWS-OPE: all operational work concerning operations of construction works, data collection and the control of water quality, ecology and emissions) and 1 in Deltares (DLT-MOD: Model application). For further analysis in meetings (OS/OA and BIS/CD), 4 aggregated actors were selected, namely Model Application, Advice, Expertise Development and Information Direction.

The intervention differed slightly from the drafted way of working:

- crit-meeting: no general principles and construction rules from organization and systems theory were preselected (time-issue);
- OS/OA-meeting: listing the contracting items on the level of individual actors was considered too detailed; therefore the experts stopped at the level of aggregated actors; scoring the gut feeling alternative to the criteria was tried for one actor, but found to be too time-consuming and therefore not continued;
- BIS/CD-meeting: no comparison with the calculated organization alternative was done by subject matter experts.

The remainder of this section will give examples of the actual findings in the intervention. The first subsections will treat the finding of contract items, then we will turn to the organization split and opinions on the method applied.

5.4.1 Subject (a): ownership of assets

For Advice and Expertise Development, the immaterial assets are important to agree upon. To be able, both on short and long term, to give advice on ecology, water quality and emissions – taking all relevant context developments into account – Deltares should keep its knowledge for water control in the Netherlands up to date. Specific themes in that are *climate-proof Netherlands* and *how to deal with cumulative effects of interventions in relationship to eco-legislation*. For advice delivery, agreements should be made on communication, moment of publication and copyrights.

For Model Application, agreements should be made on the ownership of the models, including the responsibility for maintenance and provision. Also on the means for modeling, such as specific software applications, agreements should be made.

In the area of Information Direction especially the ownership of basic data should be agreed upon. Important themes to include are the quality of the basic data (consistency, actuality), its categories and its formatting.

5.4.2 Subject (b): business & information services on organization split

When discussing the *quality* of the business services, mainly conclusions on the *content* of those business services emerged. E.g., in the area of Advice clarification arose on who should be responsible to bring in knowledge on Dutch legislation, political and governmental knowledge and skills for political influencing. This also clarified the organization split.

For information services, far more results were listed, e.g.:

- which data are necessary for Advice (such as GIS and meteo) and Model Application (not only Dutch water data, but also German and other EU water data);
- what type of data-access may be given by RWS to which parties (to prevent imperfect competition), also dealing wisely with politically sensitive information;
- to what extent should information strategy be elaborated first, clarifying e.g., the role of governmentwide shared service centers for data collection and the scope of international ambitions;
- a series of items to be agreed upon and further analyzed per information link, such as the quality of data (actuality, completeness, formats), who gets access to what, who requests and who provides data, how fast should the data be available, what are the risks of non-availability of data, what are and who pays the costs of data-access.

5.4.3 Subject (c): critical chain dependencies

For Advice a critical chain dependency was detected with other knowledge institutions. RWS wants to be sure that relevant knowledge is used by Deltares when formulating its advice. On the level of a project therefore agreements should be made which expertise Deltares should involve and how they guarantee the quality level of expertise involved. Also on the long term Deltares should make agreements with knowledge partners – transparent for RWS – to guarantee future knowledge development in the chain, to play its role as Knowledge Director.

Also the dependency on data collected or controlled by 3rd parties became clear. Several data groups were identified which needed clarification on ownership, allowed or required providers and agreements on actuality and accessibility.

5.4.4 Other items for contracting found

Apart from the areas a, b and c, the experts were eager to bring in more generic items for agreements, both for contracting the steady state and for contracting the transition.

Independence of Deltares staff, e.g. in legal affairs or audits, is of vital importance for RWS. This means agreements should be made for which customers Deltares (1) wants to be involved in the execution of an advice and (2) wants to be involved in the audit on such an advice – not both roles for the same advice. Also measures have to be agreed upon to timely signalize potential conflicts of interest and to make the advice-process as a whole transparent.

Also more general SLA and project management issues arose, e.g.:

- when and how to agree on capacity and budget;
- what boundary constraints should be fulfilled before starting a project, e.g., *making all required data available*;
- under which conditions RWS could successfully request for urgent advice, and which priority RWS should get in that case.

Finally some restrictions of contracting and agreements were formulated. With mutual trust as basis, supported by a minimal contract of 5 pages, RWS and Deltares wanted to start with a year of experience and learning on a case by case basis in so-called *Koploper*projects (projects with an example function). After that year the contract could be improved, if deemed necessary.

5.4.5 Finding the organization split

The calculated organization alternatives were compared by us with the gut feeling alternative. As boundary constraints for the graph constructions, we applied RWS-OPE and DLT-MOD.

When seeking for minP-solutions which are non-trivial (i.e. not equal to RWS-OPE or DLT-MOD), only one solution appeared for BI=91 (and no solutions for BI=55 or BI=19), which confirm the BI-hypothesis. This solution had a penalty of 47 and a modularity of 0.31. In this P47-solution Expertise Development and almost all Advice was positioned at Dlt; Information Direction, Information Production and Information Supply was kept at RWS. Insofar the results could be compared with the gut feeling alternative, P47 came quite close to it. It differed for *A060 Manager Advice*, which was positioned by most experts at RWS, while P47 put it in Dlt. And for Information Direction the experts had a far more nuanced judgment then "put everything in RWS".

When seeking maxM, three non-trivial solutions were found, subdividing EcoWaqEmi in 3, 4 or 5 clusters, the 5-cluster solution taking the theoretically maximum modularity(0.63) for EcoWaqEmi. In each of those solutions the Deltares-part with maxM (DLT-maxM) consisted next to Model Application of Advice and Expertise Development, almost the same solution as P47. In the 4- and 5-cluster solution, also an interesting internal RWS-cluster appeared which could execute information chain direction.

5.4.6 Assessment of the method applied

As added value of the method applied, *Evidence Based Splitting of Organizations* (EBSO), experts mentioned:

- good and conscious thinking about the organization split;
- an objective, systematic and structured approach;
- stimulates collective conceptualization and discussion about risks of the organization split, e.g. for information availability;
- leads fast to underpinned and shared decisions.

As weakness of the approach, experts mentioned that the criteria for organization split were too detailed; scoring the split on them did not add value and distracted the discussion. Also more time than 4 hours for the OS/OA-meeting is needed; that would have enabled dealing with the remaining 3 aggregated actors.

The management accountable for this area considered the thinking in transactions and business services well fit to connect it with the management contracts, in which performance indicators (PINs) have to be elaborated. And especially for the Information Direction – and underlying also the data collection, information production and information supply – this formal method helps to structure the work.

At the same time, a further deepening and detailing of the discussion on the organization split was not considered fruitful by the management. Enough insights were gathered to start *learning by doing*. Also it could create deceptive confidence, since the precise organization split in the end in practice also depends on individual persons, taking a certain amount and type of work with them to the new organization.

5.5 Conclusions

5.5.1 Conclusions – level of this case

In little over net 100 expert-hours, Waterdienst and Deltares were able to reach consensus on the main part of the optimal organization split for an area with an annual turnover-potential of € 7.5 million. For most actors now consensus exists on who is responsible for what. For other actors, especially in mutual information supply, the work to be done in contracting and implementation has been clarified. And the management contracting, including the formulating of performance indicators (PINs), can profit from the descriptions of roles on the organization interface.

The over-all process of shaping Deltares, working with simulations and workshops in 2007-H1, emphasizes mutual trust, common interests and cooperation. The EBSO approach completes this by clarifying different interests, different responsibilities and mutual dependencies.

Working with the CM was complementary to the elaboration of strategy. It was hard to make the criteria, based on the strategy, SMART and even harder to draw conclusions on scoring the actors on those criteria. This did not hinder drawing conclusions on the positioning of actors in Dlt or RWS and the reasons mentioned therefore could be considered as *just in time* operationalizations of the strategy.

Interestingly enough, the CM used need not be perfect to serve as a basis for the discussion on the organization split, though it impacts the quality of the calculated organization alternative. For instance, the actor *A060 Manager Advice* was positioned for certain types/parts of advice with RWS and for other types/parts with Deltares. That result is sufficient to express and underpin the organization split. However, this actor should be split in the DEMO CM – including its consequences for business and information services – to serve as a basis for a recalculated organization split.

5.5.2 Conclusions – level of this action research

Applying the method for organization split confirmed from the previous experiment Op 't Land (2007, see Chapter 4) the *BI-hypothesis – Business dependencies are more important than Information dependencies, when deciding about organization split* – for a different area, somewhat larger and with a more complex CM. Also the same result was found, namely that the non-trivial minP-solution comes close to the gut feeling organization split. A new finding is that applying the criterion maxM delivers almost the same optimal calculated organization split as the criterion minP. By maxM we also detected interesting *internal* RWS-clusters.

The method for systematically finding items for contracting is a next step after agreeing on organization split. What did it deliver?

The questions on contracting items worked on the level of aggregated actors. Apart from the designed subjects a, b and c, also important general project and SLA management issues were found. And the issue of independency of Deltares staff, e.g. in legal affairs or audits, got pinpointed.

For subject (b) we noticed that the experts found it hard to express themselves on the quality of business (QoB); their main attention went to the transaction results. Also giving specific quality of information (QoI) requirements appeared to be hard;

the answers we found more indicated a method and a project to find the data groups and make them available.

Surveying subject (c) delivered clear issues and potential problems, especially in critical knowledge and information dependencies – understandable with an institution like Deltares, where most assets are immaterial.

5.5.3 Future research directions

In the calculated organization splits, sometimes more (min-cut) solutions are possible with the same penalty. E.g. *A082 Applicability Researcher* can be positioned within RWS or Dlt with the same penalty, though modularity is better in Dlt. More insight in the sensitivity of optimal organization splits for e.g. a missing information link or small differences in BI-weight is desirable, e.g. by applying simulated annealing or genetic algorithms.

Also it would be interesting to see – in a longitudinal management research program – to what extent the intentions for contracting are really applied. After all, future cooperation is more than contracting and a cognitive exercise. It's at least as much on mutual trust and the employment, location and position of people involved. Therefore it is important to understand the contribution of this method in the change process as a whole.

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6

Conclusions and recommendations

Abstract Our research delivered an instrument for supporting organization splitting and allying, consisting of organization construction rules, algorithms for calculating a plausible organization splitting proposal, a method for finding subjects for contracting split organizations, and a real-life tested combination of all this in a way of working. This instrument has demonstrated its practical value in situations of strategic organization splitting, centralization and post-merger integration. To build on the strength of this instrument and to overcome its limitations, we propose a research agenda to make the instrument *more broadly applicable*, to make the instrument deliver *faster decision-support*, to *test* the instrument more thoroughly and to clarify the mutual dependency of organization splitting versus *ICT splitting*.

6.1 Introduction

We will start by summarizing our original problem statement, as formulated in Chapter 1. The main question our research wanted to answer is

> *Application of which organization construction rules leads to adequate splitting and allying of enterprises?*

We defined organization construction rules as the decision rules by which one decides where to split the organization. Under adequate we understood "compliant with professional principles, enterprise specific principles, situational process requirements and situational content requirements".

In Chapter 1 we also have put forward our main choices and assumptions. First we have argued that knowledge on the *right splitting of enterprises* is important nowadays, where organizations increasingly split off parts and subsequently start cooperating with those parts, be it based on for instance strategic focus on core competencies or on an effort to improve efficiency by the use of Shared Service Centers (SSCs) or Business Process Outsourcing (BPO) parties. Next we have stated that a method for splitting enterprises is missing, though currently available methods offer promising elements. Finally we made a reasonable case that such a method should be theoretically underpinned, and that applying action research would help us to find and test those organization construction rules in real-life cases in which ontology and architecture are used.

Especially two things we wanted to see (a) how architecture and ontology influence the splitting and allying of enterprises and (b) what is the "minimum size"

of architecture and ontology to still let the organization construction rules give the same result.

The remainder of this chapter is structured as follows. We will summarize the conclusions from our research as presented in the earlier chapters, first case by case and then of our research as a whole. Subsequently, we reflect on the limitations of our research: what answers are we still not able to give at all and how extensible are the conclusions from the researched domain – ING Securities and Rijkswaterstaat – towards the intended domain – all organizations that for any reason need to be split. Finally we will present recommendations for future research.

6.2 Contributions

From the shaping of ING's Shared Service Center Securities, the first case we have discussed, we learned that DEMO transactions offer a useful language for expressing the stable core of the business. Those transactions were applied as "minimum-sized organization building blocks", so the most detailed level at which to decide whether a unit of work should be in- or outsourced. Also the transactions appeared to be useful to link ING's current application portfolios. Finding those transactions was a matter of roughly one day with the business experts, which then were more solidly documented during 2 weeks, together with linking it to ING products / services, objects and external actors and testing the whole by two event traces. Further we showed the influence of 2 enterprise specific principles and 6 organization construction rules (Table 6.1) to the splitting of ING Securities. The main added value of the method appeared to be (1) to create a common conceptualization of the target situations for all parties involved; (2) to support project scoping and communication on investment decisions; (3) to get governance of operations and ICT in place.

Table 6.1. Organization construction rules case ING

nr	*Organization construction rule*: keep actors together, when...
1	... they *cannot have a supporting role* for other actors
2	... sufficient *similarity* in *services* exists
3	... sufficient *similarity* of *events/work* exists
4	... *same order types* occur
5	... those actors more or less work *on the same case / deal with the same event*
6	... the *risk to fail* (in banking sector: *operational risk*) of a split is unacceptably high

In terms of our two results (a, b), what did the ING case contribute? First of all, we found that transactions from the enterprise ontology offer a useful language to express implementation decisions for organization and ICT. Compared to Mulder (2006), who used a complete DEMO CM, we could already accomplish results with only a list of transactions and external actors. Also we were able to link the transactions to ICT application portfolios, thus giving a frame of reference for application

portfolio rationalization. Next, we found six organization construction rules, which have probably a more generic applicability. And finally, we found the three process results of the method applied, which also might be more generic.

The ING-case left us also with several questions. No complete DEMO CM had been made. What would be the added value of making such a complete CM, offering extra insight in business dependencies and information needs, and would that be worth the extra effort (1)? Also, since in the ING-case many deliverables had been made, it is difficult to tell which deliverable exactly contributed most to the results. This opens up the question (2) what we can say about organization splitting just using the DEMO CM. Finally, we would like (3) to find other organization construction rules and test the 6 we found.

In the case RWS Application Portfolio Rationalization (RAPR), we used a more complete DEMO CM as a stable description of the business. Though not the formally complete way was followed – according to Dietz (2006) a complete cycle should be followed, including the making of a Process Model, an Action Model and a State Model –, the quality was sufficient to detect duplications and similarities between applications originating from several regions but supporting the same business to build a well underpinned phasing out proposal for applications. The investment for this more complete CM appeared to be less than 25 man-days by DEMO experts together with less than 5 man-days subject matter expertise. The added values of this more complete CM appeared to be (1) a well underpinned and ordering structure of the phasing out proposal (2) a support of the positive attitude-change towards the application portfolio rationalization program and (3) a clarification of organizational responsibilities in the distinct Rijkswaterstaat regions, especially across "traditional" organizational borders; to the latter, both the knowledge of transaction and information links were contributing.

In terms of our two results (a, b), what did the RAPR case contribute? First of all it confirmed our finding from the ING case that transactions are a good language to express business similarities on an essential level. Also it showed again that this language can be used to structure applicational functionalities – it was even demonstrated that, to do so, transactions worked far better in that than actors or information links. The modeling effort required to draft a rather complete CM appeared to be modest. And in return for that, the CM appeared to clarify organizational responsibilities, both by transaction links and information links.

This focused our attention again on the organization splitting: given its quality to clarify organizational responsibility and given the modest effort required to draft a CM, how could just a complete CM support the splitting of organizations? What value would that add, when compared to using only transactions as a basis, such as in the ING case, and at the same time not using any more deliverables than the CM?

In the case RWS Deltares splitting 1 (RD-1) we again used a more complete CM, this time totally focused to support decision-making in organization splitting. We re-applied the method of the case ROOD (Mulder, 2006, pp 86-116), in which actors from the CM were used as organization building blocks to let domain experts in a half day meeting construct a free-format gut-feeling organization alternative. On top of that we used the transaction and information link coherence between actors to use the min-cut algorithm from graph theory to precalculate several organization

alternatives and let experts in that same expert meeting choose between those alternatives. The investment for using an existing CM to this end was 10 domain expert man-days, 10 consulting man-days and the use of Group Decision Support (GDS) facilities. We found that the non-trivial best-calculated alternative was quite close to the free-format gut-feeling organization alternative; 4 out of 43 (elementary) actors were positioned differently, with *separation of functions* as main reason for difference. Also we tested our Galbraith (1973) inspired BI-hypothesis – *Business dependencies are more important than Information dependencies, when deciding about organizational splits* – and we were not able to falsify it. Further on, we expanded our collection of professional functional principles (Table 6.2) and organization construction rules (Table 6.3), though time permitted only to actually test organization construction rules PC09, PC10 and PC11.

Table 6.2. Professional functional principles case RD-1

code	name of principle
PF01	better quality of operations
PF02	more flexibility in service levels
PF03	accelerated operations
PF04	accelerated time-to-market
PF05	lower operational costs
PF06	increased turnover
PF07	client centricity
PF08	customer ownership
PF09	multi-channel offering ability

In terms of our two results (a, b), what did the RD-1 case contribute? We found that a complete CM adds signifantly more value than using just a list of actors (Mulder's case ROOD) or transactions (case ING). By knowing the transaction and information links, it is now possible to calculate theoretically underpinned organization-alternatives, which also are recognized by experts as plausible. Also the explicit insight in dependencies enables a conscious trade-off between several organization alternatives by management and other experts: *if someone wants to deviate from the calculated alternative, he now will be aware of the penalties of that deviation*. Furthermore we demonstrated that a completely calculable advise on organization-splitting, based on the strength of transaction- and information-relationships, which also is recognized by experts as good, is impossible. Finally, in this case Galbraith's old hypothesis on a trade-off between business and information dependencies clearly pointed in the direction that business dependencies determine organization-splitting far more dominantly than information dependencies.

The case RD-1 left us also with some questions. Would our BI-hypothesis hold in other situations as well? If mainly business dependencies are determining organization splitting, why bother making also the information links in a CM explicit at organization splitting time? Would that also depend on the way of measuring

Table 6.3. Organization construction rules case RD-1

code	*Organization-construction rule*: keep actors together, when ...
PC01	... their mutual *interface* cannot well be standardized, due to *complexity*
PC02	... their mutual *interface* cannot well be standardized, due to *frequent change*
PC03	... they *cannot have a supporting role* for other actors
PC04	... they use the *same language / culture*
PC05	... they operate under the *same regulatory, legal and tax-regime*
PC06	... they more or less work *on the same case / deal with the same event*
PC07	... the *risk to fail* (in banking sector: *operational risk*) of a split is unacceptably high
PC08	... they need *comparable competencies*
PC09	... a *(business) transaction-relationship* exists between them
PC10	... an *information-relationship* exists between them
PC11	... they have *High Internal Cohesion and Low External Coupling* (HICLEC)

the optimum organization alternative, which we restricted now to the min-cut criterion? And of course we were seeking another opportunity to test the professional functional principles and organization construction rules discovered thus far.

In the case RWS Deltares splitting 2 (RD-2) we again used a more complete existing CM to support two goals, namely (1) decision-making in organization splitting and (2) finding specific contracting items for the cooperation over the organization split. In a series of 4 meetings we re-applied the method of RD-1, so letting experts construct a gut-feeling organization- splitting alternative and letting researchers calculate organization alternatives. Different from the approach of RD-1 was that the researchers not only constructed alternatives by using the original *minimum Penalty* criterion (minP), but also by using the *maximum Modularity* criterion (maxM). Also the comparison of gut-feeling with calculated organization alternatives was done by researchers instead of domain experts. In that same series of expert meetings also contracting items were systematically listed, using the CM and the categories (i) ownership of assets (ii) quality of business and information services and (iii) critical chain-dependencies. Conducting this series of 4 expert meetings – based on an existing CM – took an investment of 15 man-days domain experts, 45 man-days consultancy and the use of Group Decision Support facilities. As a first result, we found that the non-trivial best-calculated alternative was almost the same, both when applying the earlier minP-criterion and the new maxM-criterion. Also we found again that this non-trivial best-calculated alternative was quite close to the free-format gut-feeling organization alternative. Furthermore we confirmed our BI-hypothesis that *business dependencies are more important than information dependencies, when deciding about organizational splits*. For most actors consensus was built on who is responsible for what. The listing of contracting items worked on the level of aggregated actors and helped to determine in a fast and shared way subsequent implementation steps, e.g., ensuring mutual information supply and formulating performance indicators.

In terms of our two results (a, b), what did the RD-2 case contribute? We confirmed all our findings of case RD-1, namely (1) a more complete CM adds value above just a list of actors or transactions, by enabling the calculating of plausible organization splitting alternatives (2) the BI-hypothesis could not be falsified by case RD-2 either. In the area of calculating organization splits we found that maxM optimalizations rendered almost the same organization splits as the minP calculations, adding to that new *internal* optimal clusters. Finally we found that – though given the BI-hypothesis information links are not really necessary to calculate plausible organization splits – information links certainly add value the moment contracting between the split parties has to occur, namely (1) to determine from the information exchange between the split parties the content and the quality (QoI) (2) to detect dependencies in knowledge or on data collected and controlled by 3rd parties.

We will now summarize the over-all contribution of our research.

Let's start by answering question (b): *what is the "minimum size" of architecture and ontology to still let the organization construction rules give the same result*? The simple answer to that is: there is no minimum size; however, we now know better which part in the architecture and ontology causes which results. We subdivide those parts in several levels; see Table 6.4. This table includes an estimation of the investments needed and the benefits of each level. Note that these estimations of investments are just indicative, derived from several cases in which not exactly these levels have been used as such; much depends on project context, the embedding in an over-all approach for organization splitting, number of stakeholders, timely availability of domain experts etc. The basic investment (level 0) for keeping a classic or GDS workshop is required in every level and quality of arriving at an organization splitting proposal. The minimum-size of content used in organization splitting consists of just a list of actors or transactions (level 1). This was the case in ROOD (Mulder, 2006); indeed a complete CM was available there (level 4) – which certainly increased the reliability of the actors discerned –, but only the actors were used in the organization splitting proposal. This level 1 enables qualitative consensus building of a gut-feeling organization alternative with a bottom-up underpinning by arguments originating in the same workshop. The next level (2) enriches this approach with a test of the gut-feeling organization alternative by previously collected (enterprise specific) principles. This was shown in the ING case, where a list of transactions was used, somewhat tested by two event traces, and the organization alternative was constructed and tested by a list of enterprise specific principles and a list of six more generic principles. The extra benefit of that is that the organization splitting choices made now can be underpinned in terms of those previous formulated principles. In the next level (3) we add on this the use of formal knowledge in the CM about business dependencies, as expressed in transaction links, in graph theoretical optimizations (minP and/or maxM). As shown in the RD-1 and RD-2 case, now the extra benefit of calculating plausible organization splitting alternatives can be delivered. For delivering this extra benefit no information links need to be known, because of the BI-hypothesis which couldn't be falsified in the RD-1 and RD-2 case. In level 4 we add on this the use of information links; together with the transaction links already known and the CM-based structured inventory of contract items. As shown in the RD-1 and RD-2 case, this does not influence

the splitting proposal any longer. As shown in the RD-2 case the use of information links does however influence the *allying* of the organizations after organization split.

Table 6.4. Effect of different "sizes" of architecture/ontology in organization splitting

levl	extra effort (methods, models, principles, ...)	extra investment[a] (man-days)		extra benefits
		domain experts	consultancy	
0	basis: classic or GDS-workshop(s)	10	10	basic reporting - elaborated Post-its or GDS-report (in every next level necessary, but not sufficient)
1	+just actors/ transactions	+3	+10	+ qualitative consensus building, with bottom-up underpinning
2	+explicit principles available	+3	+5	+ underpinning choices in terms of previously formulated principles
3	+CM without I-links + graph-theoretical calcs	+2	+15	+ formally calculated plausible organization splitting proposal
4	+ CM with I-links + using CM-based structured inventory of contract items	+2	+30	+ underpinning how to contract *allying* after the organization split + extended reporting

[a] All estimations of investments are just indicative; much depends on project context, the embedding in an over-all approach for organization splitting, number of stakeholders, timely availability of domain experts, etc.

We now turn to answering question (a): *how does architecture and ontology influence the splitting and allying of enterprises*? As we saw in level 1, we confirmed the earlier finding of Mulder (2006) that, by using the actors or transactions, with a modest effort it is possible to build consensus on the organization split. For better underpinning of the splitting proposal, previously formulated principles add value (level 2), as well as the calculation of organization alternatives by using a CM with its transaction links (level 3). To build a basis for allying, a complete CM (level 4) adds even more value, where its information links give, apart from further clarifying organizational responsibilities, also insight in information exchange, data ownership and critical information chain-dependencies.

Let's finally look at the main question of our research:

Application of which organization construction rules leads to adequate splitting and allying of enterprises?

The organization construction rules we have found are (1) the informal qualitative rules as summarized in Table 6.1, Table 6.2 and Table 6.3 and (2) the formal quantitative rules, discussed as the minimal Penalty (minP) criterion with its min-cut algorithm and the maximum Modularity (maxM) criterion and algorithm. We have demonstrated that a completely calculable acceptable organization-splitting proposal is impossible. At the same time, it appeared possible to calculate plausible proposals, which also enabled trade-offs between organization-splitting alternatives.

The CM appeared to be the basis of those organization construction rules, both for the quantitative and qualitative results. Using the CM gave discussions an objective foundation; responsibilities and dependencies became clear and also new actors were discovered. Such a CM needed not be perfect to serve as a basis for the discussion on the organization split, though deficiencies impacted the quality of calculated organization alternatives. Also the strategy didn't need not to be perfect and SMARTly elaborated in criteria; together with a draft CM we were able to draw conclusions on the organizational positioning of actors, and the reasons mentioned therefore could be considered as *just in time* operationalizations of the strategy.

In the over-all process of splitting organizations, several approaches emphasize mutual trust, common interests and cooperation. Our approach *Evidence Based Splitting of Organizations* (EBSO) complements those by clarifying different interests, different responsibilities and mutual dependencies.

6.3 Limitations

This research has answered questions and at the same time evoked a number of new ones. On top of the open questions we mentioned earlier, we will elaborate three themes, namely (1) the solidity of the contributions, (2) the relationship between organization construction rules and reasons for splitting, and (3) the notion that arriving at an organization splitting proposal is part of a larger process.

Reflecting at (1) *the solidity of the contributions*, we observe the following. The cases are quite large and multidisciplinary, but the number of cases tested is not large. Therefore, how sure can we be now on the BI-hypothesis? And how generalizable is this method to other subject matter areas (e.g., manufacturing and large systems engineering) than the areas of our cases (finance, public)? On a more detailed level, we see that in the calculated organization splits sometimes more solutions are possible with roughly the same minimal Penalty (minP) or maximum Modularity (maxM); how sensitive are those solutions for small changes in the CM? Furthermore in the case ING we had the opportunity to really measure two years later the effect of the applied approach for organization splitting. How would that look like in the cases RD-1 and RD-2, e.g., (i) to what extent will the intended organization split actually be implemented and (ii) to what extent will the intentions for contracting actually be contracted and complied with, not only on the level of aggregated actors, but also on the level of elementary actors? Finally, when we look at the professional functional principles and organization construction rules, the testing of most of them appeared to be too time-consuming and too complex for one or a few expert meetings; has its operationalization been too complex?

Let's now turn to (2) *the relationship of organization construction rules with reasons for splitting and allying*. The main question we see here is: do organization construction rules (partly) depend from the reasons for splitting and allying? In the cases ING and RAPR reasons for splitting were redundancy in processes and ICT, whereas in the cases RD-1 and RD-2 the splitting occurred because of strategic focus on core competences. Would the rules be much different in other situations, such as when splitting for lack of strategic fit? Or for a situation where also new functions / products are required, leading to the founding of new parties and/or the joining forces of already existing and complementary parties?

Finally we look at the notion that (3) *arriving at an organization splitting proposal is part of a larger process*. In Chapter 1 we started to define enterprise as a goal-oriented cooperative. In our research we now mainly have shown how to arrive at a proposal to re-assign roles to organizations / legal entities, in case RD-2 also touching upon assigning of means and upon contracting for allying. How would a complete splitting proposal look like, covering the re-assigning of people and means and also preparing the allying in the full sense? And what is the contribution of EBSO in the change process of organization splitting as a whole?

6.4 Recommendations for future research

Our research delivered an instrument for supporting organization splitting and allying, consisting of (a) explored and tested organization construction rules, (b) graph-theory based algorithms for calculating a plausible organization splitting proposal, (c) a method for finding subjects for contracting the split organizations, and (d) a real-life tested combination of all this in a way of working. This instrument has demonstrated its practical value in situations of strategic organization splitting, centralization and post-merger integration. To build on the strength of this instrument, at the same time overcoming the limitations mentioned before, we propose a research agenda answering the challenges (1) to make the instrument *more broadly applicable*, (2) to make the instrument deliver *faster decision-support*, (3) to *test* the instrument more thoroughly and (4) to clarify the mutual dependency of organization splitting versus *ICT splitting*.

To *broaden the applicability* of the instrument, research on sector-dependency is needed. As stated, the instrument has been developed in the financial and public sector, characterized by immaterial production. Sectors with material production, such as manufacturing and large systems engineering, typically discern a production chain with raw materials → semifinished products → final products. In the choices for assigning roles of a given production chain to parties over the world, logistics (warehousing, transport, im- and export) could be an important influence. To make the instrument also proven applicable in this sector, further research is needed on this influence.

To make the instrument offer *faster decision-support*, there is room for further improvement. A typical decisionmaker for organization splitting wants to have early insight in effects (such as agility, costs, time-to-implementation; see Chapter 1) of several organization splitting alternatives, in order to make a better underpinned choice. We see here the classical tension that more certainty generally can be given

against higher cost and extended decision time. Further research could shed light to mitigate this tension, be it in terms of fixed relationships of organization construction rules with professional functional principles, or by offering simulation possibilities.

To build more confidence in the results of the instrument and refine it, extended and thorough *test*ing of the instrument on more cases is needed. Such testing could be done on existing cases, in retrospect or in a longitudinal management research program – e.g., to see to what extent the intentions for splitting and contracting are really applied and why (not). Such research could be deductive, such as the testing of the value of the minimal Penalty (minP) or maximum Modularity (maxM) criterion. Other research will have an exploring nature, e.g., answering the questions "how sensitive is the optimal organization split calculation for small differences – mistakes or modeling insights –" and "would finding the contracting items also be productive on the level of elementary actors (instead of staying at the level of aggregated actors)". Also attention could be given if and where weaker reformulations of the organization-construction rules found hold better, e.g. the rephrasing of PC04 *keep actors together, when . . . they use the same language / culture* to the weaker and more probable heuristic *don't combine actors, if they do not share a same language / culture*.

An area we feel really needs further exploration is the mutual dependence of organization splitting with *ICT splitting*. When splitting the organization, also the application portfolio needs to be split. This ICT splitting can be technically very complex, causing unpredictable delays and high costs or write-offs. When certain ICT-applications really mean a significant asset for the organization, it might also influence finding the optimal organization split. On the other hand, suppose that in constructing ICT-systems it would be possible to already anticipate on "plausible organization splits", then that would not only significantly improve the agility of organizations in splitting, but also the ease of allying with new partners. We see opportunities to achieve this by combining earlier research on identification of optimal application components, such as Albani and Dietz (2006), and best practices on the design of organization-independent information systems, such as Arnold et al (2000), with the insights from our research.

We believe that the research agenda indicated here is urgently needed. In Chapter 1 we started by signaling that "increasingly organizations appear to split off parts and subsequently start cooperating with those parts . . . ". Today in 2008, we also see the opposite being true *at the same time*, organizations ending outsourcing contracts and starting to do the work themselves again. To enable underpinned and fast trade-offs in decisionmaking and to cause the agility to reliably execute it at an increasing speed, that should be the focus of this research.

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Earlier work. This PhD-thesis is based on earlier publications, as follows:

- parts of Chapter 1 have been published earlier in Op 't Land (2006);
- parts of Chapter 2 have been published before by Arnold and Op 't Land (2002) and Arnold et al (2005);
- Chapter 3 is a slightly adapted version of Op 't Land et al (2008);
- parts of Chapter 4 have been previously published in Op 't Land (2007);
- parts of Chapter 5 have been published earlier by Op 't Land and Dietz (2008).

Appendices

A

Summary of literature survey

Literature survey on "organization and split(ting)"

Searching in ISI Web of Science for "organization and (split or splitting)" resulted in 241 hits. The search result was manually stripped from those dealing with biology, geography, physics, sociology, medicine and psychology. Analyzed the six remaining articles showed that these dealt with artificial intelligence, technical infrastructure, and human behavior in mergers etc. No useful results were found here.

Literature survey on "enterprise and split(ting)"

Searching in ISI Web of Science for "enterprise" resulted in 4000 hits, restricting it to "enterprise and (split or splitting)" resulted in 16 hits. Three of those hits dealt with subjects in biology or sociology. Based on the abstracts of the thirteen remaining hits, the four articles (Fleisch et al, 2004; Gulledge and Sommer, 2004; Sumi and Tsuruoka, 2002; Umar, 2005) were selected.

The results of Umar (2005) and Gulledge and Sommer (2004) have been included in Chapter 1. The other two hits appeared to lead off-track for our goal:

- Fleisch et al (2004) draw attention to the human factors influencing the implementation of information systems;
- Sumi and Tsuruoka (2002) emphasize mergers and principles of software systems; e.g., "software systems which respect the borders of 'functions' can be easily re-placed".

B

Survey used in measuring Foundations effects

Introduction

Dear Mr./Ms. <name>,

Recently you have been or are fulfilling a key role for ING's Securities Domain (ING SEC) in developing its business processes and / or ICT. In this role you supervised or influenced several business- and ICT-units.

Delft University of Technology (Department Information Systems Algorithms) is currently conducting research on the extent in which process- and ICT-development is impacted by Architecture.
In this case, we are interested in the impact the Foundations Architecture (drafted in the first half of 2002) has had on the development-projects of ING Securities Domain.
On authority of ING SEC, Frank Stockx and Marc Vanvilthoven have granted us permission to conduct this study and request your co-operation. They expect you to have a qualified opinion on the items in this survey.

We kindly request you to fill out this survey. Filling in the survey will take you approximately 30 minutes. The results of this survey will, together with other input, result in an article, to be published mid-2004. If you want to receive a copy of this article, we are more than willing to mail you this article, once published.

1 Do you want us to send you the article? *(yes/no)*
2 In case of any questions, are we allowed to contact you? *(yes/no)*
3 Do you have any remarks on your contact details as shown here? *(Role, Country, Wired phone, Cell phone)*

Thanks in advance & kind regards,

Bert Arnold and Martin Op 't Land
PhD researchers in the field of Organization Engineering and Business Connectivity

Context

1 The goals of ING SEC.

1.3 To what extent are the ING SEC business goals at Foundations-time (2002-Q2) still valid today (2004-Q1)? *(completely valid/somewhat valid/somewhat invalid/completely invalid)*

Short term goals

- cost-reduction in operations
- synergy
- professionalize (best-of-breed)
- economies of scale
- broader access of ING Group capabilities
- increase in international use of local specialisation (to enable global serving)
- decrease of only locally used specialisation

Long term goals

- supporting new distribution channels
- simplifying in-/outsourcing
- simplifying entering/leaving alliances; including adapting agreements in the alliances

2.3 How often will ING SEC departments/units/ICT-systems be using each other's services, regardless their traditional borders of geography and "label" (realized or planned within say 2 years)? *(frequent/not uncommon/some/no)*

- How often are ING SEC business units using services outside their traditional borders of geography and "label"?
- How often are ING SEC business units supplying services outside their traditional borders of geography and "label"?
- How often are ING SEC ICT-units using services/ICT-systems outside their traditional borders of geography and "label"?
- How often are ING SEC ICT-units supplying services/ICT-systems outside their traditional borders of geography and "label"?
- How often are ING SEC ICT-systems using the IFSA-bus for mutual services-requesting and -delivery?

3.3 Can you give us some examples of mutual use of services outside traditional border of geography or "label" (realized or planned within say 2 years)?

- Supplying unit (name)
- Type of unit
- Customer unit(s)
- Service(s) supplied
- Rough quantification (% of "foreign" work for supplying unit)

4.3 Are the requirements for automated Information Systems at Foundations-time (2002-Q2) still valid today (2004-Q1)? Information Systems goals

ING SEC 2002-Q2 still valid today (2004-Q1)? *(completely valid/somewhat valid/somewhat invalid/completely invalid)*

- consistent time-to-market
- offer insourcing / white-labeling
- enable 3rd party / outsourcing solutions

Flexibility

- workflow can be changed easily
- multi-lingual, multi-location
- multi-unit workflow-management, including auditing-capabilities
- portability: multi-ICT-platform
- connectivity / interoperability

IFSA-compliance

- service-based architecture
- message-based communication

2 Familiarity with Architecture2002

Architecture2002 = result Foundations-programme, as drafted in the first half of 2002.

2.1 How familiar are you with Architecture2002? *(very well known/familiar/remotely known/completely unknown)*

- over-all, as a whole
- Target Business Architecture (TBA)
- Target Operational Model (TOM)
- Current Operational Model (COM)
- Recommended Operational Model(COM)
- Target Application Architecture (TAA)
- Current Application Architecture (CAA)
- Recommended Application Architecture (RAA)

2.2 Has Architecture2002 formally been communicated to you? *(yes/no)*
If your answer is "no", please skip the next question (2c) and continue with question 2d.

2.3 Architecture2002 has been communicated to you: with what authority? *(mandatory/recommended/best practice/for your information)*

2.4 Between Foundations-time (2002Q2) and now the primary responsibility for the Securities Domain shifted from FCOO to the shared responsibility of both FCOO and FCIO. What effect did this have on the perceived importance of Architecture2002? *(increased very much/increased moderately/did not change at all/decreased moderately/decreased very much)*

- the over-all importance
- the importance for ICT
- the importance for Operations

3 Ex-ante valuation of Architecture2002

3.1 Is the Architecture2002-result compliant with the business-goals of ING SEC at Foundations-time (2002-Q2)? *(completely compliant/ somewhat compliant/somewhat incompliant/completely incompliant)*

Short term goals

- cost-reduction in operations
- synergy
- professionalize (best-of-breed)
- economies of scale
- broader access of ING Group capabilities
- increase in international use of local specialisation (to enable global serving)
- decrease of only locally used specialisation

Long term goals

- supporting new distribution channels
- simplifying in-/outsourcing
- simplifying entering/leaving alliances; including adapting agreements in the alliances

3.2 Is the Architecture2002-result compliant with the Information System goals of ING SEC at Foundations-time (2002-Q2)? *(completely compliant/ somewhat compliant/somewhat incompliant/completely incompliant)*

- consistent time-to-market
- offer insourcing / white-labelling
- enable 3rd party / outsourcing solutions

Flexibility

- workflow can be changed easily
- multi-lingual, multi-location
- multi-unit workflow-management, including auditing-capabilities
- portability: multi-ICT-platform
- connectivity / interoperability

IFSA-compliance

- service-based architecture
- message-based communication

4 Expectation of use of Architecture2002.

4.1 Did you expect Architecture2002 to be useful? *(highly useful/useful/ somewhat useful/not at all useful)*

- over-all, as a whole
- Target Business Architecture (TBA)
- Target Operational Model (TOM)
- Current Operational Model (COM)
- Recommended Operational Model(COM)
- Target Application Architecture (TAA)
- Current Application Architecture (CAA)
- Recommended Application Architecture (RAA)

4.2 For what purpose did you expect Architecture2002 to be useful?

4.3 A specific aspect of Architecture2002 is the use of "responsibilities" as building blocks. Did you expect this concept to be useful? *(highly useful/useful/ somewhat useful/not at all useful)*

Conservation of the Arch2002-effects in Design2003

Design2003 = status Dec2003 of design of ING SEC concerning its processes and ICT

We ask you to answer the questions in this paragraph considering the roles you played. As a role we define:
- a (line-)-management position within a specific department OR
- a function within a specific project

We asked you to answer the questions for up to three roles. If you have more roles, consider the three most important ones. So when you participated as a projectteam-member in two projects, that means that you have had two roles.
1

1.1 Please indicate the (up to three) most important roles you played.

- Position or function
- Department or project
- Period of your participation

  If you mentioned above a role within a specific project please indicate now:
  – the phases in which you participated
  – the current phase of the project
  – the aspect areas covered by your role in the project

  If you mentioned above a role within a specific project please indicate now:
  – the phases in which you participated
  – the current phase of the project
  – the aspect areas covered by your role in the project

- Project phases in which you participated *(design/implementation/ roll-out/first results)*
- Current phase of the project *(design/implementation/roll-out/first results)*
- What areas where covered by your role in the project? *(operations/applications/ other area)*

1.2 In the (up to 3) roles you just stated, in your opinion, can the effects intended in ING SEC business goals in 2002-Q2, be expected from Design2003? *(completely/somewhat/not really/totally not)*

Short term goals
- cost-reduction in operations
- synergy
- professionalize (best-of-breed)
- economies of scale
- broader access of ING Group capabilities
- increase in international use of local specialisation (to enable global serving)
- decrease of only locally used specialisation

Long term goals
- supporting new distribution channels
- simplifying in-/outsourcing
- simplifying entering/leaving alliances; including adapting agreements in the alliances

1.3 In the (up to 3) roles you just stated, in your opinion, can the effects intended in ING SEC information system goals in 2002-Q2, be expected from Design2003? *(completely/somewhat/not really/totally not)*

- consistent time-to-market
- offer insourcing / white-labelling
- enable 3rd party / outsourcing solutions

Flexibility
- workflow can be changed easily
- multi-lingual, multi-location
- multi-unit workflow-management, including auditing-capabilities
- portability: multi-ICT-platform
- connectivity / interoperability

IFSA-compliance
- service-based architecture
- message-based communication

1.4 Are the subdivisions / cuts in Design2003 really the best ones to realize the Foundation-goals? Please specify for the roles (+projects) you mentioned before. *(always/most of the time/sometimes/no, not at all)*

1.5 Was the concept of "responsibilities" as building blocks in Architecture2002 a useful contribution to the realization of the Foundations-goals? *(highly useful/useful/somewhat useful/not at all useful)*

On design-considerations (and -process)

1

1.1 Judging from your experience in the above mentioned roles/projects, what criteria for sub-divisions / cuts in organization and ICT have been important in Design2003? If you want, you can add your own criteria. *(most important / quite important / somewhat important / not at all important)*

- subdivision central / decentral
- subdivision retail / wholesale
- subdivision by service-level

1.2 In your opinion, why have those criteria for subdivision / cuts in organization and ICT, generally speaking, have had this degree of importance in Design2003?

1.3 Do the subdivisions / cuts in organization and ICT which are / have been made in Design2003 comply with "the theory" from Architecture2002 (TBA/TAA/TOM etc.)? or did you follow a completely different approach? *(yes / in-between, namely . . . / no / completely different, namely . . .)*

1.4 What caused this degree of compliance between the subdivisions / cuts in Design2003 with the ones in Architecture2003?

1.5 Looking back, has Architecture2002 been useful to you in Design2003?

1.6 Did you expect Architecture2002 to be useful? *(highly useful/useful/ somewhat useful/not at all useful)*

- over-all, as a whole
- Target Business Architecture (TBA)
- Target Operational Model (TOM)
- Current Operational Model (COM)
- Recommended Operational Model(COM)
- Target Application Architecture (TAA)
- Current Application Architecture (CAA)
- Recommended Application Architecture (RAA)

1.7 What roles of Architecture2002 were important in creating Design2003? *(most important/quite important/somewhat important/not at all important)*

- directing conceptualization TO BE
- reduction of complexity
- controlling redundancy in organization and ICT
- easily scoping projects
- easy control of concurrent projects
- easily assigning responsibilities for operations and ICT in the final situation
- supporting cost-effective choices between projects
- protecting investments by future-proof choices
- better business – ICT alignment
- improving staff motivation
- encouraging constrained innovation

1.8 What part of Architecture2002 were dispensable? *(not dispensable / partly dispensable, namely . . . / totally dispensable*)

- Target Business Architecture (TBA)
- Target Operational Model (TOM)
- Current Operational Model (COM)
- Recommended Operational Model(COM)
- Target Application Architecture (TAA)
- Current Application Architecture (CAA)
- Recommended Application Architecture (RAA)

1.9 What should have been part of Architecture2002 (and is not in it now)?

Summarizing

1 In your opinion, to what extent is realizing the Foundations-goals caused by Architecture2002 & why?

2 Could you please comment on the following proposition:
The building-blocks of Architecture2002 (especially the responsibilities) appeared to be a decisive factor for guaranteeing the goals of Foundations during Design2003.

3 Any other remarks?

C

Explanation selected general criteria

For each of the general criteria – the selected professional functional principles we mentioned in Table 4.1 and the organization construction rules we mentioned in Table 4.2 – we listed in Table C.1 and Table C.2 some remarks e.g. about how they have been applied, what is the rationale and what are its main parameters.

Table C.1. Remarks on the selected professional functional principles

code	Professional functional principle	remarks (example, rationale, metrics)
PF01	better quality of operations	also called operational excellence; aim at smooth, error-free and efficient operations
PF02	more flexibility in service levels	the same organizational entities (including its ICT-supply) should be able to offer the same service with different service-levels. Parameters for such service-levels include timeliness, service-times, correctness and the range of order types accepted
PF03	accelerated operations	speed up operations, shorten customer response time, e.g. differentiated as batch, real time, near real time
PF04	accelerated time-to-market	bring new products faster to the market
PF05	lower operational costs	this is typically the focus of a cost-leader in the terminology of Porter (1980); these costs not only include fte's, suppliers, error-repair, manual interventions etc but also ICT-related costs for development, maintenance and license fees
PF06	increased turnover	

code	Professional functional principle	remarks (example, rationale, metrics)
PF07	client centricity	the external part of the concept known as customer-intimacy (Treacy and Wiersema, 1993). The customer experiences attention, closeness and flawless service; he gets tailored and services across lifetime events. This concept is also used by public organizations; in the end, the general public (citizen, enterprise, tax-payer) should be in focus.
PF08	customer ownership	the internal focus needed to deliver customer-intimacy (Treacy and Wiersema, 1993), e.g. give decision authority to employees that are close to the customer, deliver products and services On Time and Above Customer Expectations (OTACE). Like ING says "All customers are ultimately ING customers. We go for maximum customer value across the whole ING organization"
PF09	multi-channel offering ability	offer the customer several channels and let them choose

Table C.2. Remarks on the selected organization construction rules

code	Organization construction rule: keep actors together, when ...	remarks (example, rationale, metrics)
PC01	... their mutual interface cannot well be standardized, due to complexity	e.g. in the ordering of highly unique and specialized (idiosyncratic) products like a oil refinery; inspired by B.1 from Williamson's questions (Williamson, 1987, p 97) "B. Design and asset aspects; 1. Does the item in question have special design features? Should it?"
PC02	... their mutual interface cannot well be standardized, due to frequent change	e.g. in ordering products, which are every time just different; inspired by C.2 from Williamson's questions (Williamson, 1987, p 97) "C. Contracting aspects; 2. Are there frequent needs to adapt the exchange relation to unanticipated disturbances?"

code	Organization construction rule: keep actors together, when ...	remarks (example, rationale, metrics)
PC03	... they cannot have a supporting role for other actors	if one actor uniquely exists to support one other actor, this could be a reason to keep them together in one organization; the other way around, if the result of an executing actor can be used by more than one initiating actor - directly visible in the DEMO CM - this can be a reason to put this executing actor in a separate organization and let him share the results between all initiators
PC04	... they use the same language / culture	
PC05	... they operate under the same regulatory, legal and tax-regime	Counterexample if not the same regulations apply: in many countries the Customer Facing Unit for fund administration has to act as a sub custodian in the local market, due to depository requirements; therefore those securities transactions need to be processed locally in the country
PC06	... they more or less work on the same case / deal with the same event	e.g. Securities Registration needs to be performed at the same time as a trade is settled ⇒ keep Registration and Settlement together
PC07	... the risk to fail (in banking sector: operational risk) of a split is unacceptably high	e.g. the operational risk of Clearing to be offered without Settlement is too large ⇒ keep Clearing & Settlement together
PC08	... they need comparable competencies	if competencies for two different actor roles are always combined in the same persons, this indicates a strong coherence ⇒ keep together
PC09	... a (business) transaction-relationship exists between them	
PC10	... an information-relationship exists between them	more precisely, if actor 1 needs information about the production of actor 2
PC11	... they have High Internal Cohesion and Low External Coupling (HICLEC)	

D

Explanation of some nonselected general criteria

In the selected case studies, as well as in literature on organization science and general system theory, sometimes other criteria have been mentioned. Without any pretension to be complete, Table D.1 and Table D.2 briefly underpin why some of the more often heard criteria have not been included in the general criteria of Table 4.1 and Table 4.2.

Table D.1. Remarks on non-selected candidate professional functional principles

code	candidate professional functional principle	why not included, other remarks (example, rationale, metrics)
NF01	better return on investment	not included, because the key components of return on investment turnover and costs have already been included in the criteria (PF06 resp. PF05)
NF02	one solution for the same function	= realize one solution for the same function within one country / one control layer, preferably also across the borders of countries / control layers. Not included, because working with the DEMO CM automatically fulfills this criterion; indeed, all transactions of the CM are defined in terms of their result and no two transactions in the same CM deliver the same result
NF03	open architecture	= new roles can easily be connected or disconnected, including the ICT-support needed. Not included, because it is not a criterion to split an organization on a different spot, but it is a principle to implement a previously given organization split.

code	candidate professional functional principle	why not included, other remarks (example, rationale, metrics)
NF04	fit with business goal	= the test "given a business goal, does this activity or responsibility fit to it?" A fundamental criterion, signaled by Eisenhardt (1989) in his agency problem = the problem that arises when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing. This criterion has not been included in the general criteria, because in order to be a testable citerion, the business goals have been operationalized in the situation specific criteria, in this case for Rijkswaterstaat and Deltares.

Table D.2. Remarks on non-selected candidate organizational construction rules

code	candidate organization construction rule: keep actors together, when ...	why not included, other remarks (example, rationale, metrics)
NC01	... sufficient similarity in services exists	Even the classic differences in service requirements between retail and wholesale customers were not considered to be a reason to split in the ING-case; it could be solved by "flexibility in service level" in delivering the same service. Not included, because in a DEMO-CM this criterion is automatically applied. Indeed, every CM transaction is defined in terms of its result, the delivered service; no two transactions in the same CM deliver the same result; therefore each service is mentioned only once in the delivery chain.

code	candidate organization construction rule: keep actors together, when ...	why not included, other remarks (example, rationale, metrics)
NC02	... sufficient similarity of events/work exist	Examples of the applicability of this criterion: • e.g. regularity reporting is mainly country-specific, so was kept at ING's Local Factory • e.g. for compliance both local and global knowledge is required, so Compliance was put in ING's Common as well as in its Local Factory • e.g. the management of ROOD's operational software applications (issuing of rules, innovation, security) • e.g. the invoicing for the different product lines of Lehnkering Not included, because in a good DEMO CM no different transactions with the same result exist.
NC03	... same order types occur	Different order types can be a reason to split; e.g. in the ING-case an instrument-specific split for the processes for cash securities and derivatives, because order routing & clearing is different. Also difference in complexity can be a reason to split; e.g. in the ING-case corporate actions for retail (standardized, mass processing, fixed procedures) differed in complexity with corporate actions for wholesale (customer-focused, tailored). Not included, because in a good DEMO CM already results of the same order type are combined in one transaction type.
NC04	... it offers opportunities to simplify and rationalize connections with external (especially supplying) parties	For this reason ING brought together its "street side securities processing" (dealing with connections to Exchanges, Clearers and Settlers) in the Common Factory. When suppliers do not offer integrated capabilities, then this stimulates decentralization in the own organization: "external decentralization drives internal decentralization". Not included; whether it is possible to simplify the external organizational interface is already tested by criterion PC01.

code	candidate organization construction rule: keep actors together, when ...	why not included, other remarks (example, rationale, metrics)
NC05	... actors are highly interdependent	For this reason ROOD put its first line support for software applications in using departments, not in the department which manages operational software applications (in issuing rules, innovation, security). Not included; this is roughly the same as the over-all HICLEC-criterion, for which all other professional principles should be an operationalization.
NC06	... commercial unity exists	i.e. no commercial offering is thinkable in which the results of two different transactions will be offered separately Not included, because it is a special case of the inverse of criterion PC01, that an actor has only a supporting role for other actors.
NC07	... the events have low frequency	ROOD (Mulder, 2006, p 106) uses "ensuring continuity" as a criterion to provide scale and to bring together more people with the same competence, who are now scattered over separate units. Not included, because already covered by other criteria: • PC08 about comparable competences, when it concerns underutilization / scattering of competences of people • PC02 about frequently changing organizational interfaces
NC08	... the events occur on a small scale	see NC07
NC09	... integrated information has to be delivered	ROOD: the need for integrated information (on subjects – like a stolen car – or events – like number of murders during a period in a region) is increasing, so that delivering this is now considered a separate (information) product, the delivering of which deserves an own responsibility in the organization. Not included: in the ROOD-case apparently a new informational actor had to be discerned; apart from criterion PC10 about information relationship between actors it does not give a criterion in itself to put this role in organization 1 or 2.
NC10	... reusing existing knowledge/facts is important	Mentioned in ROOD: When people are scattered over an organization, they do not know certain facts are known already, therefore redundant inquiries are being made. Not included: this is already clear from the CM's information links and tested by criterion PC10 about information relationship between actors.

E

Graph-theory and organization splitting

The following text we gladly adopted from Vree (2007).

E.1 The min-cut algorithm and organization splitting

An example graph

Consider the problem of dividing a graph into two parts. The links in the graph have a weight. When the graph is split some links will be cut. We want to minimize the sum of the weights of the links that are cut. This is called the minimal cut of the graph.

The graph could model an organization. The nodes could be actors in the organization and the weights could represent the importance of their relations. When a reorganization requires a division, the minimal cut could be the best way to allocate the actors to the two new parts of the organization

The tree of minimal cuts

The so called min-cut algorithm of Gomory-Hu (Gomory and Hu, 1961) finds the minimal cut between all pairs of nodes in a graph. The result of this algorithm is a tree with the same nodes as the graph, but where each link represents a cut in the original graph. The Gomory-Hu tree of the example graph from Fig. E.1 is shown in Fig. E.2.

For example, when we remove the (red) link between A5 and A8 from this tree, two subtrees remain: A4,A5,A6,A7 on the right side and A8,A9,A1,A2,A3 on the left side. The weight of the link we just removed is 4. This happens to be precisely the sum of the weights of the links that are cut by this partitioning in the original graph. It is the minimal cut between the nodes A5 and A8.

The best split

Fig. E.3 shows the minimal cut we just described. The sum of the weights of the cut links is 4. In the Gomory-Hu tree it is the (in Fig. E.2 red) link between the nodes A5 and A8.

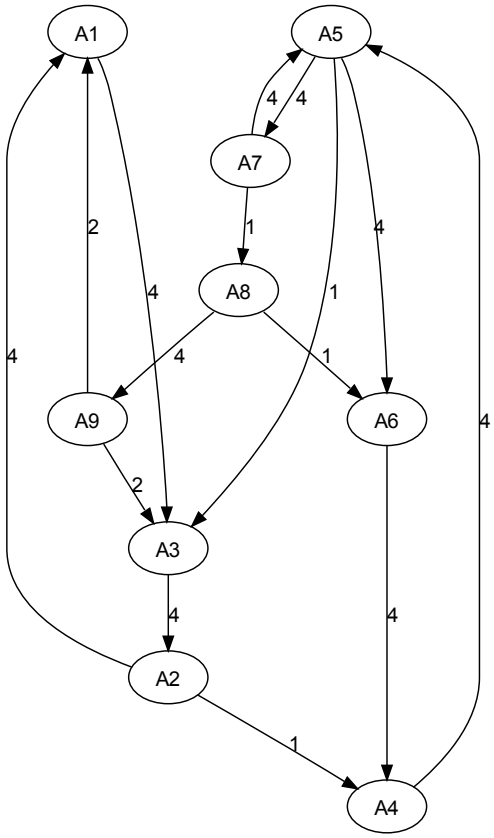

Figure E.1. An example graph

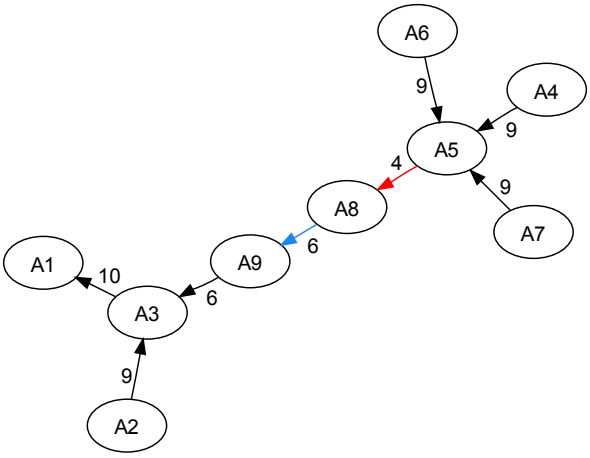

Figure E.2. Tree of minimal cuts

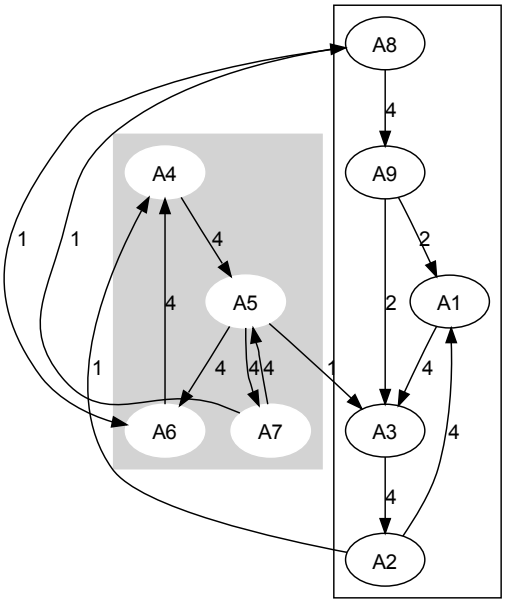

Figure E.3. The best split

One of the two next best alternatives

Fig. E.4 shows the next best minimal cut. In the Gomory-Hu tree it is the (in Fig. E.2 blue) link between nodes A8 and A9. The sum of weights of the cut links is 6.

Multi-cluster algorithm

Newman (2002) defined a quantity called *modularity*. It ranges from 0 (bad) to 1 (best) and is a measure for the internal coherence of a given clustering of nodes in a weighted graph. It is a balance between the sum of the weights of links between clusters (negative contribution) and the sum of the weights of links that remain within a cluster (positive contribution). In a random graph the modularity is close to zero for all clusterings. In a graph with no links between clusters (only links within clusters) the modularity approaches 1. A search algorithm can look for the highest modularity over all possible clusterings. For 2 clusters this algorithm gives the same result as the min-cut algorithm in the case of the current example graph. For 3 clusters the optimal clustering is shown in Fig. E.5. The modularity is 0.4.

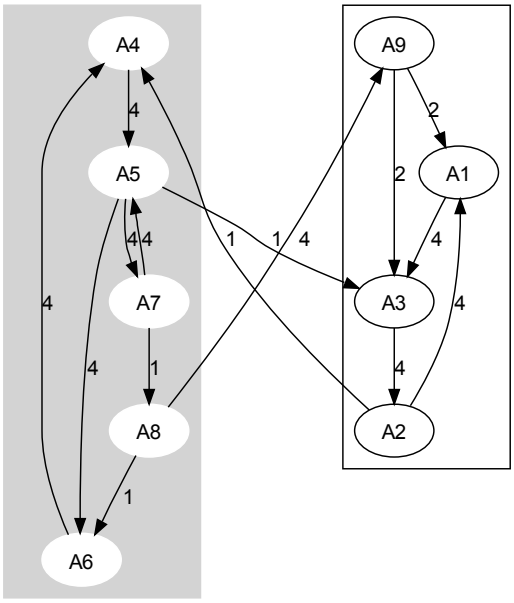

Figure E.4. One of the two next best alternatives

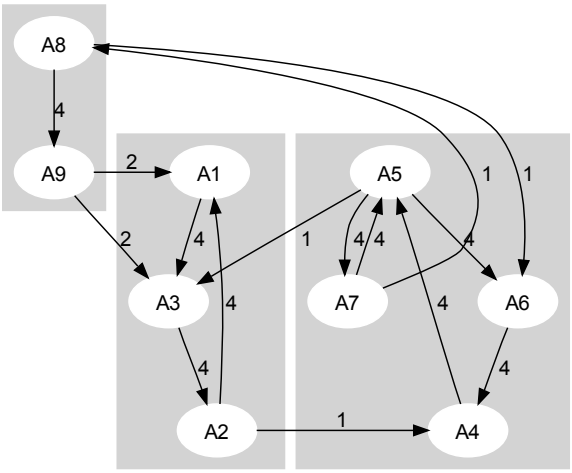

Figure E.5. Optimal 3-clustering

E.2 On modularity versus mincut in organization-splitting

An example graph 1 (Fig. E.6)

This example graph 1 contains three nodes with strong coupling to each other and weak coupling to the rest. These nodes are labeled B1, B2 and B3.

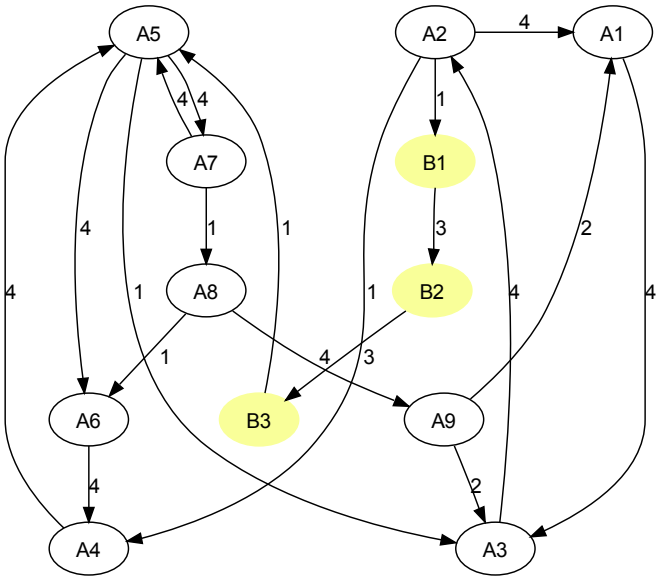

Figure E.6. Example graph 1

Gomory-Hu tree 1

Fig. E.7 shows the Gomory-Hu tree of example graph 1. The minimal cut in this tree is the link between A3 and B1. The weight of the cut is only 2, the smallest value in the tree. Removing this link from the tree results in two subtrees: B1, B2 and B2 on one side, the rest of the nodes on the other side.

The minimal cut 1

Fig. E.8 shows the minimal cut, which isolates nodes B1, B2 and B3, cutting only two edges with weight 1. However, this partitioning appears not to have a good modularity (only 0.19). This is because the cluster with the B-nodes is too small. The contribution of the internal links to the modularity is not optimal. The partitioning with the best modularity (for two partitions) is shown in Fig. E.9.

Best modularity with two clusters (Fig. E.9)

Although the sum of the weights of the links that are cut is now 4, this negative effect is more than compensated by the positive effect of the many internal links to the modularity (0.4, more than twice the value of the mincut).

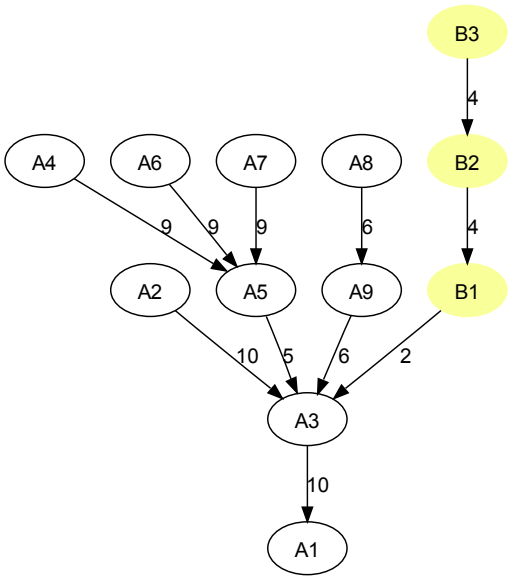

Figure E.7. Gomory-Hu tree 1

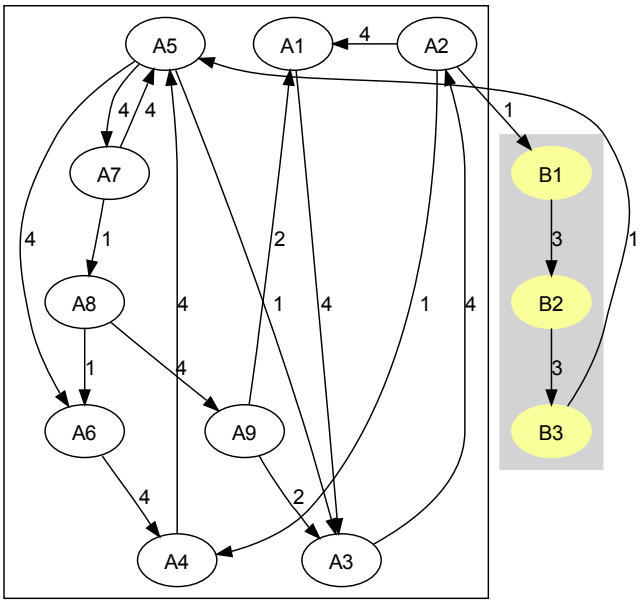

Figure E.8. The minimal cut 1

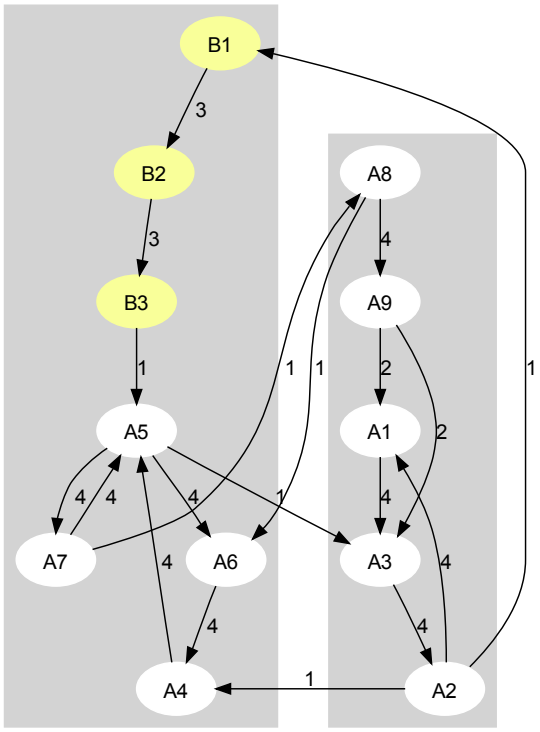

Figure E.9. Best modularity 1, with two clusters

Best modularity with three clusters (Fig. E.10)

It is interesting to note that the cluster with B-nodes reappears in the optimal division of the graph into three clusters. This is probably because the average size of the clusters approaches that of the B-node cluster. So the smallness of this cluster is no longer a disadvantage.

E.3 Centrality versus modularity and mincut in organization-splitting

An example graph 2 (Fig. E.11)

This graph contains two clusters (brown and green) that are richly interconnected but the links carry only a low weight (1). The two links that connect the intended clusters, however, have a large weight (A1→A5 and A3→A7). We will use the centrality measure to partition the graph. The centrality of a link measures the number of shortest paths that go through that link. To calculate this measure the shortest paths are computed between all node pairs. Then, for every link the fraction of shortest path that go through that link is determined. The result of this measure for the example graph is shown in the next figure (Fig. E.12).

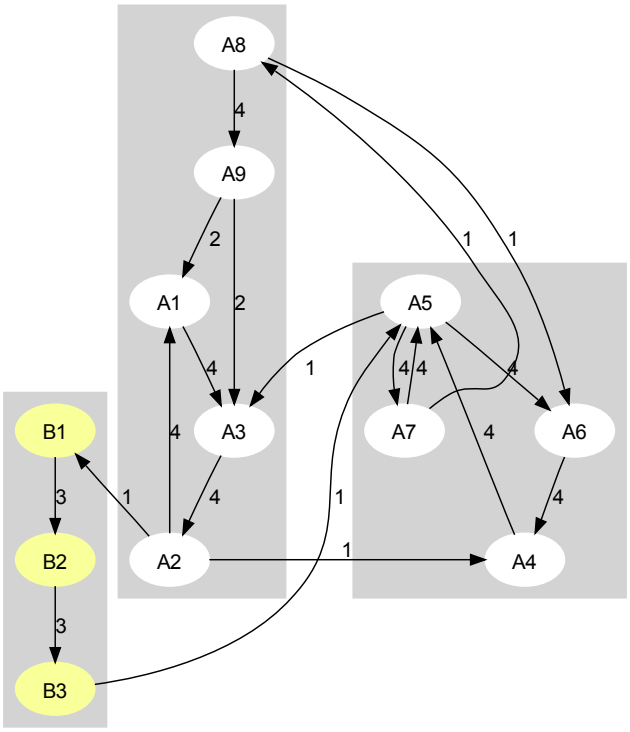

Figure E.10. Best modularity 1, with three clusters

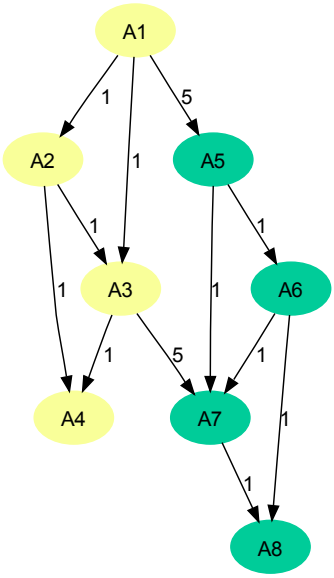

Figure E.11. Example graph 2

Centrality measure (Fig. E.12)

The link labels now indicate the fraction of shortest paths that go through this link. The link with the highest fraction of shortest paths is A3→A7 (20.3) and then follows A1→A5 with 11.7. This confirms our intuition on shortest paths when we look at the original graph. Both links have a central position between the two intended clusters. The centrality algorithm now reasons as follows: A link with a high centrality is probably a link between two clusters (because many shortest paths go through it). Links with the highest centrality are deleted until the graph falls apart and shows the required number of clusters. For two clusters the result is shown in the next figure.

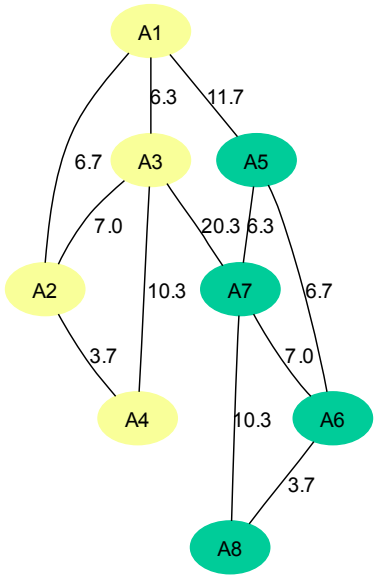

Figure E.12. Centrality measure 2

Centrality clustering (Fig. E.13)

The two heavy weighted links carry most of the shortest paths, in spite of their high weight (5). These links are deleted by the algorithm and the intended brown-green structure is found. The following pictures (Fig. E.14, Fig. E.15 and Fig. E.16) show that neither the modularity nor the mincut is able to find this structure.

The best modularity 2 (Fig. E.14)

The modularity algorithm is not able to find the intended clusters. It tries to equally divide the heavy weighted links over the two clusters (and, at the same time, to establish a minimal cut through the remaining low weighted links)

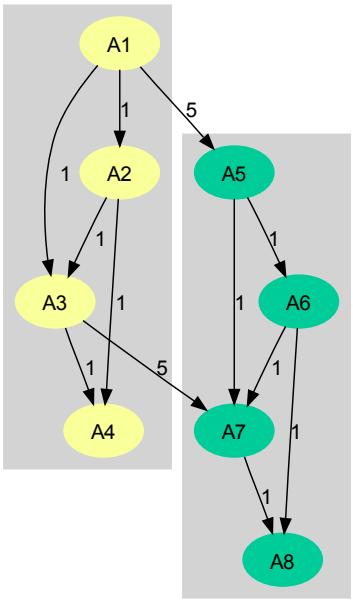

Figure E.13. Centrality clustering 2

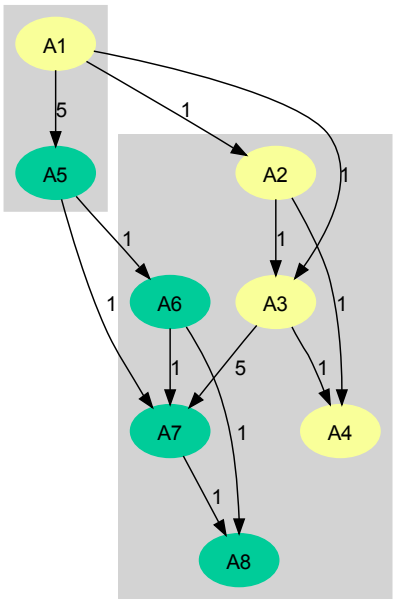

Figure E.14. Best modularity 2

The Gomory-Hu tree 2 (Fig. E.15)

The mincut tree also does not show the intended clusters. The large weights on the inter-cluster links will never allow for a minimal cut through these links. The minimal cut in this tree just cuts off the single node A4 (or A8).

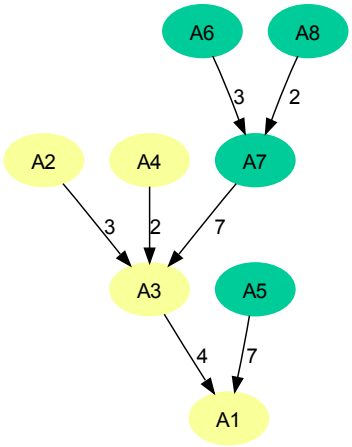

Figure E.15. Gomory-Hu tree 2

The third best minimal cut 2 (Fig. E.16)

The largest cluster size in the mincut tree is almost the intended clustering. However, node A5 is, of course, not cut at the heavy weighted link, but at the two low weighted links.

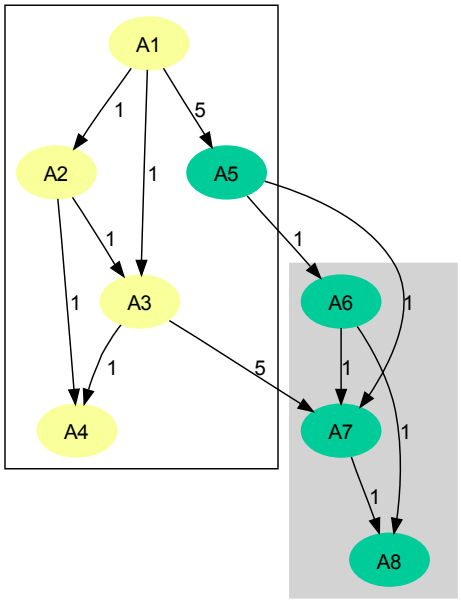

Figure E.16. Third best minimal cut 2

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Samenvatting (Summary in Dutch)

Applying Architecture and Ontology to the Splitting and Allying of Enterprises
Architectuur en ontologie toegepast op het splitsen en samenwerken van organisaties

In 't kort Organisaties splitsen in toenemende mate delen af en gaan daarmee samenwerken, zoals in Shared Service Centers of bij in- en uitbesteding. Wat is de plaats en manier om die organisatieknip adequaat te maken? En over welke onderwerpen dienen organisaties het eens te worden, wil er effectief worden samengewerkt na de organisatieknip? Om dit vraagstuk voor managers bestuurbaar te maken is action research toegepast op vier grote case-studies, waarin architectuur en ontologie werden gebruikt. Dit heeft geresulteerd in een instrument om organisatiesplitsing, samenwerking en post-fusie integratie te ondersteunen, bestaande uit (1) organisatie-constructieregels, (2) algoritmen om een plausibel organisatieknipvoorstel te berekenen, (3) een methode om onderwerpen voor contractering van de gesplitste organisaties te vinden, en (4) een getoetste combinatie van dit alles in een werkwijze met (5) inzicht in de verwachte kosten en baten daarvan. Toekomstig onderzoek dient dit instrument breder bruikbaar, verdergaand getest en sneller in beslissingsondersteuning te maken, en het dient de wederzijdse afhankelijkheid van organisatie- en ICT-splitsing te verhelderen.

Aanleiding

Bestuurders en managers van zowel profit als non-profit organisaties staan voor een veelheid aan keuzemogelijkheden in het organiseren van hun *extended* enterprise. De gebruikelijke keuzes van centralisatie en decentralisatie hebben zich uitgebreid met die van Shared Service Centers, Business Process Outsourcing en allerlei vormen van *shoring*. Klassieke motieven van kostprijsleiderschap, klantintimiteit en productleiderschap krijgen wereldwijde dimensies. En ze worden aangevuld met de eisen van de Next Generation Enterprise om beweeglijk te zijn en snel nieuwe diensten en producten te creëren door het opknippen van de organisatie en het handig samenwerken met andere partijen. Beslissingen om de organisatie te knippen dienen dus vaker, sneller en toch goed onderbouwd te worden genomen in een complexere context.

Eerder onderzoek toonde aan dat een model van de essentie van een organisatie – een *Enterprise Ontologie* volgens Dietz (2006) – in de praktijk bruikbare organisatiebouwstenen levert voor dit soort beslissingen over organisatie-knip en -samenwerking. Weinig is echter bekend over welke beslisregels daarbij worden

toegepast. Ons onderzoek spoorde deze organisatie-constructieregels op en paste die toe, gebruikmakend van ontologie en architectuur. Architectuur is hier bedoeld als een bewuste inperking van ontwerpvrijheid en bevat dus ook algemene organisatiekundige richtlijnen.

Aanpak

Zoals de onderzoeksmethode *action research* aangeeft wordt het antwoord stapsgewijs gevonden in een herhalende cyclus van interventie, validatie, reflectie en een aangepaste interventie-aanpak. Uit de ruime praktijkervaring van de onderzoeker als consultant met een methodologisch leidinggevende rol werden vier cases geselecteerd:

1 In 2001 begon ING Europa met invoering van Shared Service Centers (SSCs) voor primaire processen om operationele synergie te bereiken, en daarmee zowel kostenreductie als kwaliteitsverbetering. In Foundations – ING's programma om het SSC Effecten op te richten – werd een aanpak ontwikkeld en uitgevoerd waarin DEMO-transacties werden gebruik om de stabiele kern van het effectenbedrijf te beschrijven. Het nut van deze aanpak werd in 2004 gemeten.
2 Vanaf 2005 vond bij Rijkswaterstaat, onder directe aansturing van de CFO en CIO, een grootschalig applicatie portfolio rationalisatieprogramma plaats. Het Enterprise Architectuur Rijkswaterstaat team gaf dit programma mede vorm door een deel van een Enterprise Ontologie als stabiele beschrijving van het bedrijf te gebruiken – transacties uit het DEMO Constructie Model voor Droog Verkeersmanagement werden hierbij direct aan applicaties gekoppeld.
3 Als onderdeel van het oprichten van een Nederlandse onderzoeksinstituut op het gebied van Deltatechnologie (Deltares), diende in 2007 delen van Rijkswaterstaat op het gebied van Waterkwantiteit te worden afgesplitst. Gebruikmakend van zowel actoren uit een DEMO Constructie Model als organisatiekundige criteria werd aan een expert-meeting de organisatieknip-keuze voorgelegd. Experts werden gevraagd uit de vrije hand (op buikgevoel) hun organisatiekeuze te maken, en daarnaast gevraagd te kiezen uit voorgedefinieerde alternatieven. Deze alternatieven waren gebaseerd op het *Hoge Interne Samenhang, Lage Externe Koppeling* criterium – berekend met het grafentheoretische min-cut algoritme – op een manier die het toetsen van businessafhankelijkheden versus informatieafhankelijkheden mogelijk maakte.
4 Als vervolg op het oprichten van Deltares in 2007 diende delen van Rijkswaterstaat op het gebied van Waterkwaliteit, Ecologie en Emissies te worden afgesplitst, waarmee nadien zou worden samengewerkt. We testten opnieuw onze methode om onderbouwde keuzes over de organisatieknip te maken, en breidden die uit met een manier om compleetheid in het contracteren te waarborgen. Uitgaand van een DEMO Constructie Model werd experts gevraagd om een "buikgevoel"-organisatieknip te formuleren en om systematisch contractonderwerpen op te sommen. De voorgestelde organisatieknip werd vervolgens vergeleken met enkele grafentheoretisch berekende alternatieven, waarbij opnieuw de invloed van businessafhankelijkheden werd vergeleken met die van informatieafhankelijkheden.

Resultaten en toegevoegde waarde

Het onderzoek heeft geresulteerd in een instrument om organisatiesplitsing, samenwerking en post-fusie integratie te ondersteunen, bestaande uit (1) organisatie-constructieregels, (2) algoritmen om een plausibel organisatieknipvoorstel te berekenen, (3) een methode om onderwerpen voor contractering van de gesplitste organisaties te vinden, en (4) een getoetste combinatie van dit alles in een werkwijze met (5) inzicht in verwachte kosten en baten daarvan, de zogenaamde *Return On Modeling Effort* (ROME). De basis van dit instrument wordt gevormd door de DEMO-concepten van actor en transactie – zelf inrichtingsonafhankelijk –, die nuttig bleken te zijn als "taal" om implementatiebeslissingen voor organisatie en ICT in uit te drukken.

Ad 1 – Organisatie-constructieregels. Wij vonden de organisatie-constructieregels in onderstaande tabel door (a) een bottom-up analyse van scripts van praktijkcases waarin architectuur en ontologie werden gebruikt – aan het *grounded theory* criterium dat de gezochte regels daadwerkelijk in de praktijk zijn aangetroffen en gebruikt is daarmee voldaan – aan te vullen met (b) een top-down analyse van organisatiekundige literatuur. In twee cases hebben we tevens de organisatie-constructieregels PC09, PC10 en PC11 getoetst, leidend tot non-falsificatie van de zogenaamde BI-hypothese – *Businessafhankelijkheden zijn belangrijker dan Informatieafhankelijkheden bij het beslissen over de organisatieknip*.

code	*Organisatie-constructieregels*: houdt actoren bij elkaar, als ...
PC01	... hun onderlinge *interface* niet goed gestandaardiseerd kan worden wegens *complexiteit*
PC02	... hun onderlinge *interface* niet goed gestandaardiseerd kan worden wegens *snelle veranderingen* daarin
PC03	... ze *geen ondersteunende rol kunnen hebben* voor andere actoren
PC04	... ze *dezelfde taal / cultuur* gebruiken
PC05	... ze opereren onder *hetzelfde toezichthoudende, wettelijke en fiscale regime*
PC06	... ze min of meer werken *aan dezelfde case / afhandeling van dezelfde gebeurtenis*
PC07	... het *afbreukrisico* (in de bancaire sector: *operationeel risico*) van een organisatieknip onaanvaardbaar hoog is
PC08	... ze *vergelijkbare competenties* nodig hebben
PC09	... er een *(business) transactie-relatie* tussen hen bestaat
PC10	... er een *informatie-relatie* tussen hen bestaat
PC11	... ze Hoge Interne Samenhang, Lage Externe Koppeling – in het Engels: *High Internal Cohesion, Low External Coupling* (HICLEC) – hebben

Ad 2 – algoritmen om een plausibel organisatieknipvoorstel te berekenen. Door het DEMO Constructie Model van een enterprise op te vatten als een graaf met gewogen takken, is het mogelijk en nuttig gebleken om organisatie-alternatieven te berekenen, waarbij gebruik gemaakt werd van het *minimum Penalty* (minP) (NL:

minimale boete) en het *maximale Modulariteit* (maxM) criterium en de bijbehorende grafentheoretische algoritmen. Het "buikgevoel"-organisatie-alternatief van experts bleek dicht aan te liggen tegen de (niet-triviale) berekende organisatie-alternatieven. Dit expliciete inzicht in afhankelijkheden maakte een bewuste afweging tussen organisatie-alternatieven door management en andere experts mogelijk: *als iemand van het berekende alternatief wil afwijken, zal hij zich nu bewuster zijn van de prijs daarvan*.

Ad 3 – een methode om onderwerpen voor contractering van de gesplitste organisaties te vinden. Met een compleet DEMO Constructie Model – inclusief informatielinks – als uitgangspunt werden experts gefaciliteerd in het systematisch opsommen van contractonderwerpen over (a) eigenaarschap van bezittingen, (b) kwaliteit van de bedrijfs- en informatie-diensten, en (c) kritieke keten-afhankelijkheden. Deze wijze van inventariseren hielp om – snel en met draagvlak – daaropvolgende implementatiestappen te bepalen, bijvoorbeeld om wederzijdse informatievoorziening te waarborgen en prestatie-indicatoren te formuleren.

Ad 4 – een combinatie van alle eerdergenoemde elementen in een getoetste werkwijze levert twee resultaten voor het management, te weten (a) een *splitsingsvoorstel* met de gekozen en onderbouwde organisatieknip in termen van actoren die in één van de organisaties participeren en (b) *onderwerpen voor contractering* zoals besproken onder ad 3. De kern van de aanpak bestaat uit vier meetings, namelijk over (i) de criteria (crit), (ii) het Constructie Model (CM), (iii) de organisatieknip / het eigenaarschap van bezittingen (Organization Split / Ownership of Assets (OS/OA)), en (iv) de bedrijfs- en informatie-diensten / de kritieke keten-afhankelijkheden (Business & Information Services / Critical Dependencies (BIS/CD)). Om te toetsen hoe dit optimaal kan helpen om samenwerking te ondersteunen èn om de resultaten te laten passen in het voorgenomen organisatieveranderings- en contracteringsproces wordt deze aanpak tevoren afgestemd met het management. Voor het uitvoeren van de OS/OA meeting wordt verder een Group Decision Support sessie ingezet. De toegevoegde waarde van deze werkwijze bleek te zijn (a) het maakt goed, bewust, objectief, systematisch en gestructureerd denken over de organisatieknip mogelijk; (b) het stimuleert gedeelde beeldvorming en gesprek over risico's van de organisatieknip, b.v. voor beschikbaarheid van informatie; en (c) het leidt snel tot onderbouwde en gedeelde beslissingen.

Ad 5 – inzicht in te verwachten kosten en baten, de zogenaamde *Return On Modeling Effort* (ROME). De toegevoegde waarde voor verscheidene investeringen in modellerings- en domeinexpertise ziet er als volgt uit. Het alleen opsommen van actoren of transacties uit een DEMO Constructie Model is voldoende uitgangspunt voor het opbouwen van kwalitatieve consensus over de organisatieknip met een bottom-up onderbouwing. Door tevens principes – als SMART verwoordingen van organisatie- en ICT-strategie – te formuleren wordt het mogelijk voorgestelde keuzes ook in termen van deze principes te wegen. Met een DEMO Constructie Model zonder informatielinks wordt het mogelijk plausibele organisatieknips formeel te berekenen – onder de aanname dat de BI-hypothese algemeen geldig is. Een compleet DEMO Constructie Model tenslotte – dus met informatielinks – kan gebruikt worden (a) om een plausibele organisatieknip te berekenen – robuuster, minder afhankelijk van of de BI-hypothese inderdaad klopt – en (b) om een

gestructureerde opsomming van contractonderwerpen te maken, nodig voor het contractering van *samenwerking* na de organisatiesplitsing.

Meer algemeen blijkt de toevoegde waarde van de ontwikkelde aanpak te zijn (a) het creëren van gemeenschappelijke beeldvorming over huidige of toekomstige situaties voor alle betrokkenen; (b) het opsporen van gelijksoortige activiteiten in organisaties en redundanties in de ICT-applicatieportfolio; (c) het ondersteunen van projectafbakening en het communiceren over investeringsbeslissingen; (d) het verhelderen en toewijzen van de verantwoordelijkheid voor operaties en ICT; (e) dit alles goed onderbouwd, tegen relatief lage kosten, waarbij consensus wordt gebouwd en attitude-verandering bewerkstelligd.

Toekomstig onderzoek

De praktische waarde van het door ons onderzoek ontwikkelde instrument is getoond in strategie-gedreven organisatiesplitsing, centralisatie en post-fusie integratie. Om voort te bouwen op deze kracht en de beperkingen ervan te ondervangen stellen wij een onderzoeksagenda voor om (a) dit instrument *breder bruikbaar* te maken, bijvoorbeeld door het blootleggen van eventuele sectorafhankelijkheden, (b) dit instrument met een nog *hogere snelheid beslissingsondersteuning* te laten geven, b.v. door simulatie, (c) dit instrument vergaander te *testen*, en (d) om de wederzijdse afhankelijkheid van organisatiesplitsing en *ICT-splitsing* te verhelderen. Wij zijn ervan overtuigd dat dit onderzoek dringend nodig is om onderbouwde en vlotte afwegingen in besluitvorming mogelijk te maken en voor voldoende beweeglijkheid te zorgen om deze besluiten vervolgens ook betrouwbaar en steeds sneller uit te voeren.

Martin Op ’t Land, 2008

Curriculum vitae

Martin Op 't Land (1959) received his Masters degree in Mathematics at the university of Leiden in 1984 and started working for The Navigators. He joined Capgemini in 1985, where he works today as Principal Consultant and Certified Enterprise Architect, especially in the sectors Financial Services and Public. Martin is specialized in coherently reshaping organization and information of Extended Enterprises, amongst others using concepts of Shared Service Centers and Business Process Outsourcing.

On behalf of Capgemini, Martin is responsible for education and research in the University-based Master Architecture in the Digital World (ADW), of Radboud University Nijmegen and Capgemini. He was chairman of the Working Group Definition Architecture (GIA) and member of the NAF Working Group Extensible Architecture Framework (*x*AF). Martin lectures amongst other the subjects *Principles & Architecture Frameworks* and *Business Architecture* (ADW), *Extended Enterprise* (Master of Informatics, Hogeschool Utrecht) and *Design & Engineering Methodology for Organizations (DEMO)* (Capgemini Academy).

Martin is married with Cobi Wattez and has three children, Sjoerd, Sifra and Norbert.

Martin Op 't Land (1959) behaalde zijn doctoraal wiskunde aan de universiteit Leiden in 1984 en begon met werk voor Stichting De Navigators. Vanaf 1985 werkt hij bij Capgemini, momenteel als Principal Consultant en Certified Enterprise Architect, vooral bij financiële instellingen en overheid. Martin specialiseert zich in het in samenhang vormgeven van organisatie en informatievoorziening van de Extended Enterprise, waarbij hij ondermeer concepten van Shared Service Centers en Business Process Outsourcing inzet.

Martin is namens Capgemini inhoudelijk verantwoordelijk voor onderzoek en onderwijs in de University-based Master Architectuur in de Digitale Wereld (ADW) van Radboud Universiteit Nijmegen en Capgemini. Hij was voorzitter van de werkgroep Definitie Architectuur (GIA) en lid van de NAF-werkgroep Extensible Architecture Framework (*x*AF). Martin doceert ondermeer de vakken *Principes & Architectuurraamwerken* en *Business Architectuur* (ADW), *Extended Enterprise* (Master of Informatics, Hogeschool Utrecht) en *Design & Engineering Methodology for Organizations (DEMO)* (Capgemini Academy).

Martin is getrouwd met Cobi Wattez en heeft drie kinderen, Sjoerd, Sifra en Norbert.

Organizations increasingly split off parts and start cooperating with those parts, for instance in Shared Service Centers or by using in- or outsourcing. What is the right spot and way for finding the organization split? And on what subjects should organizations agree to cooperate effectively across the organization split? To find managerial handles for this problem, we applied action research to four large real-life case-studies in which ontology and architecture were used. This resulted in an instrument for supporting organization splitting, allying and post-merger integration, consisting of organization construction rules, algorithms for calculating a plausible organization splitting proposal, a method for finding subjects for contracting split organizations, and a real-life tested combination of all this in a way of working with a known Return On Modeling Effort.

Martin Op 't Land (1959) works as a Principal Consultant and Certified Enterprise Architect at Capgemini. He conducts research and is involved in education at several academic institutions.

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