Universiteit Leiden
ICT in Business

Improving IT Supported Organizational Change

Formalizing Organizational Implementation Fundamentals

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MASTER'S THESIS

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ABSTRACT

External and internal changes require organizations to be agile. These changes often affect the implementation of an organization. Therefore, Op 't Land and Krouwel proposed a set of organizational implementation variables(OIVs) to informedly decide upon the implementation of an organization. OIVs refer to the dimensions of the choices regarding the construction perspective of an enterprise, the implementation choices in the development of a system, given an agreed upon essence of the enterprise, and the varying nature of these choices. These OIVs are expected to have the potential to be supported by IT, but no research has been done to validate this.

This research focused on formalizing the OIVs so that the support of the OIVs by IT can be assessed or designed. We revised the definitions of the OIVs and formalized them into one model. This model was validated by modeling an implementing of the fictional Rent-A-Car case. The impact of a reorganization at Rent-A-Car was analyzed to show the effects of changes that require agility. The formalization of the OIVs can be used to assess the extent to what an IT platform, or an enterprise information system supports the organizational implementation variables or to design IT platforms that can be used to build agile enterprise information systems. We are convinced that if the choices of the OIVs can easily be adapted in an organization, this enables continuous change of an enterprise with less effort in IT change.

CONTENTS

ABBREVIATIONS

DEMO Design & Engineering Methodology for Organizations.

EIS Enterprise Information System.

GSDP Generic System Development Process.

OCD Organization Construction Diagram.

OFD Object Fact Diagram.

OIV Organizational Implementation Variable.

RAC Rent-A-Car.

1. INTRODUCTION

Companies need to deal with internal and external changes, which are unpredictable and uncertain. A way to cope with that is being agile as an organization, meaning that you can anticipate or respond to changes[1]. These changes often affect the implementation of an organization. To increase the agility of an organization Op 't Land and Krouwel proposed a set of organizational implementation variables[2]. They defined organizational implementation variables(OIV) as "the dimensions in which organizational implementation choices are made". The choices differ among different organizations, but they are also affected by change. Being able to adapt the choices in the organizational implementation variables can make your organization agile. Making the dimensions explicit will help to decide on the implementation of an organization.

1.1 Problem statement

The role of information technology is seen as an important factor to achieve agility[1, 3, 4]. As suggested by Op 't Land and Krouwel[2] the organizational implementation variables have the potential to be supported by IT, leading to agile IT. Research has been done to validate the existence of organizational implementation variables in organizations and real-life cases[5, 6], but no research has been to done assess to what extent the organizational implementation variables are supported by IT.

To assess to what extent an IT platform supports organizational implementation variables, the OIVs should be properly defined and formalized into a model. The focus of this research has been on formalizing the organizational implementation variables. This formalization can be used to assess an IT platform. The research goal is formulated as follows: *Construct a model to assess the support of organizational implementation variables by IT.*

1.1.1 Research questions

To achieve the research goal, at least the following questions need to be answered.

1. Are the OIVs sufficiently rigorous to be formalized?
2. To what extent can we categorize the OIVs?
3. To what extent can we formalize the OIVs?
4. To what extent can we assess the impact of a reorganization?

In this research the definitions of the OIVs, as proposed by van Bockhooven[5], were assessed through interviews. The second question was answered by categorizing the implementation into four phases. The formalization of the definitions also provided insights in the rigor of the definitions. The extent of the formalization was tested by modeling an implementation of the Rent-A-Car(RAC) case[7], thereby answering the third question. The fourth question was answered by modeling a reorganization of the first implementation of the RAC case and assessing the impact of the changes.

1.1.2 Scope

We focus on formalizing the organizational implementation variables. The definitions of the organizational implementation variables are built upon DEMO. The formalizations of the OIVs are expressed in DEMO models. The constructed model can be used to assess or design IT platforms and can be used as a generic model for implementing an organization or an enterprise information system. We tested this model by modeling an implementation of a fictional case.

Limitations

The goal of this research is not to validate the existence of the organizational implementation variables in practice. We did not apply the constructed model to a real life case. The model that we constructed can be used to assess the support of OIVs by IT, but no metrics were developed to measure the extent of the support.

1.1.3 Relevance

Academic relevance

This research provides insights to the fields of enterprise engineering and IT agility. We provided the field of enterprise engineering with a formal model for the implementation any organization. This contributes to the execution of the Generic Software Development Process(GSDP), by having formalized one step in coming from the essence of the organization to an operational organization. We also contributed to the GSDP by dividing the implementation into four categories. To the field of IT agility a white-box model is presented to decide upon the implementation of an organization and its IT. IT platforms can be assessed to determine if the platforms can be used to build agile information systems or to design IT platforms that can be used to agile information systems.

Practical relevance

This research provides practitioners with a formal model for implementing an organization, and what this means for the IT (support) of an implemented organization. This can also create awareness of the importance of enterprise agility and IT agility. Enterprise information systems can be assessed to determine if implementation can adapt and

adjust when changes occur. The model also provides the opportunity to assess different scenarios and implementations, before making the choices.

1.2 Outline

The outline of this thesis is as follows. In chapter 2 the relevant literature is presented. We discussed enterprise agility, the concept of organizational implementation variables, and DEMO. In chapter 3 the methodology of this research is described. The results are presented in chapter 4. The model, that was constructed in this research, is presented and elaborated by going through the implementation of the RAC case. Also an analysis is done of the reorganization of RAC. In chapter 5 the most important remarks of the OIVs and the implementation of RAC are discussed. In chapter 6 the research questions are answered, the contributions of this research are elaborated, and the limitations and suggestions for future research are discussed.

2. BACKGROUND

Companies need to deal with internal and external changes, which are unpredictable and uncertain. A way to cope with that is being agile as an organization, meaning that you can anticipate or respond to changes[1]. The role of IT is often seen as an enabling factor to achieve enterprise agility[1, 3]. Overby et al make it even more explicit by stating that IT is necessary to sense and respond to environmental change[4].

First, we will discuss the notion of enterprise agility, especially discussing the nature of change and IT perspectives on agility. Then, we will elaborate on the concept of organizational implementation variables by elaborating the notions of the organization, the implementation, and the variables, separately. Finally, we will briefly explain DEMO, especially explaining the four axioms of the PSI-theory and the four aspect models of an organization.

2.1 Enterprise agility

Overby et al. defined enterprise agility as "the ability of firms to sense environmental change and respond readily"[4]. Van Oosterhout et al. defined business agility as "being able to swiftly change businesses and business processes beyond the normal level of flexibility to effectively manage unpredictable external and internal changes" [1]. As reviewed by Sherehiy et al., literature distinguishes two approaches to define enterprise agility[8]. The first approach focuses on the flexibility of manufacturing and technologies, e.g., lean manufacturing[9]. The second approach emphasizes the ability of an organization to rapidly adapt to unpredicted changes. The first approach concerns the operation of an enterprise, whereas the second approach concerns the strategy of an enterprise[10, 11]. Following the definitions by Overby et al. and van Oosterhout et al, this research is positioned in the second approach of enterprise agility, because the decision to keep the choices of the organizational implementation variable is a strategic decision.

2.1.1 Nature of change

The reason to become agile is change[1]. To position the organizational implementation variables, it is important to understand the origin of organizational change. Van Oosterhout et al. distinguishes internal and external change factors that require agility[1]. To informedly decide upon the organizational implementation we also need to acknowledge the historical developments (temporal factors) of an organization or an industry, because the organizational implementation variables also cover choices that do not fall

into the category of agility. E.g., scheduling a human resource. Organizations operate in three types of environments: the temporal, external and internal environment[12, p.23]. Organizational change can come from any of these environments. For example, an organization changes over time, because it goes through different phases in its life cycle (temporal environment), the rise of the Internet changed the way organizations do business (external environment) and (new) management wants to reorganize an organization (internal environment). Our interpretation is that internal and external changes happen at T_n and require to rapidly adapt, and temporal changes happen between T_n and T_{n+1} and do not require to rapidly adapt.

2.1.2 IT perspectives on agility

In the domain of IT and computer science we recognize three different approaches to increase agility. The first approach is agile software development, the second approach is agile IT infrastructure and the third approach is IT agility.

The first approach emphasizes an agile software development process, meaning that during the process of developing software adaptations are made to the requirements based on feedback by the stakeholders[13]. SCRUM and the Scaled Agile Framework are examples of such agile software development methods[14, 15]. This is contrary to traditional software engineering methods. An example of such traditional method is the waterfall model, in which a set of requirements is engineered at the start of the project and at the end working software is delivered to the customer without any iterations[16]. Although Royce did not name his initial model the waterfall model, this naming is used widely for his initial model. His final model, presented in the same article, proposes iterations in his initial model.

The second approach is best described by the definition of IT infrastructure agility as proposed by Ahsan and Ye-Ngo[17]. They defined IT infrastructure agility as "the ability to build a system that can easily be reconfigured, scaled, deconstructed and reconstructed as needed, to adapt to unanticipated changes". For example, the Normalized Systems(NS) theory provides a set of principles, elements, and anticipated changes to create proven evolvability of information systems[18]. NS increases the agility of information systems by limiting the combinatorial effects that occur when changes happen.

Van Oosterhout defined IT agility as "the ability of Information Technology to support an organization to swiftly change businesses and business processes beyond the normal level of flexibility to effectively manage highly uncertain and unexpected, but potentially consequential internal and external events"[19]. This definition encompasses the alignment between the first two approaches of agile IT and enterprise agility (section 2.1). For example, the combination of DEMO[20], which has proven to realize agile enterprises, and Normalized Systems theory, which has proven to develop agile information systems[18], to realize IT agility[21]. By doing this one can align enterprise agility and IT infrastructure agility.

We position this research in the third approach, because the organizational implementation variables can be used to model an organization (creating agile an enterprise), and its supporting IT (creating agile IT).

2.2 Organizational Implementation Variables

Op 't Land and Krouwel proposed a set of organizational implementation variables(OIV)[2]. They defined implementation variables as "the dimensions in which organizational implementation choices are made". Making the dimensions explicit will help to decide on the implementation of an organization. Being able to easily and rapidly adapt the choices in the OIVs can make an organization agile. Op 't Land and Krouwel first found variables in literature and categorized them in the Enterprise Engineering Framework[22]. Secondly, these variables were tested against two fictional cases. They stopped at identifying the variables. Van Bockhooven and Molly continued the research by validating the existence of the organizational implementation variables in real-life cases[5, 6]. In their researches they validated the existence of most of the OIVs, defined the meaning of the OIVs, and proposed additional OIVs. We elaborate on what is meant by organizational implementation variables by discussing the notions of the organization, the implementation and the variables, separately.

2.2.1 The organization

The notion of an organization is related to two other concepts, namely the business and the enterprise. Dietz defined the enterprise as "any kind of collaborative activity by human beings", such as companies[7]. The business refers to the function perspective of the enterprise and the organization to the construction perspective of the enterprise. The function perspective is the relationship between a system and a stakeholder, i.e., it is the perception and interpretation of the construction. The construction is the composition, the environment, and the structure of a system[20, p. 230]. The construction corresponds with a white-box model; the function corresponds with a black-box model[20, 23]. A system can have many functions, but only one construction. The organization theorem states that an organization, i.e., the (only) construction of a system, consists of three disjoint and integrated aspect organizations: the Business (B)-organization, the Informational(I)-organization, and the Documental(D)-organization.[7, 20]. Figure 2.1 shows the representation of the organization theorem, which includes the typical production acts for each organization. Only the production is shown, because the coordination is similar between organizations. The production of the B-organization is original, the production of the I-organization is informational, and the production of the D-organization is documental.

2.2.2 Implementation

GSDP

The Generic System Development Process (GSDP), as shown in Figure 2.2, concerns two systems: the system which is going to be developed (the Object System) and the system that is going to use the services of the object system (the Using System)[23]. The GSDP consists of three phases: design, engineering and implementation. To explain the implementation phase, the first two phases need to be elaborated first.

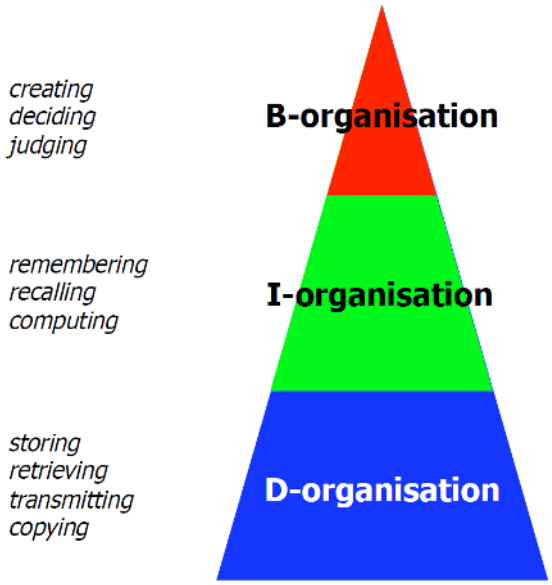

Fig. 2.1: Representation of the organization theorem[7]

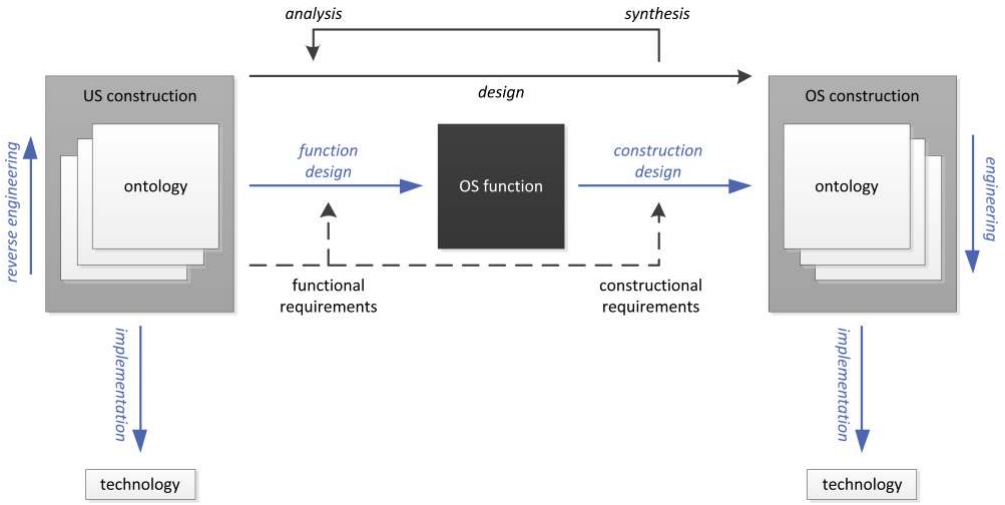

Fig. 2.2: Generic System Development Process[23]

The design phase consists of two phases, the function design and the construction design. Based on the construction of the US, function design delivers the functional specifications of the OS (a black-box model). Construction design translates the functional specifications into the ontological model. The ontology is the construction of a system that is fully independent of the way that it is implemented. The engineering phase is the process of producing more detailed white-box models, based on the ontological model. The engineering phase ends with the implementation models[23]. In these

detailed white-box models, increasingly more implementation choices are included.

Dietz defined the implementation as "the assignment of technological means to the constructional elements in the implementation model"[23]. Dietz and Hoogervorst made this definition more explicit, by defining the implementation of an organization as "the allocation of appropriate means to elements of the ontological model of the organization" [24]. They also added the 'installation' as a phase to the GSDP and defined the installation as "the assignment of specific resources for specific periods of time". After designing, engineering, implementing, and installing, the organization is ready to become operational. In the context of organizational implementation variables, we consider implementation as the umbrella term for the implementation, installation, and operation.

2.2.3 Variables

Thus far, we covered what is meant by organizational implementation. We will now look into the notion of variables. Variables refer to the varying nature of the choices that are made in the implementation. An organization operates in three environments(external, internal, and temporal)[12, p.23]. Change can come from any of those three environments. The choices in the implementation are affected by these changes. Being able to reconsider the choices and adapt to the changes can make an organization agile. The choices are also variable because organizations are (often) constructed differently, and therefore the choices will differ among organizations.

Thus the concept of organizational implementation variables refers to three notions: the construction of an enterprise(*the organization*), the implementation choices in the development of a system, given an agreed upon essence of the enterprise (*the implementation*), and the varying nature of the choices (*variables*).

2.3 DEMO

Design & Engineering Methodology for Organizations(DEMO) is a methodology developed by Prof. Jan Dietz at Delft University of Technology[25]. DEMO captures the ontology of an enterprise. The underlying theory of DEMO is the PSI-theory and stands for Performance in Social Interaction[20, 7]. The theory consists of the organization theorem and four axioms. The organization theorem was elaborated in subsection 2.2.1. The operation axiom, transaction axiom, composition axiom, and the distinction axiom are the four axioms of the PSI-theory. The ontology of the B-organization, modeled in DEMO, consists of four aspect models, as shown in Figure 2.3. The axioms and the aspect models are briefly described below. We refer to Dietz for further reading[20, 23, 7].

2.3.1 Axioms

- The *operation axiom* states that the operation of an organization is constituted by the activities of elementary chunks of authority and responsibilities fulfilled by human beings. These chunks are called actor roles. Actor roles perform production

acts (creating, deciding, and judging) and coordination acts (exposing and evoking commitment) to deliver production facts and coordination facts.

- The *transaction axiom* states that coordination acts are performed as steps in transactions. Transactions are universal patterns that always involve two actor roles: an initiator and an executor. They interact to achieve a production fact.
- The *composition axiom* states that every transactions is either 1) enclosed in another transaction, 2) is a customer transaction, or 3) is self-activated.
- The *distinction axiom* states that in the operation of actors, human beings have three capabilities: performa (social correspondence), informa (cognitive correspondence) and forma (notational correspondence).

2.3.2 Aspect models

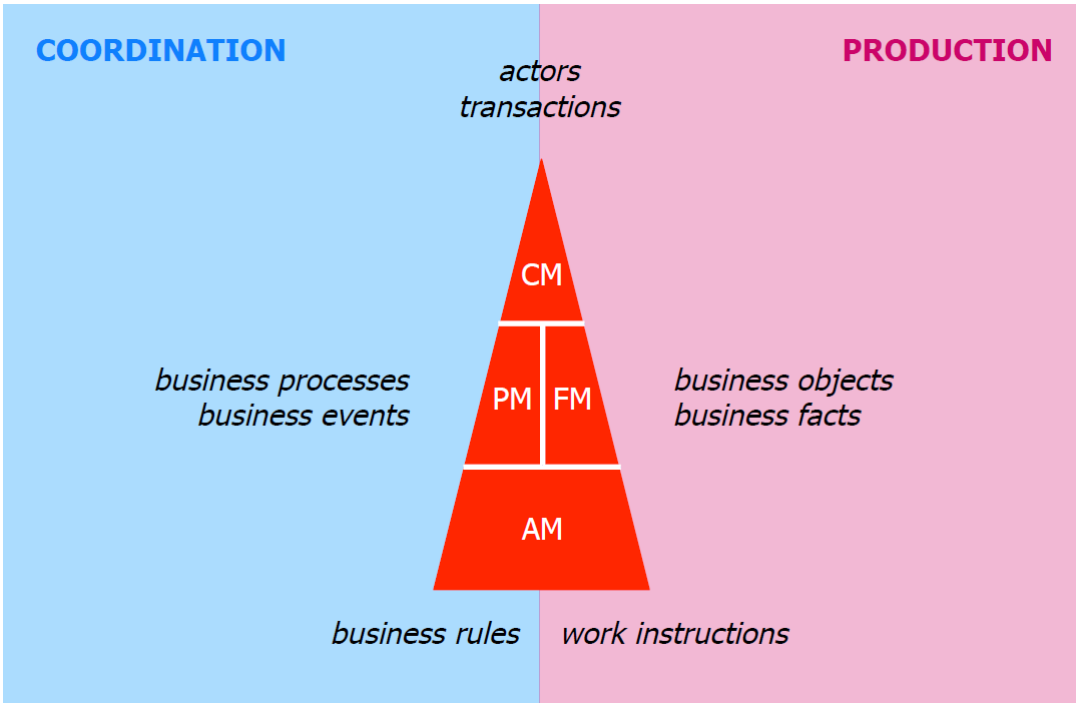

Fig. 2.3: The four aspect models[7]

- The *construction model*(CM) expresses the coherence (chain/network) of services within a defined scope. The CM contains the actors and transactions. Information links, initiator links, and executor links connect the actors and transactions. Information links indicate that an actor role has access to the corresponding transaction

bank of the transaction kind. Initiator links and executor links indicate which actor roles are initiators and which ones are executors. The construction model is represented by the organization construction diagram, the Transaction Product Table, and the bank contents table.

- The *process model*(PM) expresses the order of transaction steps. The PM contains the transaction kinds, response links, and waiting links in the coordination world. These links indicate how the transaction kinds interrelate. The process model is represented by the process structure diagrams and transaction pattern diagrams.
- The *action model*(AM) expresses the rules for dealing with actions. The AM contains the action rules. The action rules are the guidelines for an actor to deal with an agendum types. The action model is represented by action rule specifications.
- The *fact model*(FM) expresses the information items that are relevant for the organization. The FM contains the fact types and business laws in the production world. The fact types model the state of the world and the business laws formulate the lawfulness of the states. The fact model is represented by the object fact diagram and the derived fact specification.

3. METHODOLOGY

In this chapter we present the methodology of this research. First we elaborate on the review of literature. Then we explain the process of formalizing the OIVs, especially how we reviewed and revised the definitions, how we created diagrams for each OIVs and how we integrated them, and how we validated the definitions and diagrams. Finally we describe the process of modeling an implementation of a fictional case.

3.1 Literature

Articles were searched on Google Scholar and in the Leiden University catalog and were retrieved, if not available on Google Scholar or in the Leiden University catalog, through the catalog of Mendeley[1]. Searches were performed with the following terms: agility, enterprise agility, IT agility, organizational implementation, (the nature of) organizational change, enterprise engineering, and DEMO, or any conjugation of these terms.

Searching for 'organizational implementation' in the Leiden University catalog resulted in 79 hits. By stripping the results from those that are related to other fields of science, such as health care and psychology, we had 14 hits left. Based on the abstracts none of these 14 hits were found useful. Additional searches were performed on Google Scholar, but did not yield any new insights into organizational implementation as compared by the literature found by Op 't Land and Krouwel[2]. We also added the other terms to the term 'organizational implementation', but this only provided articles that were relevant for the positioning of the organizational implementation variables.

Throughout the interviews, conducted in this research, we retrieved one unpublished document that provided new insights to the implementation of an organization. Dietz and Hoogervorst made the notion of implementation more explicit and added different phases to the GSDP [24]. The notion of implementation and the phases have been included in chapter 2.

3.2 Formalizing the organizational implementation variables

Based upon earlier literature and two fictional case studies, Op 't Land and Krouwel [2] proposed a set of organizational implementation variables, but they did not propose any definitions for the variables. These definitions will be necessary to formalize the variables. In research by van Bockhooven [5] and Molly [6] definitions were proposed for the

[1] `http://www.mendeley.com/research-papers/`

organizational implementation variables. In this research the definitions by van Bockhooven were considered as the basis for definitions of the organizational implementation variables. The list of OIVs that is considered in this research is shown in Table V.2 This research also contributed to that list, by reviewing the list and proposing suggestions to van Bockhooven. The definitions of the organizational implementation variables are built upon DEMO. The formalizations of the OIVs are expressed in DEMO models. Now, we elaborate on the iterative process of formalizing the organizational implementation variables in detail.

1. **Review and revise definitions**
   We started with reviewing the definitions, as proposed by van Bockhooven[5], once again. As result of this review, we decided to revise most of the definitions. There were two reasons to make that decision. The first reason was to create consistency. Part of creating consistency was to ensure that the terminology in the definitions and the structure of the definitions are the same. Naming conventions are related to the use of the term 'agendum type' everywhere, instead of using different terms such as 'act type' and 'act'. We structured the definitions as follows: *an A is a B that C* (in which A is the name of the variable)[26]. The other part of creating consistency was to ensure that OIVs are not derived from the X-references. By doing this it was ensured that objects stay the same when changes were made to its attributes. The second reason of revising the definitions was that some definitions diverted in a negative way from the intended meaning of the OIVs by Op 't Land and Krouwel [2]. In such cases we proposed a new definition that was based on the origins of the variable. Other reasons for revising the definition of an OIV are mentioned in the remarks of that OIV in Appendix II.
   Examples and counter examples: We added examples and counter examples to each OIV to make the meaning of the OIVs more explicit. These examples were based on the EUrent case[27].

2. **Create DEMO models**
   The next step was to create DEMO models, which we expressed in DEMO diagrams [20]. Two types of diagrams were created: object fact diagrams and organization construction diagrams (see subsection 2.3.2). For each organizational implementation variable, separate object fact diagrams and organization construction diagrams were constructed.

   (a) **Create organization construction diagram**
   Our organization construction diagram(OCD) shows which transactions need to be completed in order to implement an organization. Each OCD is accompanied with a Transaction Product Table. Often an OIV concerns the assignment of two categories. In these cases we only modeled the transaction assigning, but not the transaction finish assignment. By leaving these transactions out of the diagrams, the diagrams are smaller and easier to understand. We do assume throughout this research that we can finish assignments.

(b) **Create object fact diagram**
The object fact diagram(OFD) is a factual representation of the definitions. The OFD consists of fact types and transaction result kinds, which are the results of transaction kinds in the OCD. The instances of the fact types and result kinds, are determined in the OCD.

(c) **Verification by instantiation**
Sets of instances of the fact types and the transaction result kinds were created to verify whether the diagrams represent the definitions correctly[20, p. 155]. The sets of instances are also based on the EUrent case[27]. We also used the approach of verification by instantiation to determine the unicity in fact types and transaction result kinds.

3. **Interviews with Op 't Land and Krouwel**
In a total of 10 sessions Op 't Land and Krouwel[2] were interviewed. In these interviews each organizational implementation variable was discussed in detail. Based on suggestions from these discussions, adjustments were made to the definitions, examples, and diagrams of the OIVs.

4. **Integrate diagrams**
To capture a holistic view and to properly understand the relations between organizational implementation variables, the diagrams of each OIV are integrated into two diagrams: an integrated object fact diagram and an integrated organization construction diagram. The integrated organization construction diagram was also useful for drawing information links between actor roles and transaction kinds that are not in the scope of the same variable. Throughout this thesis, these two integrated diagrams are what we refer to as 'the constructed model'.

5. **Validate correctness with additional interviews**
Dietz was interviewed throughout three sessions[20]. In these sessions we validated the OIVs. The focus was primarily on the definitions and intended meaning of the OIVs. Adjustments were made to the definitions and based on these adjustments the diagrams were adjusted.

3.3 Modeling an implementation of the Rent-A-Car case

We used the constructed model to model an implementation of the Rent-A-Car(RAC case, based on the ontological model of the RAC case as proposed by Dietz[7]. This modeling was done according to the categories of the implementation that we proposed. We created a population, based on the narrative of RAC and its construction model[7], for each OIV. To illustrate the operation of the organization, we created two different scenarios, which are based on the transactions in the ontological model and the implementation of the RAC case. We also used this model of the implementation of the RAC case to further validate the correctness of the definitions of the OIVs and their formalizations. Problems that arose while modeling the implementation and the scenarios are discussed in detail.

4. RESULTS

In this chapter we present our findings. First, we present the implementation categories and especially how we categorized the OIVs. Then, we present the constructed model by showing both the OFD and OCD of the organizational implementation variables. To elaborate on this model, we discuss the modeled implementation of the RAC case. This elaboration is done per category of the implementation. Finally, we present an analysis of a modeled reorganization of the RAC case.

4.1 Implementation categories

Dietz and Hoogervorst proposed three categories for the implementation, namely implementation, installation, and operation[24]. We were not satisfied with these categories, because we did not agree on assigning specific human resource in the *implementation,* while the scheduling is part of the *installation.* We consider assigning of human resources as a form of scheduling and therefore should be part of the *installation.* We also argued that the governing of the resources is a separate category. Therefore we proposed the following categories for the implementation, namely implementation, installation, operation and HR and means.

The criteria for positioning the OIVs in these categories is as follows. In the *implementation* the structure of the organization, such as functionary types, organizational units, and FTE norms, and the rules guiding the operation, such as rules for the assignment of agendums, event location restrictions, and the way of fulfilling agendum types, are defined, as well as the assignments between these elements. These elements contain choices that are dependent on the ontology. The ontology also contains (action) rules, but on that level they are fully independent of the implementation. Assignments are also made between elements in the ontological model and elements in the implementation. In the *installation* specific and qualified (human) resources are assigned to elements of the implementation and scheduled in time and space. The installed (human) resources act on instances in the *operation. HR and means* refers to the governing of resources in general, such as the hiring, firing, and development of people and the acquiring, discharge, and maintenance of machines.

Categorization of the OIVs

Table 4.1 shows an overview of the categorized OIVs and Table 4.2 shows an overview of the OIVs that are suggested for future research. Both tables also show the revision

history of the OIVs. We defined each OIV, even if the OIV is not within the scope of this research.

OIV	Revision history
Implementation	
Allocation of Full Time Equivalent	Revised name and definition
Competence	Revised definition
Event location restrictions	Revised definition
Functionary type	Revised definition
Juristic person	Revised name and definition
Language support	Revised definition
Order of working	Revised definition
Organizational unit	Revised definition
Rules for the assignment of an agendum	Revised definition
Way of dealing with an agendum type	Revised name and definition
Work locations	Revised definition
X-reference of agendum type and competence	New
X-reference of functionary type and agendum type	Revised name and definition
X-reference of functionary type and organizational unit	New
X-reference of functionary type and work location	New
X-reference of work locations and agendum type	Revised name and definition
HR and means	
Human resource	Revised name and definition
Sourcing	Revised definition
Validation of competences	Not changed
Technical channels	Revised definition
Installation	
X-reference of human resource and functionary type	Revised definition
X-reference of human resource and organizational unit	Proposed definition
X-reference of human resource and work location	Revised definition
Operation	
Addressee specificity	Revised definition
Delegation (incidental)	New
Out of scope	
Region	Proposed definition
X-reference of actor role and organizational unit	Proposed definition
X-reference of human resource and actor role	Proposed definition
Separation of duties	Not changed
Removed	
Organization structure	Removed

Tab. 4.1: Categorization of organizational implementation variables

OIV	Revision history
Implementation	
X-reference of actor role and juristic person	New
HR	
Means	New
Installation	
X-reference of human resources and region	New
Schedule of human resources	New
Schedule of means	New

Tab. 4.2: Suggested OIVs for future research

4.2 Model of the organizational implementation variables

The next three pages present the organization construction diagram of the OIVs, as shown in Figure 4.1, the Transaction Product Table, as shown in Table 4.3, and the object fact diagram of the OIVs, as shown in Figure 4.2. These diagrams are derived from integrating the separate diagrams of each OIV, which are presented in Table I. The OCD and OFD are further elaborated in section 4.3.

Transaction kind	**Product kind**
B-T01 Define competence	P01 [Competence] has been defined
B-T02 Choose supported language	P02 Supported [language] has been chosen
B-T03 Establish order	P03 [Order] has been established
B-T04 Define set of assignment rules	P04 [Set of assignment rules] has been defined
B-T06 Establish technical channel availability	P06 [Technical channel availability] has been established
B-T07 Establish validation method	P07 [Validation method] has been established
B-T09 Assign human resource to functionary type	P09 [HR - FT Assignment] has been established
B-T10 Start employment	P10 [Employment] has been started
B-T11 End employment	P11 [Employment] has been ended
B-T12 Establish event location restriction	P12 [Event location restriction] has been established
B-T13 Recognize entity as having legal personality	P13 [Entity] has been recognized as having legal personality
B-T14 Create organizational unit	P14 [Organizational unit] has been created
B-T18 Establish hierarchical placement	P18 [Hierarchical placement] has been established
B-T19 Place human resource in organizational unit	P19 [Human resource placement] has been established
B-T20 Make work location available to human resource	P20 [HR Location availability] has been established
B-T21 Assign functionary type to agendum type	P21 [FT Agendum type Assignment] has been established
B-T22 Make work location available to deal with agendum type	P22 [AT Location Availability] has been established
B-T24 Place functionary type in organizational unit	P24 [Functionary type Placement] has been established
B-T25 Assign functionary type to work location	B-T25 [FT Location Availability] has been established
B-T26 Establish AT competence requirement	P26 [Agendum type competence requirement] has been determined
B-T27 Create functionary type	P27 [Functionary type] has been created
B-T28 Determine FTE norm	P28 [FTE norm] has been determined
B-T29 Establish delegation	P29 [Delegation] has been established
B-T30 Specify addressee	P30 [Addressee Specification] has been specified
B-T31 Establish agendum type fulfillment	P31 [Agendum type fulfillment] has established
B-T32 Make location available for working	P32 [Location] has been made available for working
B-T33 Manage addressees	P33 C-ACT addressee management for [period] has been done
B-T34 Establish rules for agendum assignment	P34 [Rules for agendum assignment] have been established
B-T35 Make means available	P35 [Means] have been made available
B-T36 Start hire agreement	P36 [Hire agreement] has been started
B-T37 End hire agreement	P37 [Hire agreement] has been ended
B-T38 Manage HR	P38 HR management for [period] has been done

Tab. 4.3: Transaction Product Table

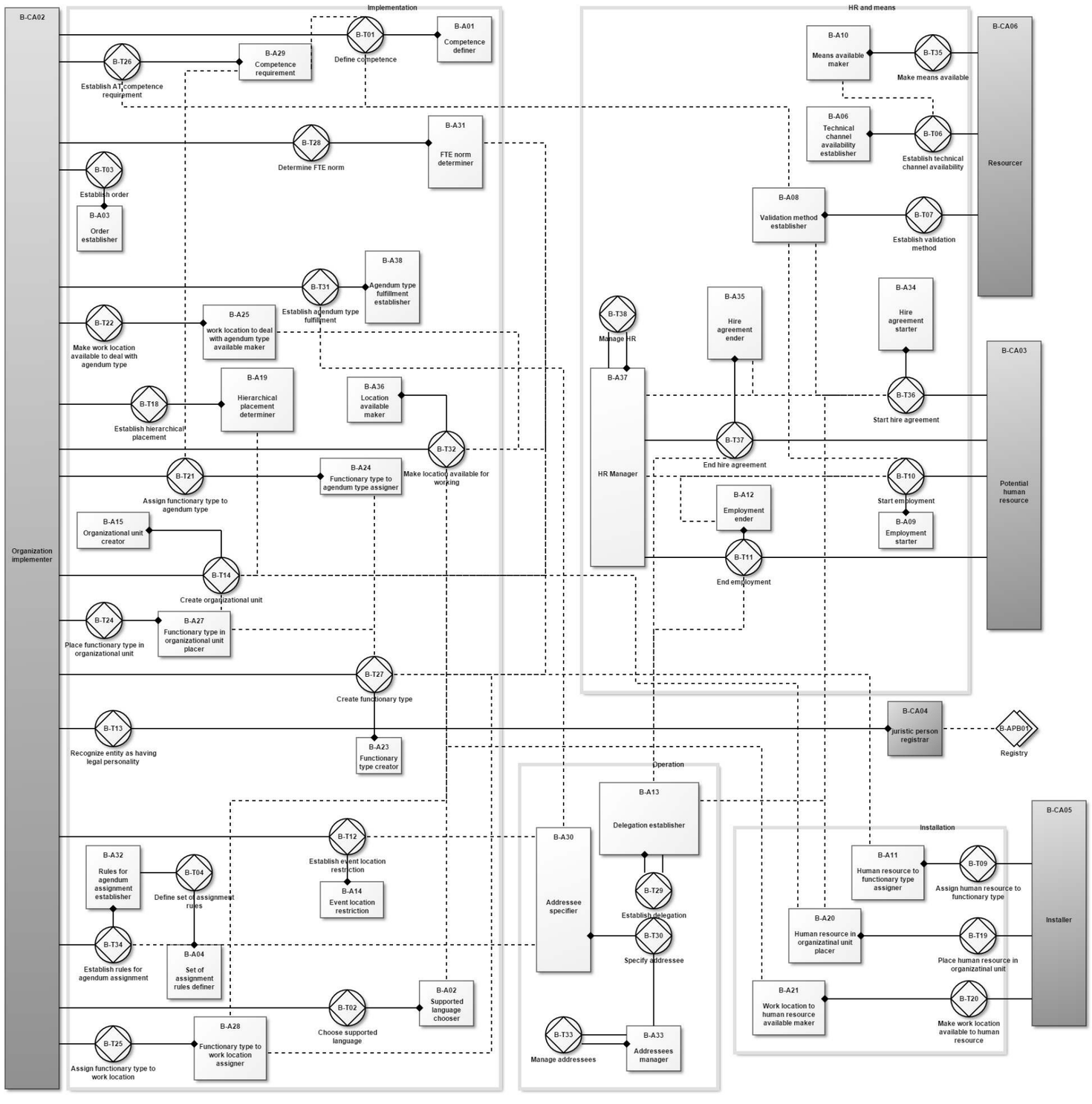

Fig. 4.1: Organization construction diagram of the organizational implementation variables

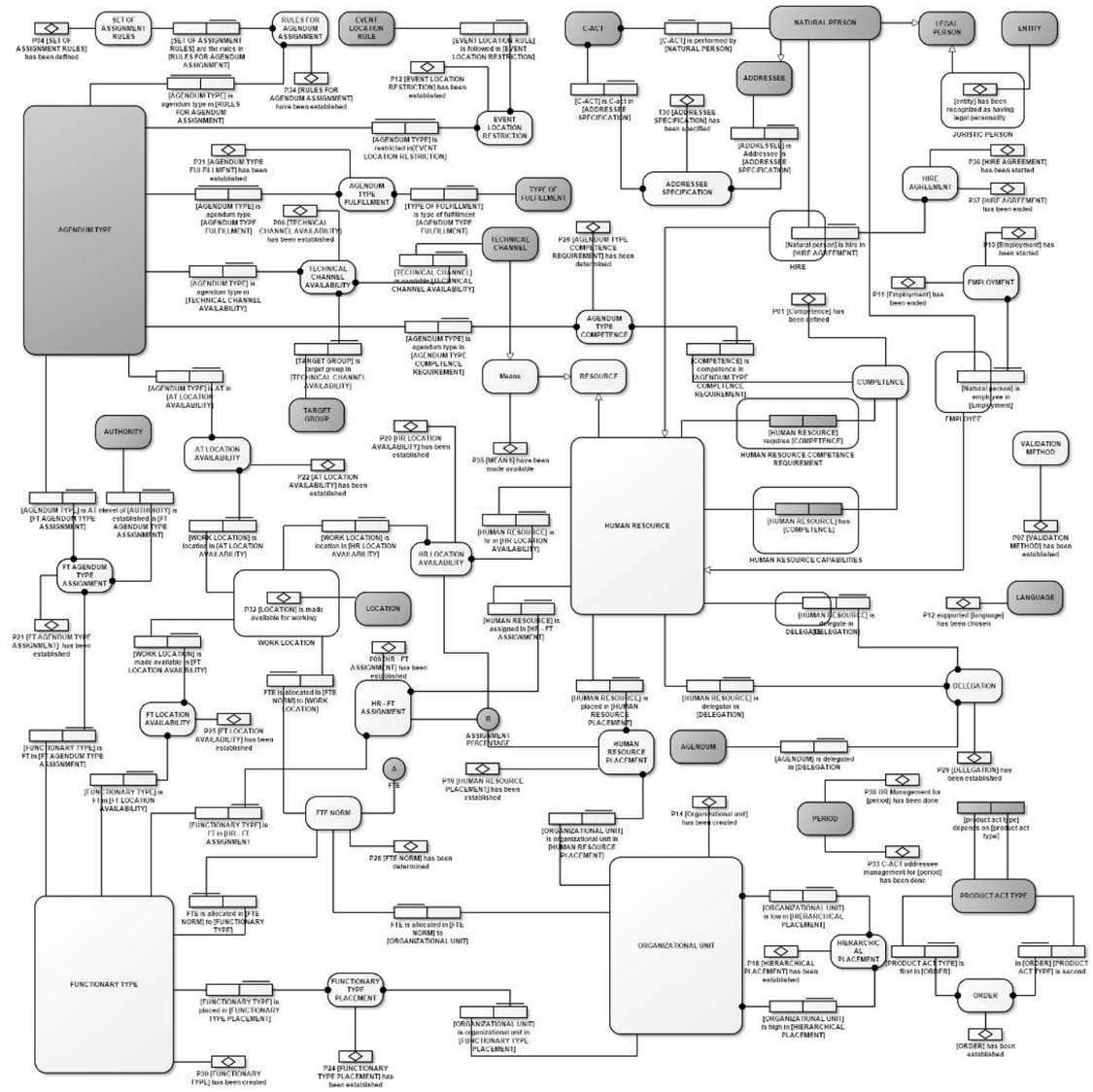

Fig. 4.2: Object fact diagram of the organizational implementation variables

4.3 Rent-A-Car

Rent-A-Car(RAC) is a fictional case, based upon the EU-Rent case[27], and adapted by Dietz[7]. It concerns a company called Rent-A-Car that is in the car rental business. We modeled the implementation of the RAC case, as shown in Appendix III, with the constructed model.

4.4 RAC: Implementation

4.4.1 Allocation of Full Time Equivalent

To implement this OIV the following OIVs have to be implemented first: Functionary type, Organizational unit, and Work locations. The OIV Allocation of Full Time Equivalent concerns the norm of FTE in the organization. The actual amount of FTE in the organization can be derived from the X-references in the installation. In the RAC implementation the FTE norm was set at 11 (the sum of FTE norms in Table III.2). This is equal to the actual amount of FTE in the organization. In this fictional case we always modeled the FTE norm as a combination of functionary type, organizational unit, and work location. In subsection 5.2.2 it is discussed why we did this.

4.4.2 Competence, functionary type, and organizational unit

We defined six different competences, as shown in Table III.3. More competences could have been defined, but this would increase the complexity of this fictional case without adding value to it. To define these competences, it is not necessary to define other OIVs first. Even though it is possible to define all kinds of competences, such as computer programming skills, it is unnecessary to define competences that are most likely unnecessary in the organization that is being implemented. Therefore one should keep in mind the ontological model of the organization, when implementing or modeling an implementation.

Functionary types can also be created independently from other OIVs. As defined in section II.7, a functionary type is created with the intention to be assigned to agendum types. Therefore, it is desirable to create a functionary type that is in line with the agendum types that are intended to be assigned to the functionary type. E.g., a functionary type called ‘transporter’ will be perceived as vague if the agendum type ‘rental payment is requested’ is assigned to it, while a functionary type called ‘desk officer’ will be perceived as obvious for the same assignment. The six functionary types that we created, shown in Table III.4, are all in line with the agendum types that they are performing, except for the functionary type ‘managing director’. This functionary type is further elaborated in subsection 4.4.6.

We constructed the OIV Organizational unit in a similar way as the OIVs competence and functionary type. This OIV does not depend on other OIVs, but only on it self. This dependency, shown in Figure III.2, presents the hierarchical relations between organizational units. Functionary types will be placed in organizational units, and therefore it is desirable to create an organizational unit that corresponds to the functionary

types, that one wants to place in the organizational unit. E.g., it is desirable to create an organizational unit called 'logistics' and place functionary types such as 'distributor' and 'transporter' in the organizational unit, while it is undesirable to create an organizational unit called 'sales' and places the same functionary types in the organizational unit. This is similar to the link between functionary types and agendum types.

4.4.3 Event location restrictions, rules for the assignment of an agendum, and way of dealing with an agendum type

To determine how to deal with agendum types the following OIVs are considered: Event location restrictions, Rules for the assignment of an agendum, and Way of dealing with an agendum type. The OIV Event location restrictions recognizes only the two following rules: no restriction and a restriction to the starting location of an agendum. If an agendum type is restricted to a location, every product act type of the agendum type needs to be dealt with at the location at which the agendum type is started. Therefore it is only necessary to determine the event location rule for the request. We established for each relevant agendum type in RAC an event location rule, as shown in Table III.6.In the RAC case, only two agendum types require to be dealt with at the location where it is started. In this implementation, it was because in those situations a car is exchanged between RAC and a customer at a certain location.

The rules for the assignment of an agendum have been defined in Table III.7. These rules determine how an addressee is specified in the RAC: Operation. Because an organization can not control how externals assign agendums to persons, it is only relevant to define the rules for assignment of an agendum for the agendum types dealt with by internal actors. To be able to define these rules other OIVs have to be instantiated first. Depending on the rules that an organization wants to define, it will vary which OIV has to be defined first. In the example of RAC we modeled the following OIVs first: Organizational unit, Human resource, and Functionary type.

To implement the way of dealing with an agendum type, it was determined that each agendum type can be fulfilled concurrently and individually (shown in Table III.8). The results of this OIV could be seen in the scheduling of human resources in time and space. E.g., if an agendum type needs to be dealt with concurrently and collectively, we must schedule human resources to work during the same period of time (Schedule of human resources). We did not cover the scheduling of human resources in this research, but we proposed a definition for this OIV in subsection II.29.3.

4.4.4 Juristic person, language support, and work location

The three OIVs juristic person, language support and work location, are closely related to the countries in which RAC will operate. RAC will operate in the Netherlands and in Belgium. Therefore we modeled that RAC is registered at the Dutch chamber of commerce[1], and its subsidiary RAC BE is registered at the Belgium chamber of

[1] `http://www.kvk.nl/`

commerce[2]. Registering the two entities as a juristic person, as shown in Table III.9, is conform the definition proposed in section II.9. The other juristic person is Consulting Inc. We marked this instance grey, because the previous versions of the constructed model could not support this juristic person. The OCD, as presented in Figure 4.1, now has the production bank *B-APB01 Registry*.

In section II.10 language support is defined as the language in which an organization operates. To be able to operate in The Netherlands and in Belgium, RAC will be required to operate in Dutch, German and French. It is also decided to operate in English, as shown in Table III.10, because cars are often rented by tourists that speak English. The language support is an element of the OFD, presented in Figure 4.2, that is not connected to anything.

The locations that have been made available for working, are shown in Table III.11. Each work location is a location within the countries in which RAC operates. In other organizations it is possible that there are work locations outside of the countries that they operate in. Especially with the help of IT working abroad can be effectuated. This is also the case for working at home. E.g., we could have chosen that 'rental contracting is requested' could be dealt with at home. In this organization agendum types can not be dealt with at home.

4.4.5 Order of working

Order of working is defined as the order between two product act types. This order is established within the dependencies between transaction kinds that are established in the ontological model. We only established one order, as shown in Table III.12. The rental contracting execute follows after the rental payment promise. This means that a customer can not get a rental contract until the rental payment is promised. Such an order helps RAC to mitigate big financial risks. The dependency between the product act types was already determined in the ontological model.

4.4.6 X-references

The population of the X-references is shown in subsection III.2.6. The X-references consist of an assignment between two OIVs, except for the ones in which an assignment between an OIV and an agendum type or actor role is defined. This exception is the case for the X-reference of agendum type and competence, X-reference of functionary type and agendum type, and X-reference of work locations and agendum type. To instantiate the X-references the following OIVs have been modeled first:Competences, Functionary types, Organizational units, and Work locations. Following the same reasoning as with the implementation of rules for the assignment of an agendum, only the relevant agendum types are considered in these X-references.

Table III.14 and Table III.14 show that we did not assign the managing directors to deal with an agendum type. In the RAC case it is not mentioned what the managing

[2] `http://economie.fgov.be/nl/ondernemingen/bce/`

directors actually do. It is only stated that "Janno or Ties may drop by and help a walk-in customer or pick up the telephone"[7]. This is due to the fact that there are no transaction kinds in the ontological model of RAC that are related to management. We can imagine that managers are the people who are fulfilling actor roles such as 'B-CA05 installer', as shown in Figure 4.1, which means that Janno and Ties are fulfilling operational roles in the RAC case.

In the OIV X-reference of functionary type and agendum type we acknowledged the notion of authority. By doing this we managed to create a structural delegation. In Table III.14 the accountability and responsibility are shown. If a functionary type is accountable for an agendum type, it means that if a human resource of that functionary type is fulfilling an instance of the agendum type (agendum) he is accountable for that agendum. If there is also a functionary type responsible for that agendum type, the human resource (the one that is accountable for the agendum) can delegate the agendum to a human resource who is fulfilling a functionary type that is responsible for that agendum type. E.g., in Table III.14 the 'distributor' is accountable for dealing with the 'penalty payment is stated' and the 'head of front office' is responsible for that agendum type. If there is a customer that states the penalty payment, Mik (a distributor) can delegate this agendum to Chiara(the head of front office).

4.5 RAC: HR and means

4.5.1 Sourcing

Sourcing concerns the making available of resources. Two types of resources are made available: human resources and means. In this research we identified an employee and a hire as two types of human resources, which are covered by the OIV Human resource. In RAC we have hired twelve human resources (shown in Table III.18), of which ten are employed and two are hired externally. In the installation we will consider the human resources as one category and do not concern ourselves with the contractual nature of the human resource.

The means concern all non-human resources. We recognized one specialization of means, namely Technical channels. In Table III.20 some cells are marked grey. This is because our model does not support a walk-in as a channel. Walking into an office building is a channel that most organizations will need to be able to operate. Renaming and redefining the OIV to 'Channels' was discussed, but we decided not to adapt that terminology. Channels is a very broad term that has very different meanings. E.g., a reseller is often seen as a channel, but this is not a way to communicate with the organization. The reseller communicates with the organization, via certain channels.

4.5.2 Validation of competences

The Validation of competences of the RAC case is shown in subsection III.3.2. The competence requirements are derived from the following X-references: X-reference of human resource and functionary type, X-reference of agendum type and competence, and

X-reference of functionary type and agendum type. Because Janno and Ties (both managing directors) are not assigned to any agendum types, they do not have requirements for competences. We assume that each human resource has the required competences, i.e., it is validated that the competence requirement is a subset of the competence capabilities. This is not presented in subsection III.3.2. This is the first view on validation. The second view on validating competences is to validate to what extent a human resource has the competences he claims to have. E.g., assessing intelligence with an IQ test. The validation method can be used for both views. The validation method is not fully incorporated into the model, as shown in Figure 4.2, i.e. it is an element of the model that is not connected to anything.

4.6 RAC: Installation

The following X-references are categorized as part of the installation: X-reference of human resource and functionary type,X-reference of human resource and organizational unit, and X-reference of human resource and work location.

Each of the X-references concerns the assignment of a human resource to either a functionary type, organizational unit, or work location. In these OIVs we make no distinction between the contractual nature of the human resources, as shown in section III.4, we only make them available. In each X-reference there is also an assignment percentage. From this assignment percentage the actual FTE can be calculated. To calculate the FTE the three X-references must be combined. For example, Janno has an assignment percentage of 100% in each table. An assignment percentage of 100% means 1 FTE. The tables are combined together and therefore Janno is a total of 1 FTE and not 3 FTE. It is possible to have an assignment percentage of 0% in Table III.23 and Table III.25, i.e., that a human resource is not fulfilling that functionary type or working at that location, but he is authorized to do so.

4.7 RAC: Operation

In the operation we recognized two OIVs, namely Addressee specificity and Delegation (incidental). These OIVs concern the dealing with specific instances and are only used when an organization is operational.

The addressee specificity, shown in Table III.26, is the result of following the rules specified in Table III.7. If an addressee is specific enough to evoke a commitment, it is not necessary to specify the addressee. E.g., Mik calls Anthony and Harold(point 2 in subsection IV.6.2). What is meant by specifying an addressee is elaborated in section II.2.

The incidental delegation concerns the issues of delegation that are not covered by structural delegation(part of X-reference of functionary type and agendum type). In incidental delegation a human resource delegates one agendum to another human resource. This is for example useful when a person becomes ill. To delegate an agendum the delegated human resource must have the required competences to deal with the

agendum.

4.8 RAC 2.0

This section discusses the reorganization of RAC, as presented in Appendix IV. In this reorganization we modeled an implementation of the RAC case in which we removed the functionary type 'desk officer' and work location 'office 3', because of external changes that require agility. The object fact diagram directly shows the impact of the reorganization.

In the implementation the FTE norm has decreased from 11 FTE, in Table III.2, to 6.5 FTE, in Table IV.1. Since we did not fire any human resource, RAC now has an overcapacity of 4.5 FTE. The rules for assignment of an agendum, shown in Table IV.6, required a change because the rules previously contained the desk officer. Because of the removal of the work location, we decided that RAC is no longer operating in Belgium. Therefore we decided that the juristic person RAC BE is longer required(Table IV.8) and that the supported languages German and French are not supported anymore(Table IV.9). In the X-references there are no longer any assignments to the functionary type 'desk officer' and to the work location 'office 3'.

In the HR and means we see no differences in the sourcing, shown in subsection IV.3.1, because we did not fire anybody. In subsection IV.3.2 we did notice difference in the competence requirements. Jane, Michael, Emma, and David no longer have any competence requirements. In the installation (section IV.4) we also see that the actual FTE as decreased from 11 FTE to 6.5 FTE and that there are also no longer any assignments to the functionary type 'desk officer' and work location 'location 3'. Because the rules of the assignment of an agendum changed, the addressee specificity also changed in the operation (Table IV.26).

5. DISCUSSION

In this chapter we will first discuss the most important remarks of the organizational implementation variables. We will elaborate the dependencies in the OIVs, the availability of resources and locations, the use agendum types instead of actor roles, and the loose elements in Figure 4.2. Then, we will discuss the findings of the implementations of the Rent-A-Car case that we modeled. We will elaborate on the order of modeling the implementation, and the freedom of choices in the implementation of an organization. In Appendix II each OIV is discussed, separately.

5.1 Organizational Implementation Variables

5.1.1 Dependencies in OIVs

We revised the following OIVs for the same reason: Competence, Human resource, Functionary type, Organizational unit, and Work locations. These OIVs were previously defined by the existence of dependencies to other objects. E.g., functionary type was defined by its coordination acts and production acts. We removed these dependencies. E.g., a functionary type can be created without assigning acts to it yet. The OIV organizational unit is an exception, because it still has one dependency left (it is dependent on another organizational unit). The dependencies were removed for two reasons.

The first reason is that we argued that this is better for communication purposes. If one of these OIVs would have been instantiated based on its dependencies, then any changes in its dependencies would have created a different instance. E.g., The functionary type 'distributor' is created based on that it has to deal with the agendum type 'car issue is requested'. If it is decided that the distributor also has to deal with the agendum type 'car drop off is requested', the 'distributor' would have to be called differently because it is no longer the same functionary type. One could argue that this is actually what you want, because the name is merely a label of the instance and the construction is more important than the label. However, we argued that the label is more important, because it stays clear what is meant by the instance. E.g., in the previous example the 'distributor' would still be called the 'distributor', even though some of its responsibilities have changed.

The second reason is that it gives the possibility to instantiate an OIV, before knowing what the specific use(s) or who the specific user(s) of the instance will be. This is useful when implementing an organization top-down. E.g., the functionary type 'distributor' can be created, without knowing what agendum types it will be dealing with.

Now that the 'distributor' is already created, the organization can instantiate other X-references as well, such as placing the distributor in an organizational unit, or the organization can already communicate about the distributor. The agendum types can be assigned to the distributor at later stage, via the X-reference of functionary type and agendum type. Information about former assignments will not be lost, because in DEMO, history is kept of the production and coordination world[20, p. 82].

Since these OIVs are created without its dependencies, it gives enterprise engineers the possibility to create any instance of these OIVs they want. This can result in irrelevant instances of an OIV. For example, one could define software engineering skills as a competence when implementing a pizzeria, but that would probably be unnecessary. Therefore, an enterprise engineer should always consider the organization or the scope of the organization that he is implementing. Modeling the ontological model of an organization will provide the boundaries for implementing the organization. An enterprise engineer should also consider creating a new instance of one of these OIVs, when the assignments of instance become unrelated to the meaning of the instance. For example, if the functionary type 'distributor' is only assigned to deal with the agendum type 'rental contracting is requested', it would be better to create a new functionary type called 'desk officer' and assign the agendum type to this functionary type.

5.1.2 The availability of resources and locations

The following OIVs have been revised for the same reason: Sourcing, Technical channels, and Work locations. These OIVs stress the importance of the availability of, respectively, resources, technical channels (a type of resource) and locations. We regarded the nature of an instance as less important than the availability of an instance, when considering the results of these OIVs in the installation. E.g., for the X-reference of human resource and functionary type it does not matter whether an human resource is an employee or hired externally, as long as they are available to be assigned to a functionary type. Work locations is now positioned as part of the implementation category, but it can be considered to position work locations in the HR and means category.

5.1.3 Actor roles and agendum types

In this research we constructed the OIVs according to the notion of agendum types. When implementing an organization, one considers the agendum types that are described in the action model of the ontology. One can derive the actor roles from the agendum types and vice versa. Using agendum types instead of actor roles provided us with more fine grained assignments compared to assignments to actor roles and an enterprise engineer can only focus on the product fact types that need a response from the organization. Another advantage is that we do not have to create an OIV for structural delegations between functionary types. We covered this with the X-reference of functionary type and agendum type.

There is also a downside to using agendum types instead of actor roles. One actor role often deals with multiple agendum types. Using actor roles will reduce the num-

ber of assignments that are needed in the X-references. This is especially the case for outsourcing. One can just outsource an actor role to an different organization, without having to outsource each agendum type individually (X-reference of actor role and juristic person).

Loose OIVs

There are two OIVs in Figure 4.2 that also do not have a reference law to any other OIV, namely Language support, and Validation of competences. We argued that both OIVs are necessary and important, but how they are explicitly related to other categories in the fact diagram is still unclear. Order of working is also a loose element in Figure 4.2, but the product act type is related to other elements from the OIVs, because the product act type is derived from the DEMO terminology. This relation is also shown in Table I.1 and in the glossary.

5.2 Rent-A-Car

5.2.1 Order of implementation

We noticed that there was a certain order in which we modeled the implementation of the RAC case. We followed the order of the categories,as shown in section 5.2.1, by doing the implementation first, HR and means second, installation third, and operation last. The OIVs that can be created independently from others, such as a functionary type, were implemented first. The OIVs in the first item, except for juristic person, were also the input for most of the X-references. It was remarkable that Competence and X-reference of agendum type and competence were implemented together. This was because the competences were based on the agendum types. We did not define any competence without making the assignment to an agendum type. The implementation of an organization was an iterative process, i.e., choices were adjusted based on choices in a later stage.

Order

Implementation

1. Functionary type, juristic person, organizational unit, and work locations
2. Competence and the X-reference agendum type and competence
3. Event location restrictions, order of working, and way of dealing with an agendum type
4. Language support and the X-references: functionary type and agendum type, functionary type and organizational unit, functionary type and work location, and work locations and agendum type
5. Allocation of FTE and rules for the assignment of an agendum

HR and means

1. Human resource and technical channels
2. Sourcing
3. Validation of competences

Installation

1. the X-references: human resource and functionary type, human resource and organizational unit, and human resource and work location

Operation

1. Addressee specificity and delegation

5.2.2 Freedom of choice

The modeling of the implementation of RAC provided useful insights in the freedom and restrictions of the OIVs. Most OIVs provide a lot of freedom to an enterprise engineer, because most of the OIVs have many-to-many relationships in their formalizations. This freedom leaves open a lot of options for practitioners without providing guidelines to what good choices are.

For some OIVs the freedom negatively affects the transparency and traceability in the organization, especially with the OIV Allocation of Full Time Equivalent. In the allocation of FTE the FTE norm of the organization is set. After discussing this OIV extensively, we came to the consensus that the FTE norm can be set per functionary type, organizational unit, and work location, or a combination of these OIVs, because one often wants to specify a certain occupancy per element. In the RAC implementation we chose to set the norm as the combination of these OIVs, because that way we can derive the amount of FTE at any level, as well as the combination of them. Attempts to set the FTE norm per element failed, because it becomes difficult to trace the amounts of FTE. E.g., the FTE norms are set as 4 FTE to the functionary type 'desk officer', 2 FTE to the work location 'office 1', and 4 FTE to the desk officer at 'office 1'. This could mean that there are 10 FTE working at RAC (the sum of FTE) or it could mean that there are only 4 FTE working at RAC (the 4 FTE 'desk officer' are working at 'office 1' and the 2 FTE at 'office 1' are fulfilled by desk officers).

6. CONCLUSIONS AND RECOMMENDATIONS

Companies need to be agile to deal with internal and external changes[1]. These changes often occur in the implementation of an organization. Op 't Land and Krouwel proposed a set of organizational implementation variables[2]. They defined organizational implementation variables as "the dimensions in which organizational implementation choices are made". The OIVs refer to the construction perspective of an enterprise, the implementation choices in the development of a system, given an agreed upon essence of the enterprise, and the varying nature of these choices. These OIVs are expected to have the potential to be supported by IT, but no research has been done to validate this. To assess the extent to which IT in an organization supports the OIVs, a formal model is required. The goal of this research was to: *Construct a model to assess the support of organizational implementation variables by IT.* To achieve this research goal we proposed four research questions.

6.1 Answering the research questions

6.1.1 Are the OIVs sufficiently rigorous to be formalized?

In this research, we used the OIVs and their definitions that van Bockhooven[5] proposed. We found that the OIVs were not sufficiently rigorous to be formalized. The process of formalizing the OIVs provided most of the insights into the rigor of the OIVs. Twenty three definitions and six names were revised, one OIV was removed, four OIVs were proposed, and four OIVs were taken out of scope, as shown in Table 4.1, and five OIVs were suggested, as shown in Table 4.2. We proposed definitions for the suggested OIVs and the OIVs that were taken out of scope. Every other OIV consists of a definition, examples and counter examples, a formalization, and remarks (see Appendix II).

6.1.2 To what extent can we categorize the OIVs?

Dietz proposed three categories of implementation[24]. Because we were not satisfied with these three categories, we proposed a set of four categories for the implementation of an organization, namely the implementation, the installation, the operation, and HR and means. We positioned the OIVs in these four implementation categories.

6.1.3 To what extent can we formalize the OIVs?

Each OIV, that was within the scope, was formalized in an organization construction diagram and an object fact diagram. The formalizations were verified by instantiating

each fact type and result kind with examples from the EUrent case[27]. Each OIV was validated through interviews. The formalizations of the OIVs were integrated into one model, which consists of one organization construction diagram and one object fact diagram. This model was tested by modeling an implementation of the Rent-A-Car case[7]. We found that the OIVs technical channels and validation of competences are not formalized properly and failed in the test. The other OIVs were formalized properly.

6.1.4 To what extent can we assess the impact of a reorganization?

We modeled a reorganization of the Rent-A-Car case and assessed the impact of a reorganization. In each of the four categories, we noticed changes in the population of the OIVs . Especially the category installation showed the impact of the reorganization. In that category we noticed a difference in the capacity of human resources (a change to overcapacity).

6.2 Research goal and contributions

The goal of this research was accomplished. A formal model, consisting of an organization construction diagram and an object fact diagram, was constructed (see Figure 4.1 and Figure 4.2). This model can be used to assess the support of organizational implementation variables by IT. If these choices are implemented in the organization in such way that the organization can respond to change by adjusting the choices, then we are convinced that the OIVs will help to provide an agile organization. If this is also the case for IT in the organization, this will create IT agility, i.e., enabling continuous change through aligning enterprise agility and agile IT. An IT platform should be able to support the transactions in the OCD and to capture the fact types and result kinds in the OFD. The constructed model can be used to assess current IT platforms and designing new IT platforms for building agile enterprise information systems(EIS). An EIS can also be assessed to determine if it supports the OIVs.

To the field of enterprise engineering a formal model now exists to model the implementation of any organization. This contributes to the execution of the Generic Software Development Process(GSDP)[23], by having formalized one step in coming from the essence of the organization to an operational organization. The construction model of the ontology can contribute to the splitting and allying of organizations[28]. Since the OIVs are implemented given an agreed upon ontology, we are convinced that by using our model insights in the impact of the splitting and allying of organizations in the implementation can be provided. The constructed model also provides a step in the process of developing cross-organizational IT applications with DEMO as a starting point[29]. The model is generic foundation for every IT application. The applications will differ from each over by making different choices within the dimensions. We also contributed to the GSDP by categorizing the implementation and proposing criteria for positioning OIVs in these categories.

The constructed model can also be used to assess the impact of different implementations and scenarios in an organization. The constructed model can help to make the

choices that practitioners need to make in the implementation explicit. This formal approach also creates awareness to the importance of enterprise agility and IT agility and helps with making better choices.

6.3 Limitations and future research

Some limitations have been identified in this research. Future research should be focused at resolving these limitations. The limitations that will be addressed are: the use of a fictional case, the lack of metrics, the OIVs that are out of the scope, and the action model and process model.

The constructed model was tested using the RAC case[7]. This is a fictional case. Therefore, the model should be applied in a real organization. We suggest the following approaches: applying the model to an organization to see whether we can capture the entire implementation of that organization in the model(organizational audit), assessing the extent to which an IT platform supports the model and develop an EIS with an IT platform(implementing an EIS), and assess the extent to which an existing enterprise information system supports OIVs (IT audit). Especially methods and platforms that provide agile enterprise information systems should be assessed. E.g., assessing to what extent the set of anticipated changes in the Normalized Systems theory can support the OIVs[18]. An assessment of the NS Expanders could be done to determine this[30].

The constructed model can be used to assess whether the organizational implementation variables are supported by IT. However, it does not assess if the OIVs are supported as choices that can be easily altered or as fixed choices. We have not provided any metrics to measure the extent of the support, but metrics should be added to the OIVs. By doing this it will be possible to compare IT platforms and to compare enterprise information systems. It will also be possible to determine if agile IT is achieved in an organization. To completely provide agile IT in the future, we expect enterprise information systems to be able to alter the choices of the OIVs while the system is in operation, without having to go through the design and engineering phase of the GSDP.

Although rigor is added to the OIVs, there is still room for improvement. Four OIVs were taken out of scope and five OIVs were suggested. These OIVs should to be reviewed to determine if they should be part of the set of OIVs and they should be formalized. To add more rigor, it should also be researched which OIVs are necessary for an implementation and which ones are optionally, and to what extent there is a generic order in implementing an organization.

DEMO recognizes four aspect models[20], namely the construction model, process model, action model, and fact model. The OIVs were only formalized in an OCD and an OFD, and should be formalized in the other models as well. We argue that those other models will provide useful insights and are necessary to create a generic model for implementation. E.g., the process step diagram can contribute to formalizing the sourcing process. In the process of further formalizing the OIVs, the freedom in the models should be reconsidered. Restricting the implementation will provide better directions to practitioners for implementing an organization and an enterprise information system.

The definitions and formalizations of the OIVs build upon the DEMO theory. If there is no ontological model available of the organization, the OIVs can not be implemented.

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GLOSSARY

Act type A coordination act type or a production act type. $\{$Act type$\}$=$\{$Coordination act type$\} \cup \{$Product action type$\}$.

Agendum The coordination event to which an actor has to respond[7]. An agendum is an instance of agendum type.

Agendum type The product fact type to which an actor needs to responds. Agendum types are described in the action model of the ontology. $\{$Agendum type$\} \subset \{$Product fact type$\}$.

Coordination act The atomic act in transactions. The result of a successfully performed coordination act is the creation of the corresponding coordination fact[7]. A coordination act is an instance of a coordination act type.

Coordination act type . $\{$Coordination act type$\}$ = $\{$request, promise, state, accept, decline, quit, reject, stop, cancel, allow, refuse, revoke-request, revoke-promise, revoke-state, revoke-accept, allow-revoke-request, allow-revoke-promise, allow-revoke-state, allow-revoke-accept, refuse-revoke-request, refuse-revoke-promise, refuse-revoke-state, refuse-revoke-accept$\}$ [20].

Fact type The generic concept for modeling the state of a world[7]. $\{$Fact type$\}$= $\{$is requested, is promised, is stated, is accepted, is declined, is quited, is rejected, is stopped, is canceled, is allowed, is refused, is executed, request is revoked, promise is revoked, state is revoked, accept is revoked, revoke-request is allowed, revoke-promise is allowed, revoke-state is allowed, revoke-accept is allowed, revoke-request is refused, revoke-promise is refused, revoke-state is refused, revoke-accept is refused $\}$.

Product act type The Cartesian product of the set of transaction kinds and the act types. $\{$Product act type$\} = \{$Transaction kinds$\} \times \{$act types$\}$.

Product fact type The Cartesian product of the fact types and the set of transaction kinds (in the ontology). $\{$Product fact type$\} = \{$Fact type$\} \times \{$Transaction kind$\}$.

Production act The act in a transaction by which the executor creates the product as well as its dependent production facts[7]. A production act is an instance of a production act type.

Production act type . $\{$Production act type$\} = \{$execute$\}$.

Transaction kind Transactions of the same transaction kind regard products of the same product kind[7]. $\{$Transaction kind$\}= \{$transaction kind $\in$ Scope of Interest$\}$.

APPENDIX

I. NOTATIONS

Table I.1 shows the notations of terms used throughout this appendix.

Term	**Example from EU-Rent case**	**Notation**
Agendum	Rental start #1005 is requested	AT01-1005/rq
Agendum type	Rental start is requested	AT01/rq
Act type	request, promise, execute	rq, pm, ex
Fact type	is requested, is promised	is requested, is promised
Coordination act*	Rental start request #1005	C01-1005/rq
Coordination act type	request, promise	rq, pm
Production act	Rental start execute #1005	P01-1005/ex
Production act type	execute	ex
Product fact type**	Rental start is requested	PF01/rq
Product act type	Rental start request	T01/rq
Transaction kind	Rental start, Rental end	T01, T02

Tab. I.1: Notations

*Coordination acts are structured as shown in Figure II.4, however in this document we do not state the time, performer and addressee unless this is necessary to understand the OIV.
**The difference between a product fact type and an agendum type is that a subject needs to respond to an agendum type as defined in the ontological model.

II. ORGANIZATIONAL IMPLEMENTATION VARIABLES

II.1 Introduction

In this chapter each organizational implementation variables is presented. The examples, counter examples, and verification by instantiation are based on the construction diagram of the EUrent case, as shown in Figure II.1. Each OIV was structured as follows, except for the OIVs that were taken out of scope. For those OIVs, as well as the suggested OIVs for future research, only a definition is proposed and some remarks were made.

II.1.1 Structure of OIVs

- Name of OIV
- Definition of OIV
- Examples
- Counter examples
- Formalization
  - OCD and Transaction Product Table
  - OFD
  - Verification by instantiation
- Remarks
  - Related OIVs
  - Old definition (if relevant)

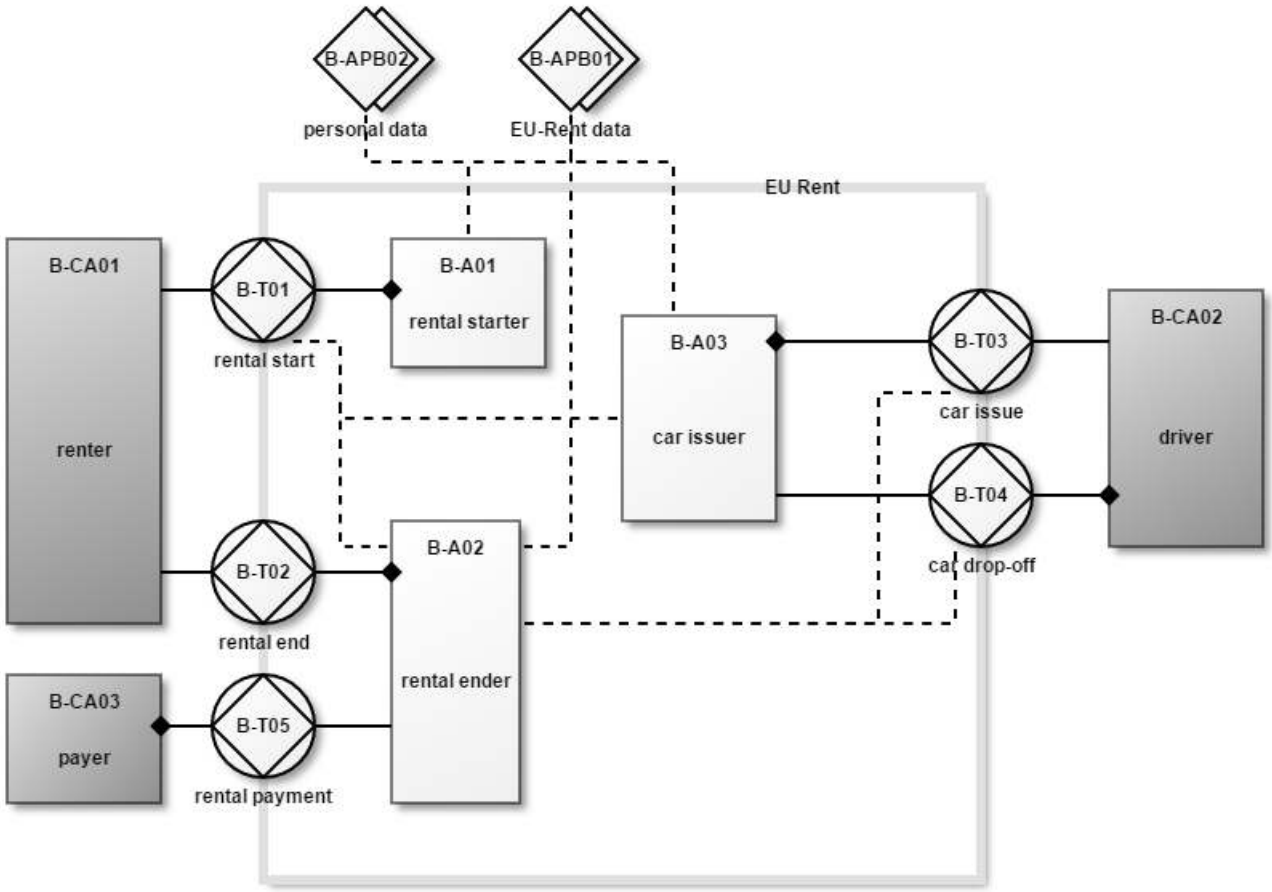


Fig. II.1: Construction diagram of the EUrent case[27]

II.2 Addressee specificity

II.2.1 Definition

Addressee specificity is making the addressee of a coordination act is so specific that the commitment for that coordination act can be evoked.

II.2.2 Examples

Example 1 (a natural person evokes the commitment)

1. rental start request number 1005 is addressed to RAC by John.
2. rental start request number 1005 is addressed to Head of front office.
3. rental start request number 1005 is addressed to Desk officer.
4. rental start request number 1005 is addressed to Jane.
5. Jane can evoke the commitment for rental start request number 1005.

Example 2 (an automaton evokes the commitment)

1. rental start request number 1005 is addressed to RAC by John.
2. rental start request number 1005 is addressed to *reservation system*.
3. Reservation system can evoke the commitment for rental start request number 1005.

Example 3 (the addressee is specific and can evoke the commitment)

1. rental start request number 1005 is addressed to Chiara by John.
2. Chiara can evoke the commitment for rental start request number 1005.

II.2.3 Counter examples

1. Jane is the executor of T01/rq
2. Mik is the initiator of T03/rq

II.2.4 Formalization

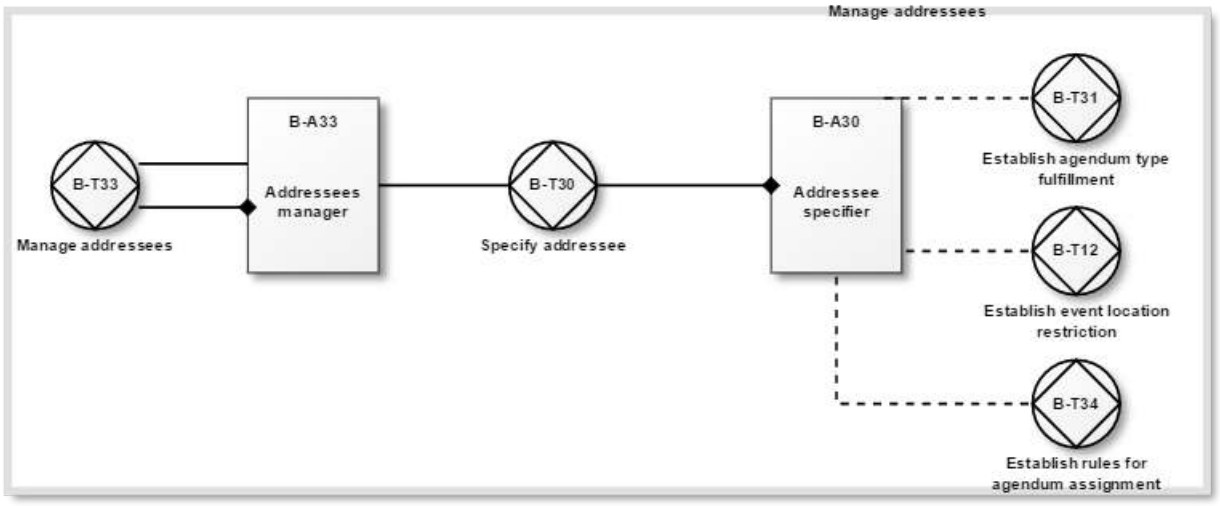


Fig. II.2: OCD of Addressee specificity

Transaction kind	**Product kind**
B-T30 Specify addressee	P30 [Addressee Specification] has been specified
B-T33 Manage addressees	P33 C-ACT addressee management for [period] has been done

Tab. II.1: Transaction Product Table

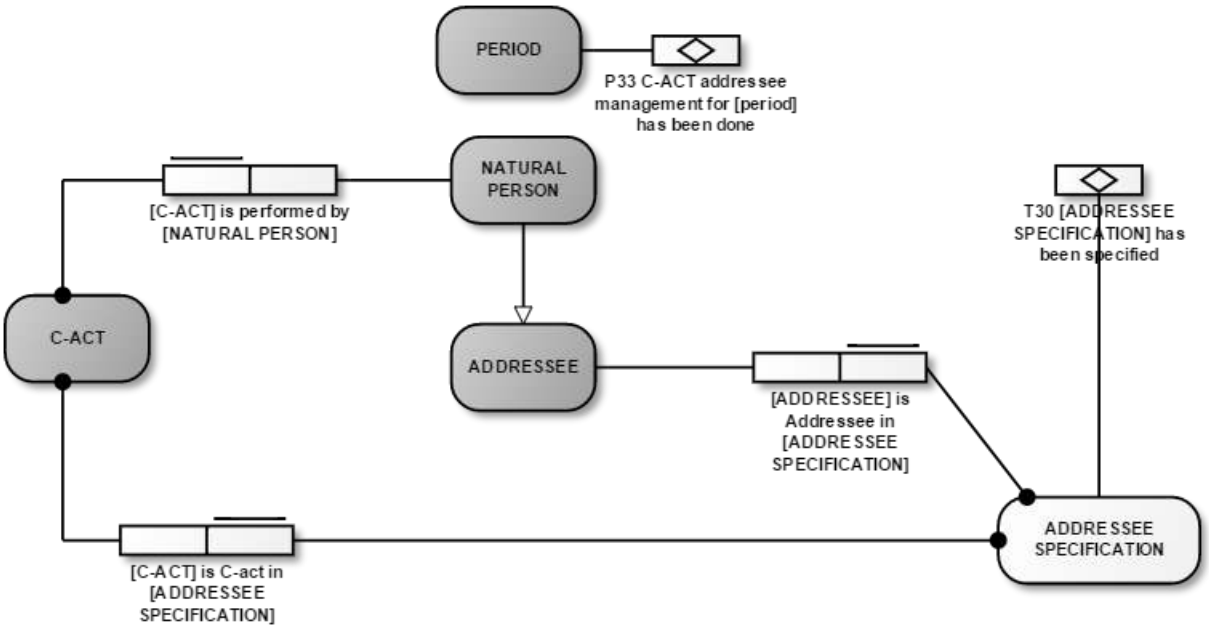


Fig. II.3: OFD of Addressee specificity

II.2.5 Verification by instantiation

Primary transactions

Performer	Intention	Addressee	Fact	Time
John	request	RAC	rental start #1005 has started	1/9/2014
James	request	RAC	rental start #1010 has started	1/10/2014

Tab. II.2: Instances of C01/rq

Table II.45, in Rules for the assignment of an agendum, shows instances of a set of rules that make the addressee more specific.

Instances of OIV

C-act	Natural person
C01-1005/rq	John
C01-1006/rq	John
~~C01-1005/rq~~	~~Jane~~

Tab. II.3: Instances of emph[natural person] is the performer of [C-ACT]

C-Act	Addressee specification
C01-1005/rq	1
~~C01-1006/rq~~	~~1~~
C01-1005/rq	.

Tab. II.4: Instances of *[C-ACT] is C-act in [ADDRESSEE SPECIFICATION]*

Addressee specification	Addressee
1	Chiara
2	Chiara
~~1~~	~~Desk officer~~

Tab. II.5: Instances of *[ADDRESSEE] is Addressee in [ADDRESSEE SPECIFICATION]*

C-act	Addressee specification
C01-1005/rq	RAC
C01-1005/rq	Desk officer
C01-1005/rq	Jane
C01-1010/rq	RAC
C01-1010/rq	Chiara

Tab. II.6: Instances of *P30 [ADDRESSEE SPECIFICATION] has been specified*

II.2.6 Remarks

- Customers often direct their requests to an organization, through channels, and not to a specific human resource of the organization. For example, in the RAC case customers will probably send the request to rent a car to info@rac.com. In such a case the addressee is not specific enough to evoke a commitment, as shown in Table II.2. The transaction is repeated until the specified addressee is a natural person (or an automaton) that can evoke the commitment for that coordination act. A coordination act should have an addressee that can evoke a commitment (distinction axiom [20, p. 105]). Figure II.4 shows the standard notation of a coordination act. When the addressee of a coordination act is already specific and the addressee can evoke commitment, it is not necessary to further specify the addressee. Even when a request is addressed to a natural person, it does not mean that this natural person is always authorized to evoke a commitment for that coordination act. E.g., in the RAC case, John could request the rental start to Ferre, but Ferre is not authorized to evoke the commitment of a rental start request. This is also the reason for revising the definition of this OIV, because in the old definition it was sufficient if the addressee of an coordination act was specific.

- Based on rules captured by OIV Rules for the assignment of an agendum, the addressee is specified. These rules determine the layers in an organization for dispatching an agendum type and specifying an addressee. E.g., in the RAC case, first rental start is requested could be dispatched per region, after that per functionary type or per customer type. Especially in large organizations it is common practice to have a layered structure through which requests are dispatched. This also means that the external object ADDRESSEE, as shown in Figure II.3, can take different values from different OIVs. For example, ADDRESSEE can be an instance of functionary type or an instance of organizational unit. We did not formalize in the model what an ADDRESSEE can be, because that is specific for an organization.

- In organizations, addressees need to be specified, not only when an event is triggered externally, but also when they are triggered internally. For example, when dealing with a legal issue a human resource does not always know who to contact at

the legal department and therefore addresses his request for legal assistance to the entire department. The addressee is not specific enough to evoke a commitment in that situation, therefore the agenda addressee checker of the legal department will make a request to further specify the addressee. The agenda addressee checker checks whether there are agendums in the agenda of which the c-act is not specific enough to evoke a commitment.

- It can be argued that this OIV should be called 'Executor specificity'. The reasoning behind this is that the addressee of a request, when specified, will be the executor of the transaction. In that situation you are actually specifying the executor. This is true when it concerns an act type that is addressed to the executor, such as a request or an accept. However, the addressee is not always the executor. Act types, such as a promise or state, are directed to the initiator. Although the initiator is known most of the time, there are cases in which the initiator needs to be specified. For example, when dealing with a juristic person (e.g., another organization) the initiator, on behalf of the juristic person, can be different compared to when the transaction was started, or when the initiator is not available anymore(e.g., illness) and the transaction still needs to be completed. So the addressee switches between the initiator and the executor and the addressee can change over time. Therefore we have decided that 'Addressee specificity' is better suited for this OIV.
- An automaton that can evoke a commitment is contrary to the DEMO theory[20, p. 123].

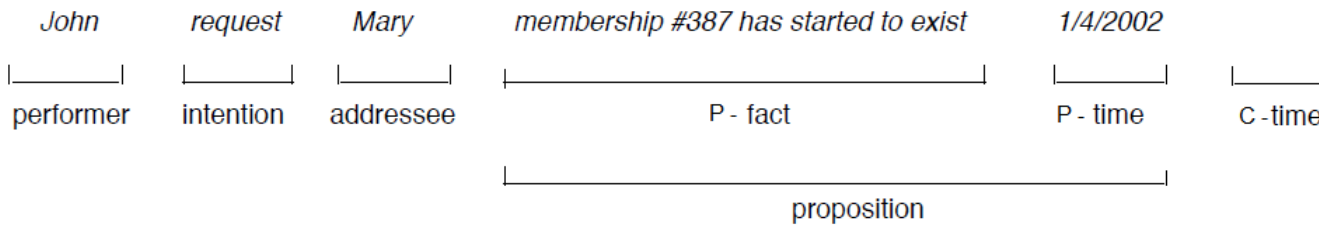


Fig. II.4: Standard notation of a coordination act, extended cf. [20, p. 84]

Related OIVs

Rules for the assignment of an agendum

Old definition

The extent to which the addressee is already on the specificity of a subject (human being) [5]

II.3 Allocation of Full Time Equivalent

II.3.1 Definition

The allocation of full time equivalent(FTE) is the norm amount of FTE allocated per functionary type, organizational unit and work location.

II.3.2 Examples

1. 4 FTE has been allocated to desk officer(functionary type) in distribution(org. unit) at the Air lane 23, Amsterdam, Netherlands (work location).
2. 3 FTE has been allocated to desk officer.
3. 10 FTE has been allocated to distribution.
4. 2 FTE has been allocated to Air lane 23, Amsterdam, Netherlands .

II.3.3 Counter examples

1. 4 actual FTE are working as a desk officer

II.3.4 Formalization

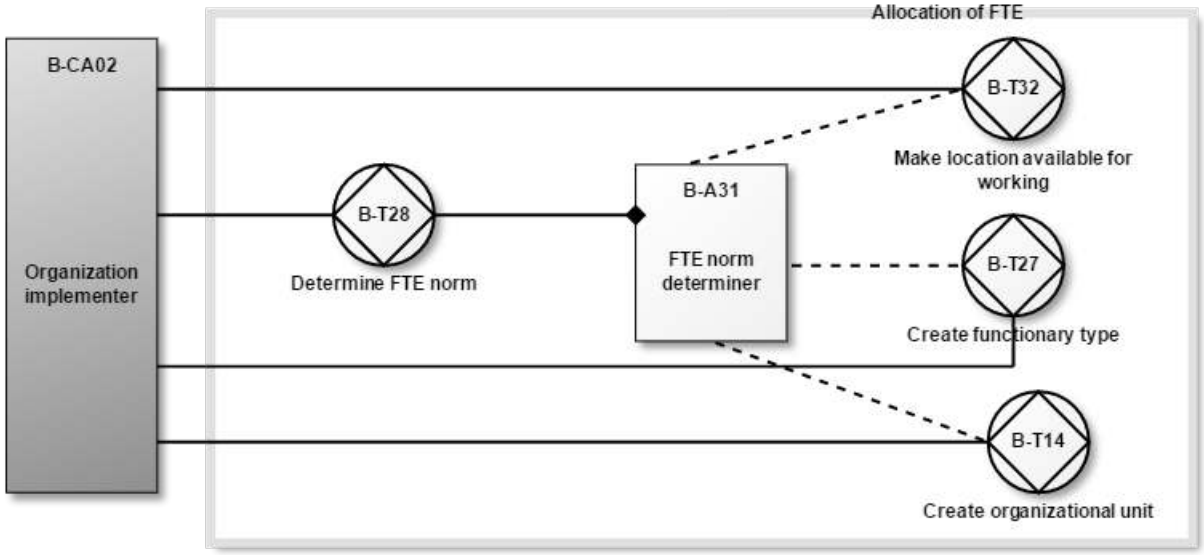


Fig. II.5: OCD of Allocation of Full Time Equivalent

Transaction kind	Product kind
B-T28 Determine FTE norm	P28 [FTE norm] has been determined

Tab. II.7: Transaction Product Table

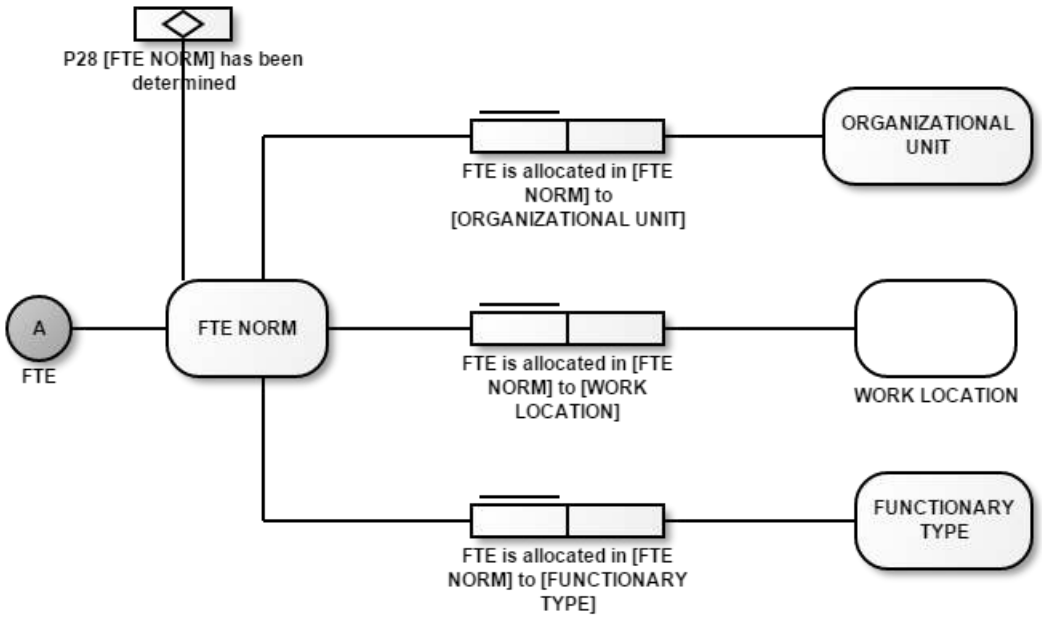


Fig. II.6: OFD of Allocation of Full Time Equivalent

II.3.5 Verification by instantiation

FTE Norm	Organizational unit
1	Distribution
2	Distribution
~~1~~	~~Sales~~

Tab. II.8: Instances of *FTE is allocated in [FTE NORM] to [ORGANIZATIONAL UNIT]*

FTE Norm	Work location
1	Head office
2	Head office
~~1~~	~~Schiphol Airport office~~

Tab. II.9: Instances of *FTE is allocated in [FTE NORM] to [WORK LOCATION]*

FTE Norm	Functionary type
1	Distributor
2	Distributor
~~1~~	~~Desk officer~~

Tab. II.10: Instances of *FTE is allocated in [FTE NORM] to [FUNCTIONARY TYPE]*

FTE norm
3 FTE - Distributor
3 FTE - Head office
3 FTE - Distribution
3 FTE - Distributor - Head office - Distribution

Tab. II.11: Instances of *P28 [FTE NORM] has been established*

II.3.6 Remarks

- This OIV sets the norm amount of FTE that is allocated. This might differ from the actual amount of FTE. You can derive this actual amount from the following X-references: X-reference of human resource and functionary type, X-reference of human resource and work location and X-reference of human resource and work location. In an organization there can be a gap between the norm amount and the actual amount. A higher actual amount than the norm amount might indicate overcapacity of human resources. A lower actual amount than the norm amount might indicate undercapacity of human resources. To lower the gap one can consider altering the norm amount or altering the actual amount (hiring or firing human resources).

- The assignment percentage was removed from the definition, because it concerns the assignment percentage of one specific human resource. Therefore the assignment percentage is now taken into account in the three previously mentioned X-references.

- The amount of FTE can be allocated at each level(functionary type, organizational unit and work location) separately or as a any combination of the three levels. The latter means that if one FTE norm has allocations with more than one level, they

are combined. This is shown the first example of subsection II.3.2. A FTE norm should at least contain an allocation for one of the three levels. (#FTE is allocated to an element from (functionary type ∪ organizational unit ∪ work location)).

Old definition

The amount of FTE per department, functionary type, location, etc. combined with their assignment percentage. [5]

II.4 Competence

II.4.1 Definition

A competence is an integrated set of knowledge and understanding, skills and attitudes

II.4.2 Examples

1. Microsoft Office knowledge
2. Customer friendliness
3. Highly intelligent

II.4.3 Counter examples

1. Microsoft Office certification
2. Driver's license

II.4.4 Formalization

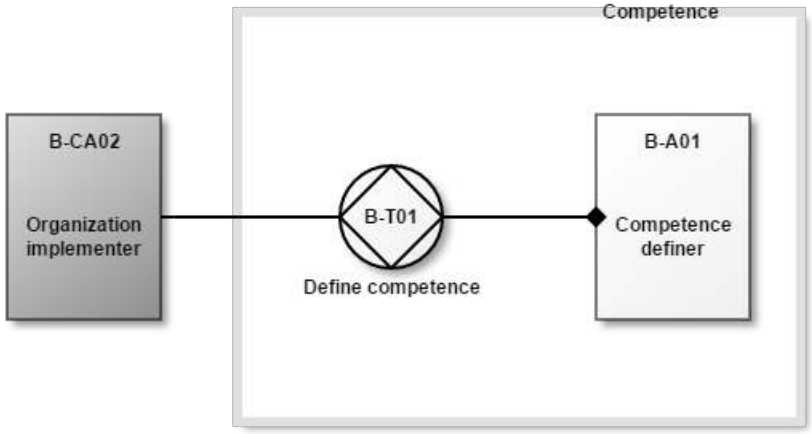


Fig. II.7: OCD of Competence

Transaction Product Table

Transaction kind	**Product kind**
B-T01 Define competence	P01 [Competence] has been defined

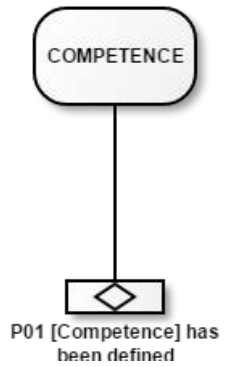


Fig. II.8: OFD of Competence

II.4.5 Verification by instantiation

Competence
Microsoft Office knowledge
Customer friendliness
High intelligence

Tab. II.12: Instances of *P01 [Competence] has been defined*

II.4.6 Remarks

- Only the first part of the old definition has been used to define a competence. The strict dependency of a competence on the subject and on the production acts and coordination acts has been left out of the definition. By doing this a competence can be defined, without having to define its corresponding acts or agendum types first. Changes in agendum types do not influence the competences directly. This follows a similar reasoning as with OIV Functionary type, that is no longer defined by its acts. A competence can also be used for multiple agendum types and multiple human resources, without having to define a new competence.
- To require a competence for dealing with an agendum type, the following X-reference is proposed: X-reference of agendum type and competence. The requirement of a competence for a human resource is covered by the OIV: Validation of competences.

Related OIVs

X-reference of agendum type and competence
Validation of competences

Old definition

The integrated set of knowledge and understanding, skills and attitudes that are required for a subject to perform particular P-acts and the corresponding C-acts.(Defined in [5] based it on definitions from [20] and businessdictionary)

II.5 Delegation (incidental)

II.5.1 Definition

Delegation is the transfer of authority to deal with an agendum from one human resource to another, while that human resource keeps the responsibility.

II.5.2 Examples

1. Dealing with the promise of rental start #1005 is delegated from Chiara to Jane (meaning that Chiara is still responsible and Jane deals with the promise).
2. Dealing with the request of car pickup #1001 is delegated from Mik to Ferre.

II.5.3 Counter example

1. Dealing with rental start is requested is delegated from head of front office to desk officer.

II.5.4 Formalization

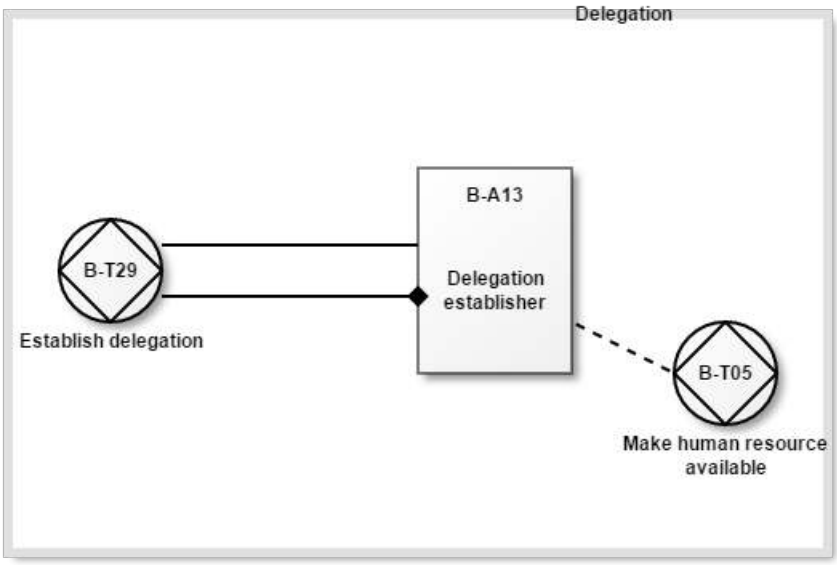


Fig. II.9: OCD of Delegation (incidental)

Transaction kind	Product kind
B-T29 Establish delegation	P29 [Delegation] has been established

Tab. II.13: Transaction Product Table

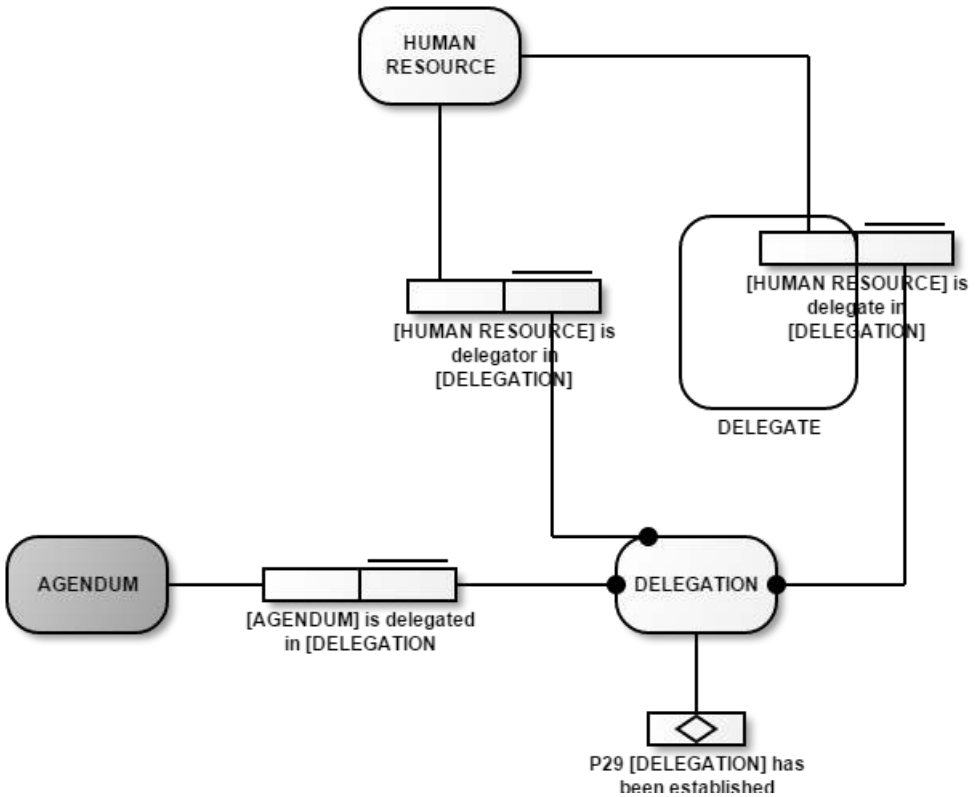


Fig. II.10: OFD of Delegation (incidental)

II.5.5 Verification by instantiation

Agendum	Delegation
AT01-102/rq	1
~~AT01-101/rq~~	~~1~~
AT01-102/rq	2

Tab. II.14: Instances of *[AGENDUM] is delegated in [DELEGATION*

Human resource	Delegation
Chiara	1
~~Mik~~	~~1~~
Chiara	2

Tab. II.15: Instances of *[HUMAN RESOURCE] is delegator in [DELEGATION]*

Human resource	Delegation
Mik	1
~~Chiara~~	~~1~~
Mik	2

Tab. II.16: Instances of *[HUMAN RESOURCE] is delegate in [DELEGATION]*

Delegation
AT01-103/rq - Chiara - Mik
AT02-102/rq - Mik - Chiara
AT01-100/rq - Mik - Jane

Tab. II.17: Instance of *P29 [DELEGATION] has been established*

II.5.6 Remarks

- In this research two variations of the OIV delegation exist, namely incidental delegation and structural delegation. The structural delegation is covered by the OIV X-reference of functionary type and agendum type. The incidental delegation, defined in this OIV, is part of the operation of an organization. The structural delegation is part of the implementation of an organization. Incidental delegation is the transfer of authority to deal with an agendum from one human resource to another. E.g., when an human resource becomes ill he can transfer the authority to deal with the agendum to another human resource. The delegate should have the required competences to deal with the agendum that is delegated to him. Structural delegation is the transfer of authority to deal with an agendum type from a functionary type to another functionary type. E.g., the functionary type distributor is assigned to deal with penalty payment is stated and is accountable for that agendum type, but the desk officer is responsible for that agendum type. Mik, who is a the distributor, can delegate the agendum that he is dealing with to Jane, who is desk officer. The delegate should have the required competences to deal with the agendum that is delegated to him.

Related OIVs

Sourcing
Validation of competences
X-reference of agendum type and competence
X-reference of functionary type and agendum type

Related definition

The subject who is authorized for performing an act, may delegate the authority to someone else. If a subject A delegates authority to a subject B, subject A remains (also) responsible for the acts of subject B.[20]

II.6 Event location restrictions

II.6.1 Definition

Event location restrictions are the rules that indicate the extent to which dealing with an agendum type is restricted to a location.

II.6.2 Examples

Rule regarding rental start is requested.

1. Dealing with rental start is requested is not restricted to a location.

Rule regarding car pick up is requested.

1. Dealing with car pick up is requested is restricted to the location at which it is started.

II.6.3 Counter example

1. Rental start is requested is dealt with at ABCstreet 123, Leiden, Netherlands.

II.6.4 Formalization

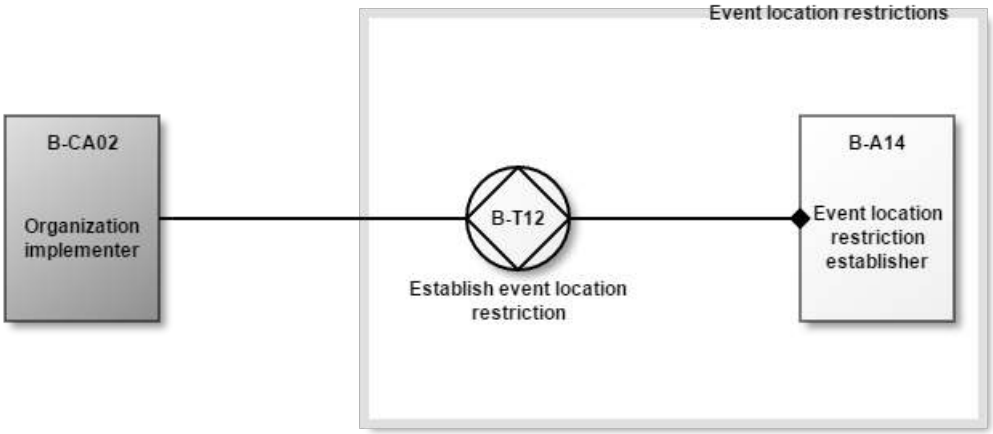


Fig. II.11: OCD of Event location restrictions

Transaction kind	Product kind
B-T12 Establish event location restriction	P12 [Event location restriction] has been established

Tab. II.18: Transaction Product Table

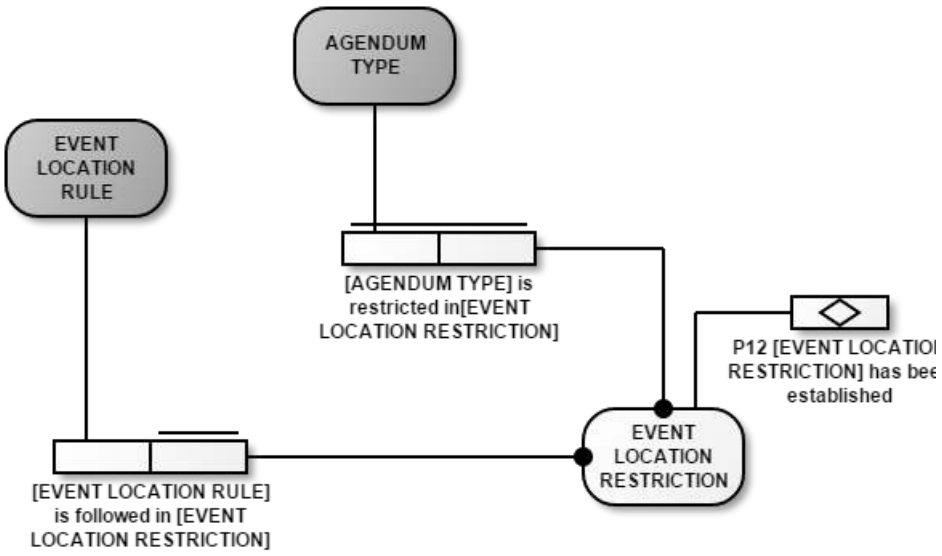


Fig. II.12: OFD of Event location restrictions

II.6.5 Verification by instantiation

Event location rule	**Event location restriction**
Dealing with agendum type is not restricted to a location	1
~~Dealing with agendum type is restricted to a location~~	~~1~~
Dealing with agendum type is not restricted to a location	2

Tab. II.19: Instances of *[EVENT LOCATION RULE] is followed in [EVENT LOCATION RESTRICTION]*

Agendum type	Event location restriction
AT01/rq	1
~~AT02/rq~~	~~1~~
~~AT01/rq~~	~~2~~

Tab. II.20: Instances of *[EVENT LOCATION RULE] is followed in [EVENT LOCATION RESTRICTION]*

Event location restriction
Dealing with agendum type is not restricted to a location - Rental start is requested
Dealing with agendum type is restricted to a location - Car pick up is requested

Tab. II.21: Instances of *P12 [EVENT LOCATION RESTRICTION] has been established*

II.6.6 Remarks

- This OIV specified whether the product act types of an agendum type can be performed at different locations or that the performance of the product act types are restricted to the location that the agendum has been started at. E.g., if there is no restriction, Jane (a desk officer) could do the rental start state at a different location than she did the rental start promise. If there is a restriction she could not do that. The choice of locations is always restricted by the OIV X-reference of work locations and agendum type, even when this OIV has specified that there is no restriction. Since there are only two options as event location rule, the event location rule is external in Figure II.12.

Related OIVs

Order of working
Way of dealing with an agendum type
X-reference of work locations and agendum type

Old definition

The extent to which the execution of an act is restricted to a location.[5]

II.7 Functionary type

II.7.1 Definition

A functionary type is a call sign intended for the assignment of agendum types (*in X-reference with functionary type*)

II.7.2 Examples

1. Desk officer is a functionary type.
2. Distributor is a functionary type.

II.7.3 Examples

1. Rental starter (actor role)

II.7.4 Formalization

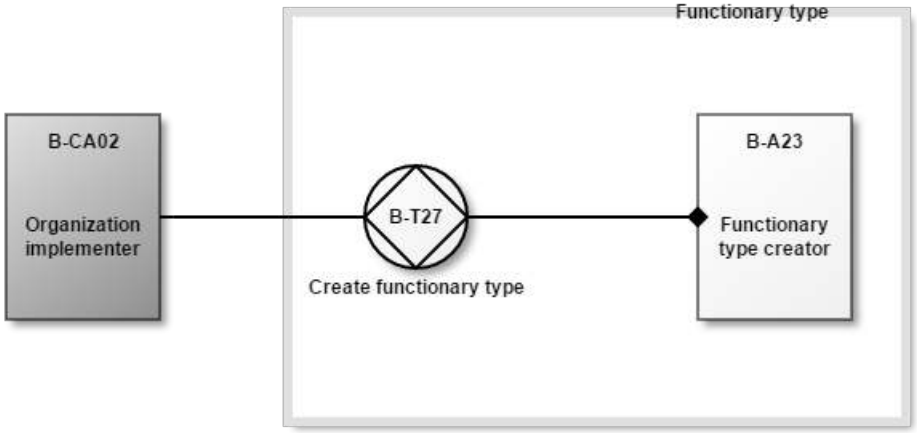


Fig. II.13: OCD of Functionary type

Transaction kind	**Product kind**
B-T27 Create functionary type	P27 [Functionary type] has been created

Tab. II.22: Transaction Product Table

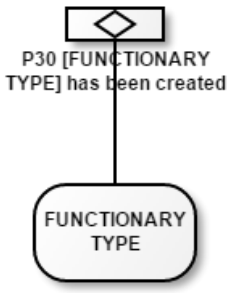


Fig. II.14: OFD of Functionary type

Functionary type
Desk officer
Distributor
Head of head office
Managing director

Tab. II.23: Instances of *P30 [Functionary type] has been created*

II.7.5 Verification by instantiation

II.7.6 Remarks

- In the old definition a functionary type was defined by the acts it is responsible for. In this situation any changes to the responsibilities or to the acts will result in a new functionary type. E.g., in a pizzeria the functionary type 'transporter' is created. The only responsibility for this functionary type is the delivery of the pizza order. However, later on it has been decided that the 'transporter' should also accept the payment, meaning that the responsibilities have changed and therefore the functionary type should change. 'Transporter' will now be called 'transporter 2.0'. One could argue that it is better to define a functionary type by its responsibilities and that the name of the functionary type is merely a label used for communication purposes.

- In this research we argue that for communication purposes it is better to define a functionary type by its call sign. E.g., at the same pizzeria mentioned before, we still call the 'transporter' the 'transporter' although its responsibilities have changed. Even though responsibilities have changed, it is still clear to what functionary type is being referred. There is another advantage of defining a functionary type by its call sign. When implementing organizations top-down there is no need to know all the agendum types a functionary type should be responsible for, at the moment of creating the functionary type. These assignments could be done

at a later stage and are covered by the OIV: X-reference of functionary type and agendum type.

- In a completely designed, engineered and operational organization there should be no functionary types that have an empty set of agendum types. Also the union of assigned agendum types in X-reference of functionary type and agendum type should be equal to the cartesian product of all transactions and the standard agendum types, meaning there are no a unassigned agendum types and every agendum type is mentioned in the X-reference.

Related OIVs

Allocation of Full Time Equivalent
X-reference of human resource and functionary type
X-reference of functionary type and agendum type
X-reference of functionary type and organizational unit
X-reference of functionary type and work location

Old definition

A cluster of responsibilities for coordination acts and production acts[31]

II.8 Human resource

II.8.1 Definition

A human resource is a natural person who works under a contract of employ or under a hire agreement.

II.8.2 Examples

1. Jane is employed at RAC.
2. Chiara is employed at RAC.
3. Anthony is hired externally at RAC.

II.8.3 Counter examples

1. Jackson is an illegal worker.

II.8.4 Formalization

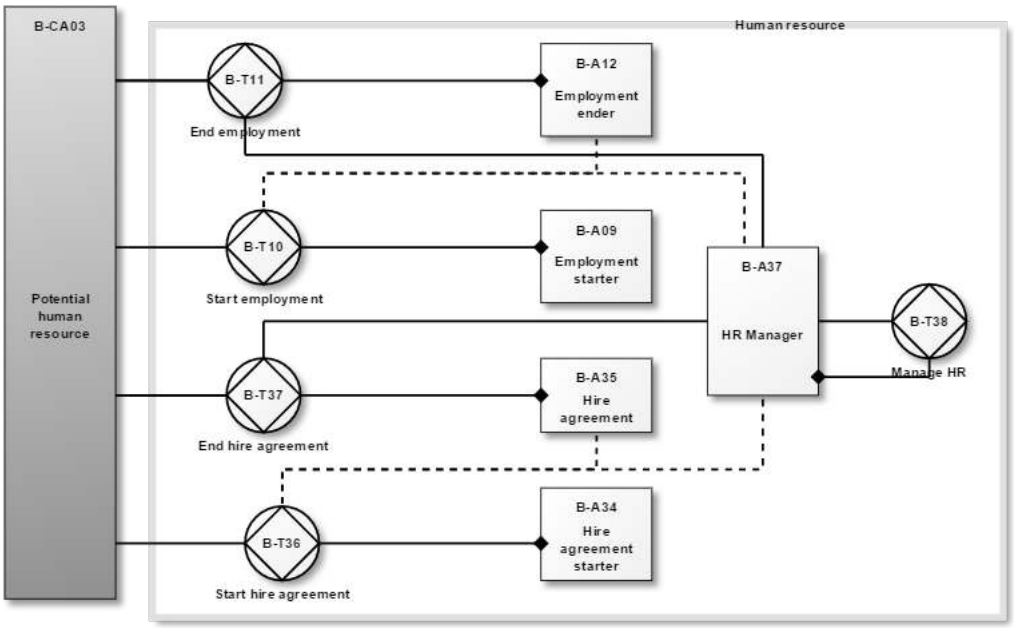


Fig. II.15: OCD of Human resource

Transaction Product Table

Transaction kind	**Product kind**
B-T10 Start employment	P10 [Employment] has been started
B-T11 End employment	P11 [Employment] has been ended
B-T36 Start hire agreement	P36 [Hire agreement] has been started
B-T37 End hire agreement	P37 [Hire agreement] has been ended
. B-T38 Manage HR	P38 HR management for [period] has been done

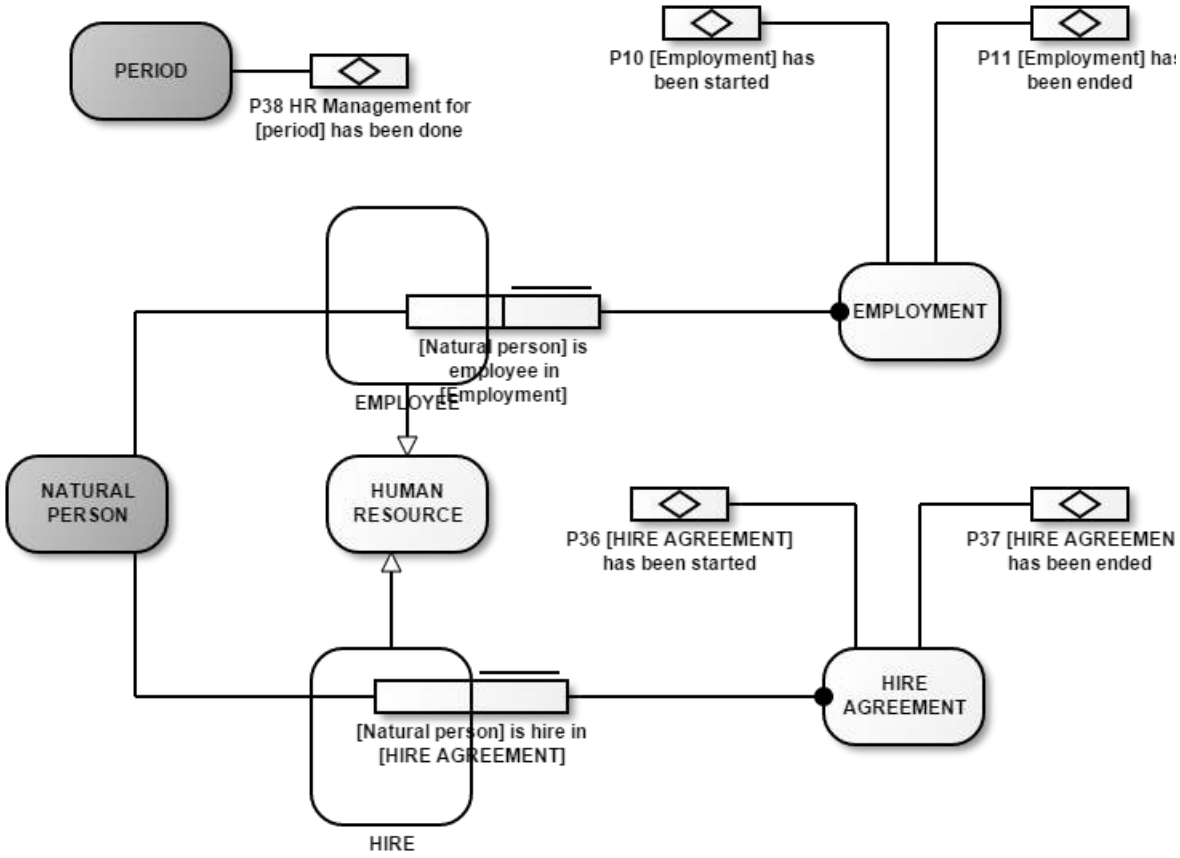


Fig. II.16: OFD of Human resource

II.8.5 Verification by instantiation

Natural person	Employment
Jane	Employment #1
~~Chiara~~	~~Employment #1~~
Jane	Employment #2

Tab. II.24: Instances of *[Natural person]is the employee in [Employment]*

Natural person	Hire agreement
Jane	Hire agreement #1
~~Chiara~~	~~Hire agreement #1~~
Jane	Hire agreement #2

Tab. II.25: Instances of *[Natural person]is the hire in [Hire agreement]*

II.8.6 Remarks

- In the old definition an employee is defined by the functionary types it fulfills. The functionary types a natural person fulfills can change over time, but this natural person does not become a different employee because of this change. Therefore an employee is now defined by its contract of employment[32]. This follows similar reasoning as with OIV Functionary type. This OIV also defines a hire, a natural person who is under a hire agreement. A hire is hired externally. Together the employee and hire are the human resources in the organization Sourcing distinguishes two types of resources that are available for dealing with agendum types: human resources and means.
- In a contract of employment or hire agreement often the initial functionary type, organizational unit and work location of the employee are stated. These aspects are covered by seperate OIVs: X-reference of human resource and functionary type, X-reference of human resource and organizational unit and X-reference of human resource and work location. When an initial functionary type, organizational unit or work location is stated in the contract of employment or hire agreement, a validation of competencesII.16 needs to be completed before signing the contract. Also an initial salary and length of the contract(e.g., temporary or permanent) are often stated in this contract.

Related OIVs

Sourcing
X-reference of human resource and functionary type
X-reference of human resource and organizational unit
X-reference of human resource and work location

Old definition

An employee is a natural person who fulfills one or more functionary types(employee).[5]

II.9 Juristic person

II.9.1 Definition

Juristic person is an entity that is recognized as having legal personality, i.e., it is capable of enjoying and being subject to legal rights and duties. [33]

II.9.2 Examples

1. RAC
2. RAC Belgium

II.9.3 Examples

1. John (natural person)

II.9.4 Formalization

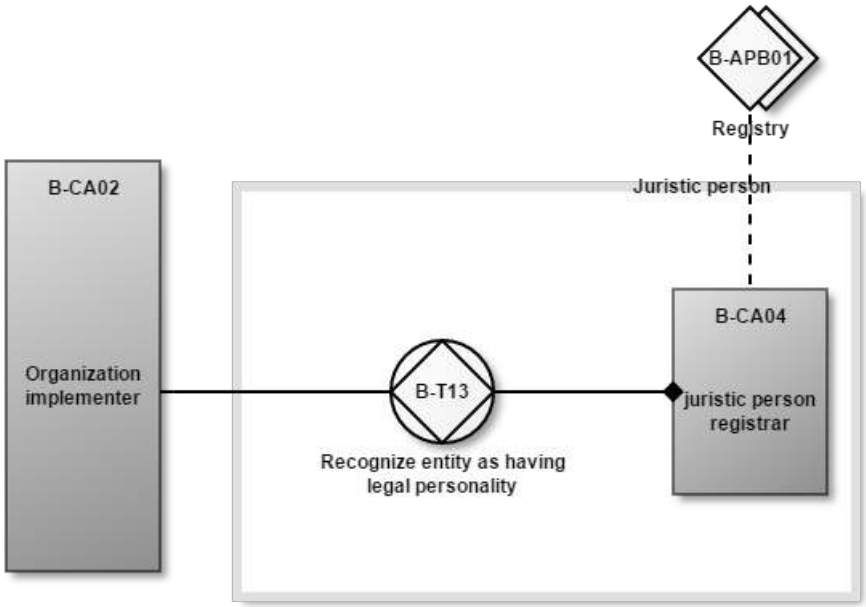


Fig. II.17: OCD of Juristic person

Transaction kind	Product kind
B-T13 Recognize entity as having legal personality	P13 Entity has been recognized as having legal personality

Tab. II.26: Transaction Product Table

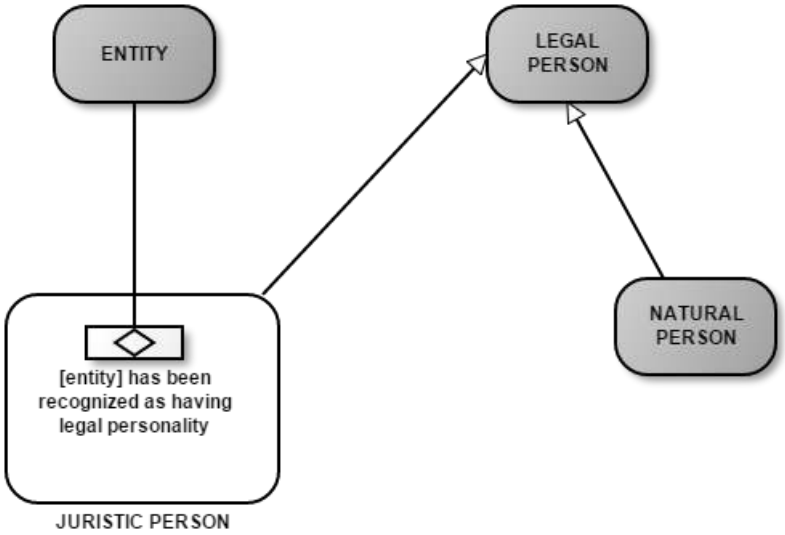


Fig. II.18: OFD of Juristic person

II.9.5 Verification by instantiation

Entity
RAC
Fictious RAC

Tab. II.27: Instance of *Entity*

Juristic person
RAC

Tab. II.28: Instance of *Juristic Person*

II.9.6 Remarks

- It is important to recognize that there are related terms with (quite) similar definitions, due to differences between countries in their laws. They all incorporate the idea of an entity that is treated like a person in the eyes of the law. Some of this related terminology has been stated below in section section II.9.6. The name and definition of this OIV has been revised, because the revised name and definition are more widely accepted.
- In the scope of one organization, you can only request that your organization is recognized as having legal personality. It might be necessary to do this in every country your organization operates in. This is also what was modeled in the OCD, however one needs to recognize other juristic persons, out of the scope of the organization, as well. E.g., when contracting a supplier, one needs to know if the supplier is registered as an organization. Often this can be verified at the Chamber of Commerce in a country. Therefore the production bank *B-APB01 Registry* is created. This is especially important if it is decided to outsource certain actor roles.

Related terminology

- *Legal person* is a natural person (i.e., a human being) or a *juristic person[33]
- *Legal entity* is a body, other than a natural person, that can function legally, sue or be sued, and make decisions through agents.[34]
- *Artificial person* is an entity, such as a corporation, created by law and given certain legal rights and duties of a human being; a being, real or imaginary, who for the purpose of legal reasoning is treated more or less as a human being.[34]

Related OIVs

Language support
Organizational unit
Work locations

Old definition

A legal entity is a legal construction, not being a natural person, that can act as an independent carrier of rights and obligations.(Legal entity)[5]

II.10 Language support

II.10.1 Definition

Language support is the decision in what languages the organization operates.

II.10.2 Examples

1. RAC operates in the English language.
2. RAC operates in the Dutch language.
3. RAC operates in the French language.

II.10.3 Counter examples

1. RAC uses tolks to support the Dutch language.

II.10.4 Formalization

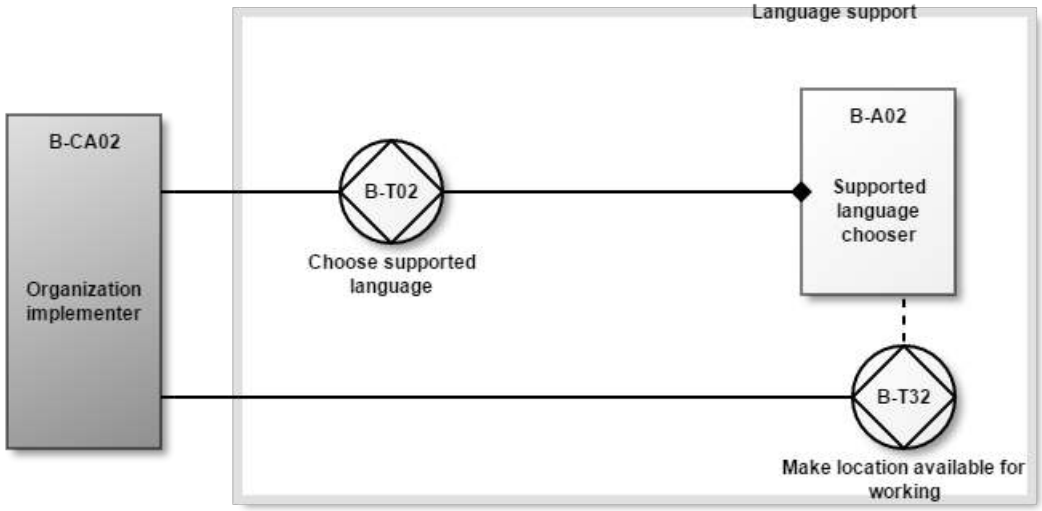


Fig. II.19: OCD of Language support

Transaction kind	**Product kind**
B-T02 Choose supported language	P02 Supported [language] has been chosen

Tab. II.29: Transaction Product Table

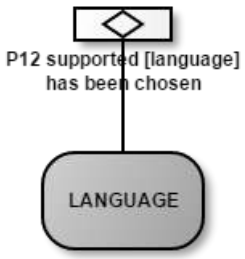


Fig. II.20: OFD of Language support

II.10.5 Verification by instantiation

Language
English
Dutch
French
German

Tab. II.30: Instances of *[LANGUAGE]*

Language
English
Dutch
French

Tab. II.31: Instances of *P02 Supported [language] has been chosen*

II.10.6 Remarks

- The definition of this OIV has been revised. The reason for doing this is that the old definition diverted from the intented meaning of this OIV[2]. Language support is not about providing employees and customers with translations, but it the decision in what languages the organization operates. E.g., RAC operates in English and Dutch. This might, but not necessarily, require translations. Technology can play an important role in expanding the languages that are supported by an organization. For example, by providing translations.
- Language support is closely related to the work locations of an organization. When business operations cross borders, an organization should support the language(s) of the other country. The support of certain languages in a country

may be required by law. E.g., in Belgium the government must support three languages(Dutch, French and German)[1]. Language support is also related to Sourcing. It is favourable if an human resource is able to communicate in the languages that are required by his work location assignments. E.g., an human resource working in the Netherlands and in the United States of America should be able to communicate in Dutch and English. The ability to communicate in a certain language is a competence.

Related OIVs

Competence
Juristic person
Sourcing
Work locations

Old definition

Ways to support employees and customers when translations are required.[5]

[1] http://www2.derand.be/livingintranslation/taal_belgie.php

II.11 Order of working

II.11.1 Definition

Order of working is the order between two product act types (within their already defined dependencies).

II.11.2 Examples

1. The execute of “rental start“ follows the state of “rental payment“. (up-front payment)
2. The promise of “issue car“ follows the accept of “car transport“.

II.11.3 Counter examples

1. The execute of “rental start“ depends on state of “rental payment“. (up-front payment)
2. The promise of “issue car“ depends on the accept of “car transport“.

II.11.4 Formalization

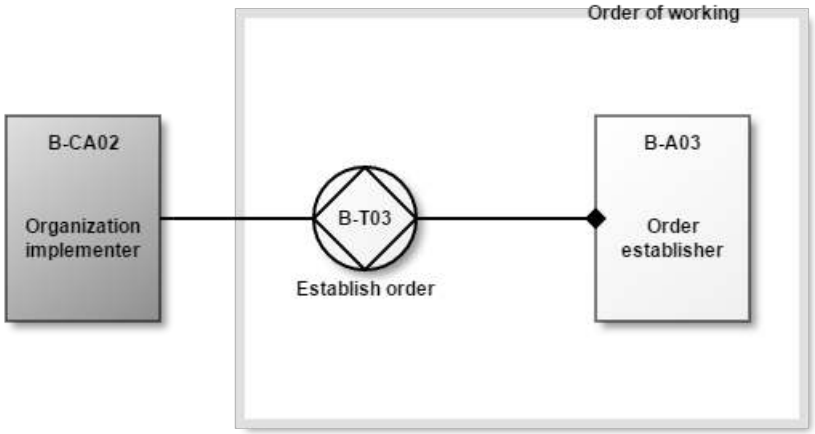


Fig. II.21: OCD of Order of working

Transaction kind	**Product kind**
B-T03 Establish order	P03 [Order] has been established

Tab. II.32: Transaction Product Table

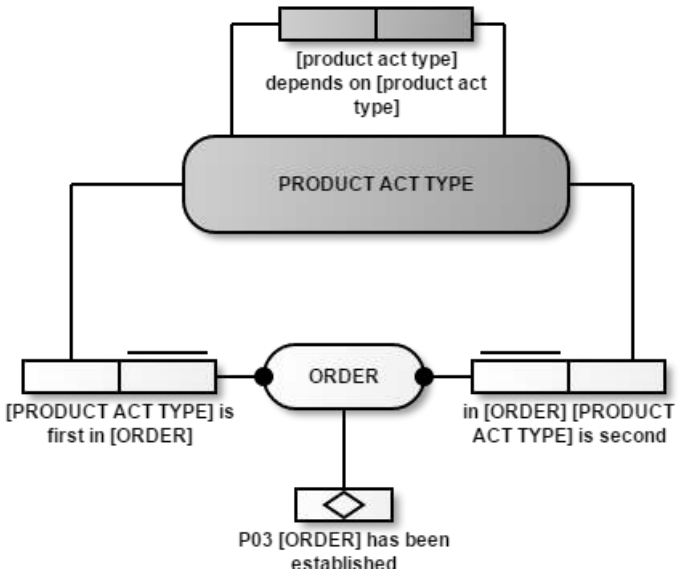


Fig. II.22: OFD of Order of working

II.11.5 Verification by instantiation

Product act type	**Order**
T05/st	1
~~T01/st~~	~~1~~
T05/st	2

Tab. II.33: Instances of*[PRODUCT ACT TYPE] is first in [ORDER]*

Product act type	**Order**
T05/st	1
~~T01/st~~	~~1~~
T05/st	2

Tab. II.34: Instances of*in [ORDER] [PRODUCT ACT TYPE] is second*

Order
T05/st - T01/ex
T05/st - T02/st
T06/st - T01/ex

Tab. II.35: Instances of *P03 [ORDER] has been established]*

II.11.6 Remarks

- When dealing with an agendum type certain transaction kinds may need to be fulfilled before the agendum type can be fulfilled. E.g., when dealing with an request for a mortgage, approving the mortgage depends on a credit check(in Figure II.21 this is the external fact type). Within this dependency an order between product act types can be established. E.g., the promise or decline of the mortgage requests follows the state of the credit check. The dependency is part of the ontological model, but the order in which the dependency is carried out is part of the implementation.

Related OIVs

Event location restrictions
Way of dealing with an agendum type

Old definition

The order in which different acts are performed[5]

II.12 Organizational unit

II.12.1 Definition

An organizational unit is a named element or segment of an organization that has an hierarchical relation with another organizational unit.

II.12.2 Examples

1. Distribution is placed under Logistics.
2. Transportation is placed under Logistics.

II.12.3 Counter examples

1. RAC (a company)

II.12.4 Formalization

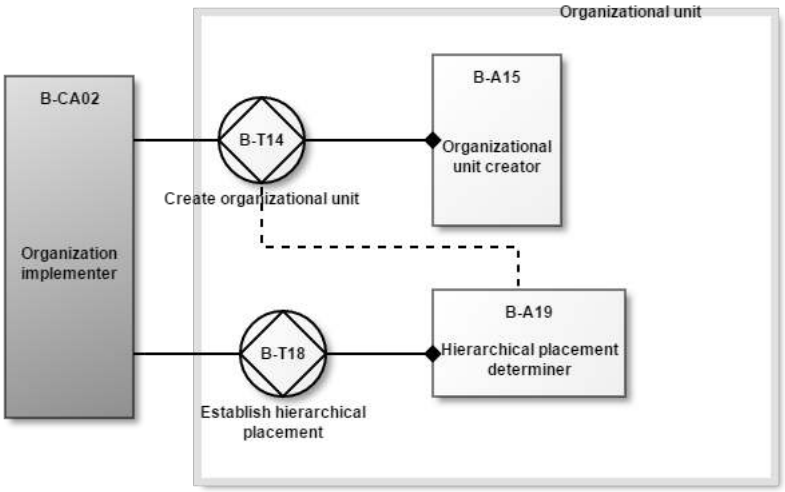


Fig. II.23: OCD of Organizational unit

Transaction kind	**Product kind**
B-T14 Create organizational unit	P14 [Organizational unit] has been created
B-T18 Establish hierarchical placement	P18 [Hierarchical placement] has been established

Tab. II.36: Transaction Product Table

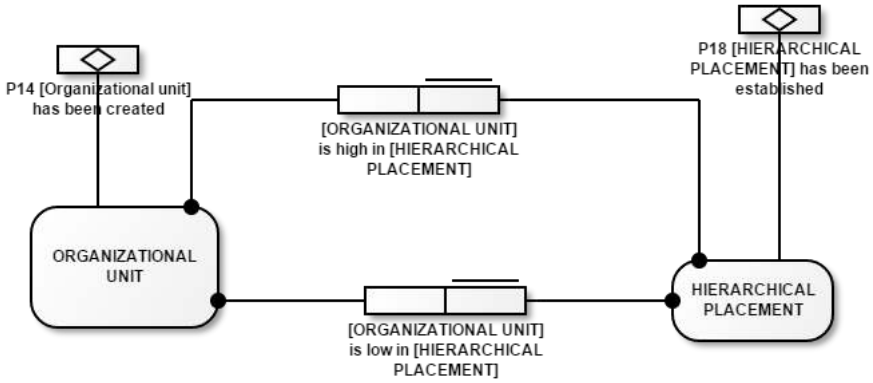


Fig. II.24: OFD of Organizational unit

II.12.5 Verification by instantiation

Organizational Unit
Distribution
Marketing
Sales
IT

Tab. II.37: Instances of *P14 [organizational unit] has been created*

Organizational unit	Hierarchical placement
Distribution	1
~~Sales~~	~~1~~
Distribution	2

Tab. II.38: Instances of *[ORGANIZATIONAL UNIT] is high in [HIERARCHICAL PLACEMENT]*

Organizational unit	Hierarchical placement
Marketing	1
~~IT~~	~~1~~
Marketing	2

Tab. II.39: Instances of *[ORGANIZATIONAL UNIT] is high in [HIERARCHICAL PLACEMENT]*

Hierarchical placement
Distribution - Transportation
Marketing - Sales

Tab. II.40: Instances of *P18 [HIERARCHICAL PLACEMENT] has been established*

II.12.6 Remarks

- Following the same reasoning as with Functionary type, the dependencies are removed except for the dependency to itself. This dependency creates a hierarchical relation between organizational units. E.g., IT is under Finance in the hierarchy. We acknowledge that there are many types of relations possible between organizational units, such as an operational relation. The hierarchical relation is also a constructural relation between organizational units(see the organization theorem in subsection 2.2.1). The construction perspective is also another reason for removing the business function as a dependency.
- Deriving the implementation from the ontological model does not require to specify organizational units. An organizational unit is used to divide an organization. Each organizational unit can be constructed differently. E.g., placing different functionary types in the unit. This is especially beneficial for large organization, where one does not want all the functionary types to belong to one organizational unit because that can become untraceable.

Related OIVs

Allocation of Full Time Equivalent
Juristic person

X-reference of human resource and organizational unit
X-reference of functionary type and organizational unit

Old definition

A logical element or segment of a company representing a specific business function, and a definite place on the organizational chart, under the domain of a manager[32].

II.13 Rules for the assignment of an agendum

II.13.1 Definition

Rules for the assignment of an agendum are rules that are followed within an organization to assign an agendum to a human resource.

II.13.2 Examples

Rules for assigning agendums of the agendum type rental start is requested to human resource:

1. Dealing with rental start is requested are assigned to Head of front office.
2. Rental start is requested from juristic persons(e.g., organizations) are dealt with by Chiara. Otherwise rental start is requested are assigned to a Desk officer.
3. Rental start is requested is assigned to Jane.

II.13.3 Counter example

1. Action rules

II.13.4 Formalization

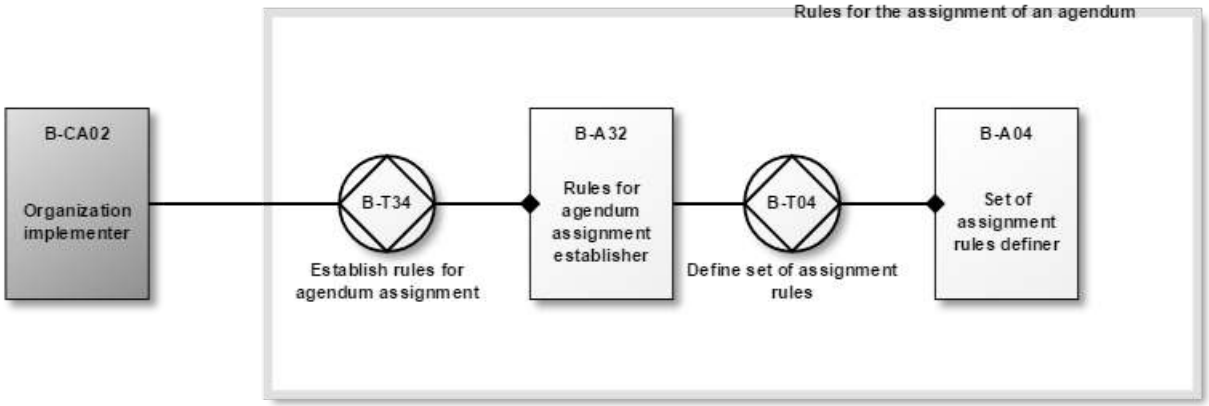


Fig. II.25: OCD of Rules for the assignment of an agendum

Transaction kind	Product kind
B-T04 Define set of assignment rules	P04 [Set of assignment rules] has been defined
B-T34 Establish rules for agendum assignment	P34 [Rules for agendum assignment] have been established

Tab. II.41: Transaction Product Table

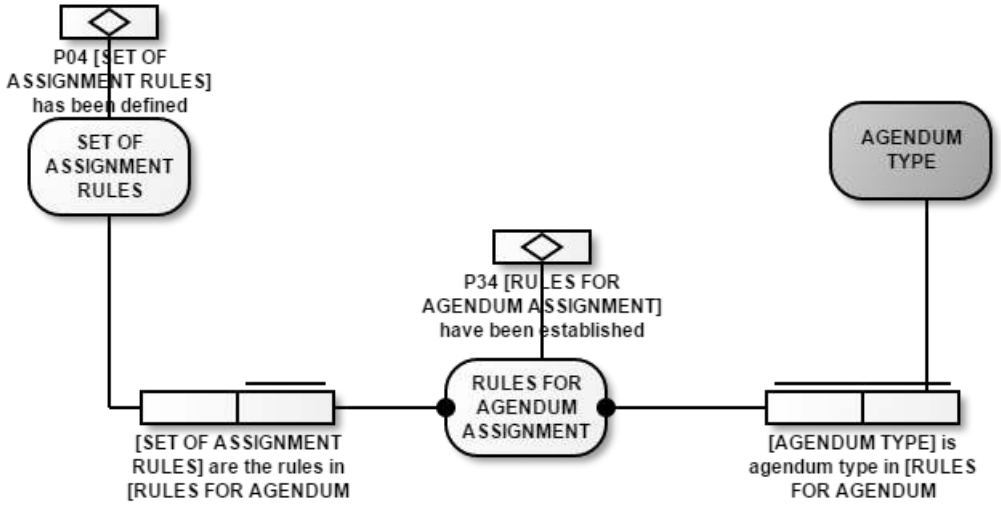


Fig. II.26: OFD of Rules for the assignment of an agendum

II.13.5 Verification by instantiation

Set of assignment rules
1. Dealing with agendum type is assigned to Head of front office. 2a. Agendums* from organizations are dealt with by Chiara. 2b. All other agendums are assigned to a Desk officer. 3. Agendum is assigned to a free Desk officer
1. Dealing with agendum is assigned to Jane.

Tab. II.42: Instances of *P04 [SET OF ASSIGNMENT RULES] has been defined*

Set of assignment rules	Rules for agendum assignment
1. Dealing with agendum type is assigned to Head of front office. 2a. Agendums* from organizations are dealt with by Chiara. 2b. All other agendums are assigned to a Desk officer. 3. Agendum is assigned to a free Desk officer	1
~~1. Dealing with agendum is assigned to Jane.~~	~~1~~
1. Dealing with agendum type is assigned to Head of front office. 2a. Agendums,from organizations are dealt with by Chiara. 2b. All other agendums are assigned to a Desk officer. 3. Agendum is assigned to a free Desk officer	2

Tab. II.43: Instances of *[SET OF ASSIGNMENT RULES] are the rules in [RULES FOR AGENDUM ASSIGNMENT]*

Agendum type	Rules for agendum assignment
AT01/rq	1
~~AT02/rq~~	~~1~~
~~AT01/rq~~	~~2~~

Tab. II.44: Instances of *[AGENDUM TYPE] is agendum type in [RULES FOR AGENDUM ASSIGNMENT]*

Rules for agendum assignment	
1. Dealing with agendum type is assigned to Head of front office. 2a. Agendums* from organizations are dealt with by Chiara. 2b. All other agendums are assigned to a Desk officer. 3. Agendum is assigned to a free Desk officer	- AT01/rq
1. Dealing with agendum type is assigned to Head of front office. 2a. Agendums,from organizations are dealt with by Chiara. 2b. All other agendums are assigned to a Desk officer. 3. Agendum is assigned to a free Desk officer	- AT02/rq

Tab. II.45: Instances of *P34 [Rules for agendum assignment] have been established*

II.13.6 Remarks

- These rules are applied to determine the addressee in OIV Addressee specificity. To be able to define these rules other OIVs have to instantiated first. It depends on the rules the organization implementer (often an enterprise engineer) wants to implements, which OIVs will have to be instantiated first. E.g., if organization implementer decides that agendums are dispatched via organizational units, then the OIV organizational unit has to be instantiated first.

- To give human resources freedom of choosing which agendum to complete or the order in which agendums are completed, an organization can always implement a rule that states that certain agendums are piled up for selected human resources to pick up themselves.

Related OIVs

Addressee specificity

Old definition

Rules that are followed within an organization to assign employees to specific tasks.[5]

II.14 Sourcing

II.14.1 Definition

Sourcing is the availability of human resources and means to deal with agendum types.

II.14.2 Examples

1. Jane (human resource/employee)
2. Anthony (human resource/hire)
3. Volkswagen Up (means)

II.14.3 Counter example

1. Jane is employed
2. Anthony is hired externally

II.14.4 Formalization

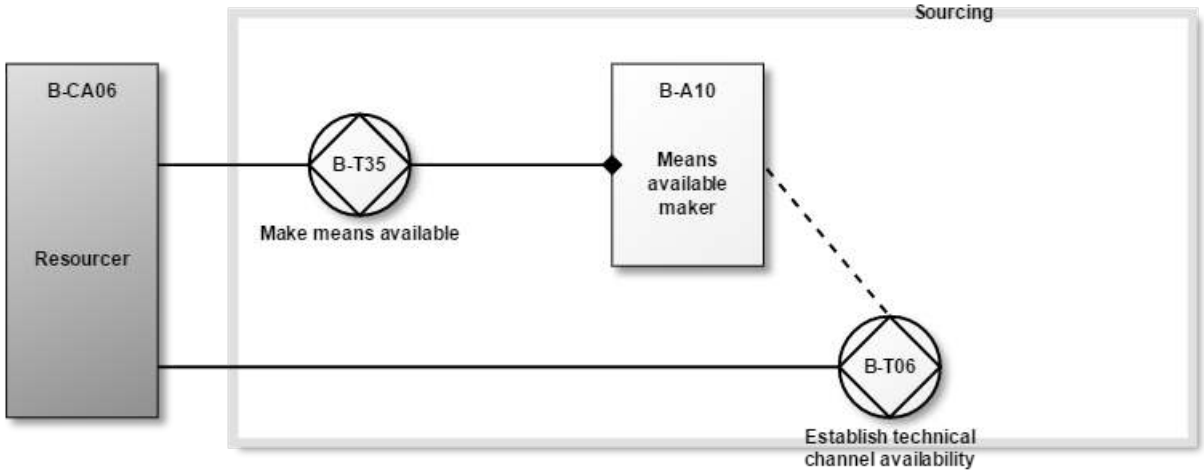


Fig. II.27: OCD of Sourcing

Transaction kind	**Product kind**
B-T35 Make means available	P35 [Means] have been made available

Tab. II.46: Transaction Product Table

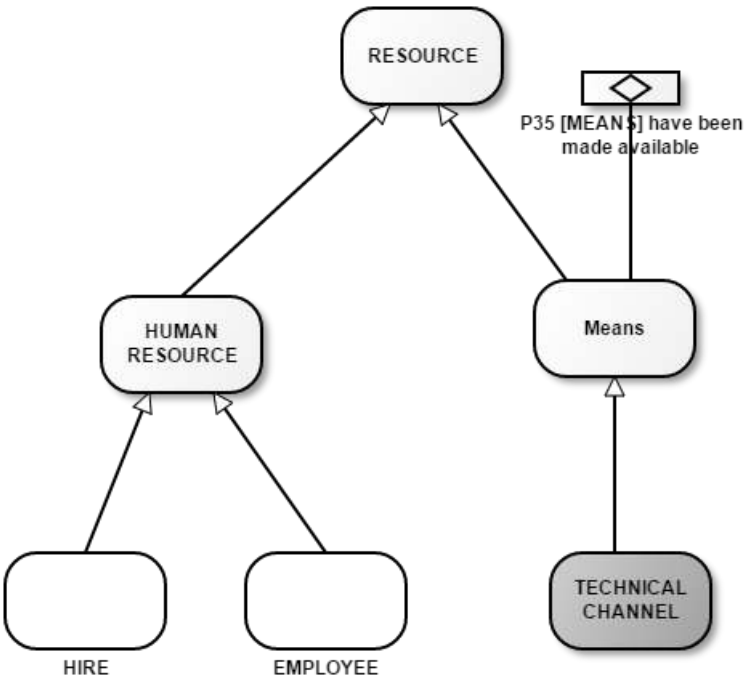


Fig. II.28: OFD of Sourcing

II.14.5 Verification by instantiation

Human resource
Mik(employee)
Chiara(employee)
Anthony(hire)

Tab. II.47: Instances of *[HUMAN RESOURCE]*

Means
Car 1
Car 2
Telephone(Technical channel)

Tab. II.48: Instances of *P35 [MEANS] have been made available*

II.14.6 Remarks

- The definition of this OIV has been revised. The reason for doing this is that the old definition diverted from the intended meaning of this OIV. Op 't Land and Krouwel proposed this OIV together with the OIV employee (now named Human resource) [2] and thereafter van Bockhooven proposed to separate the OIVs[5]. In this research we kept the separation of the OIVs, but have brought the definitions closer together by making Human resource an specialization of this OIV. Sourcing, in the , is focused on the availability of resources instead of the process of finding recourses.
- In this OIV two types of resources are distinguished, namely human resources and means. Human resources have two have two specializations: employees and hires.In the installation defined in section II.20, section II.21 , and section II.22, it does not matter whether human resources are employed or hired externally. They only need to be available during the installation regardless of their contractual relation to the organization. Means are all non-human resources that are available to the organization (see subsection II.29.2). We recognize one specialization of means, the technical channels. The notion of means needs to be further elaborated in future research.

Related OIVs

Human resource
Delegation (incidental)
X-reference of human resource and functionary type
X-reference of human resource and organizational unit
X-reference of human resource and work location

Old definition

The process of finding suppliers of goods or services[32].

II.15 Technical channels

II.15.1 Definition

Technical channel is the availability of ways to establish contact with a target group for dealing with an agendum type.

II.15.2 Examples

1. To deal with rental start is requested, email is available to Chiara. (human resource)
2. To deal with car drop off is requested, email is available to John. (customer)
3. To deal with rental start is requested, email is available to Volkswagen. (supplier)

II.15.3 Counter examples

1. Walk-in
2. Reseller

II.15.4 Formalization

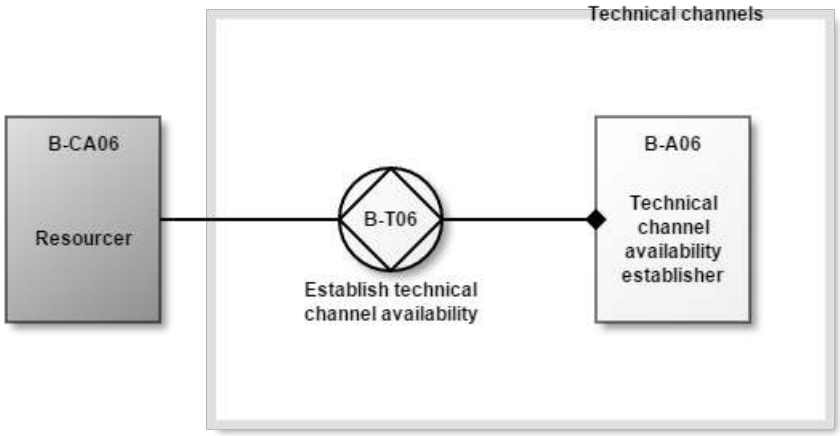


Fig. II.29: OCD of Technical channels

Transaction kind	Product kind
B-T06 Establish technical channel availability	P06 [Technical channel availability] has been established

Tab. II.49: Transaction Product Table

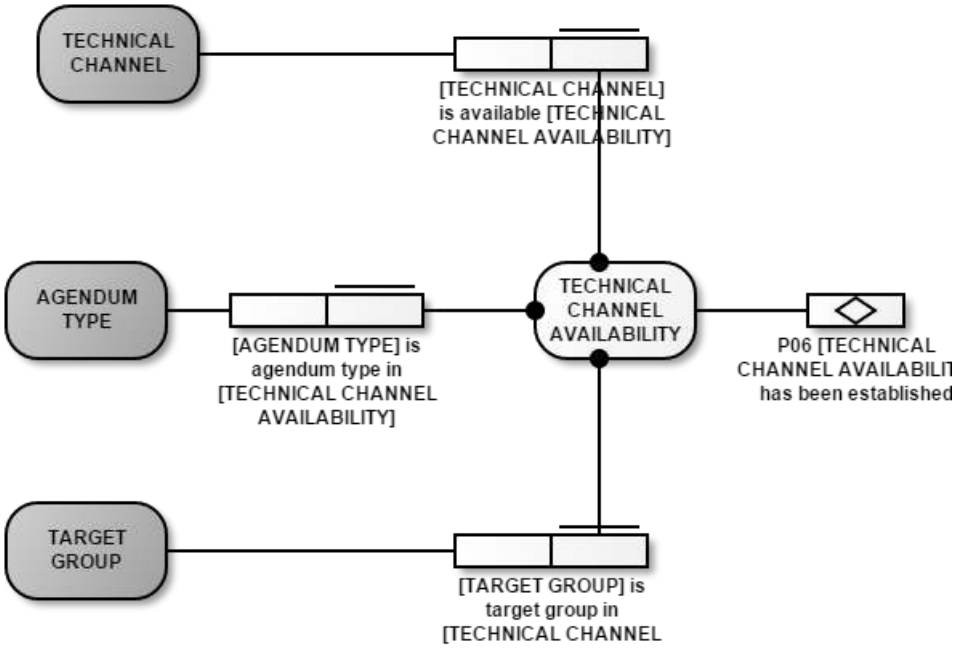


Fig. II.30: OFD of Technical channels

II.15.5 Verification by instantiation

Technical channel	**Technical channel availability**
VOIP	1
~~Webportal~~	~~1~~
VOIP	2

Tab. II.50: Instances of *[TECHNICAL CHANNEL] is available [TECHNICAL CHANNEL AVAILABILITY]*

Agendum type	**Technical channel availability**
AT01/rq	1
~~AT02/rq~~	~~1~~
AT01/rq	2

Tab. II.51: Instances of *[AGENDUM TYPE] is agendum type in [TECHNICAL CHANNEL AVAILABILITY]*

Target group	**Technical channel availability**
Customer	1
~~Supplier~~	~~1~~
Customer	2

Tab. II.52: Instances of *[TECHNICAL CHANNEL] is available [TECHNICAL CHANNEL AVAILABILITY]*

Technical channel availability
AT01/rq - email - human resource
AT01/rq - VOIP - human resource
AT02/rq - web page - supplier

Tab. II.53: Instances of *P06 [TECHNICAL CHANNEL AVAILABILITY] has been established*

II.15.6 Remarks

- This OIV is focused on the availability of technical channels, not on the establishment of technical channels. Technical channels(a specialization of means) are made available for a specific target group. E.g., VOIP can only be used by human resources. The target group is external, as shown in Figure II.30, because it is not clear as of yet at what type of level these target groups are useful. For example, one could only distinguish human resources, customers and suppliers as target groups, but one could establish the technical channel availability per customer or human resource (instance level). Technical channels are made available for specific agendum types. By doing this an organization can restrict certain channels to specific agendum types. E.g., an organization could restrict customers to use of its website for requesting a rental.
- The implementation of the RAC case showed that this OIV misses the option to walk in to an office. This need to further researched in the future.

Related OIVs

Sourcing

Old definition

Ways to establish customer contact and contact between human resources and suppliers.[5]

II.16 Validation of competences

II.16.1 Definition

Validation of competences are ways to validate if an human resource has the required competences.

II.16.2 Examples

Validating the competences.

1. Microsoft Office knowledge is validated by checking for certification.
2. High intelligence is validated by doing an assessment test.
3. Driving experience is validated by checking the driver's license.

Validating the required compentences.

1. To deal with rental start is requested Chiara requires Microsoft Office knowledge. Chiara has Microsoft Office knowledge.
2. To deal with car transport is requested Mik requires driving capabilities. Mik has driving experience.

II.16.3 Counter examples

1. Microsoft office knowledge

II.16.4 Formalization

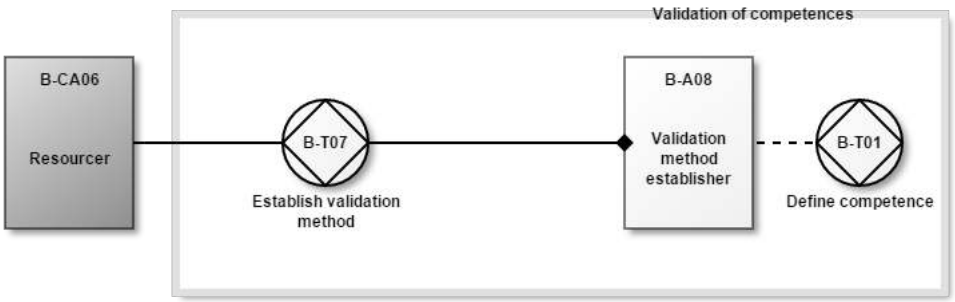


Fig. II.31: OCD of Validation of competences

Transaction kind	Product kind
B-T07 Establish validation method	P07 [Validation method] has been established

Tab. II.54: Transaction Product Table

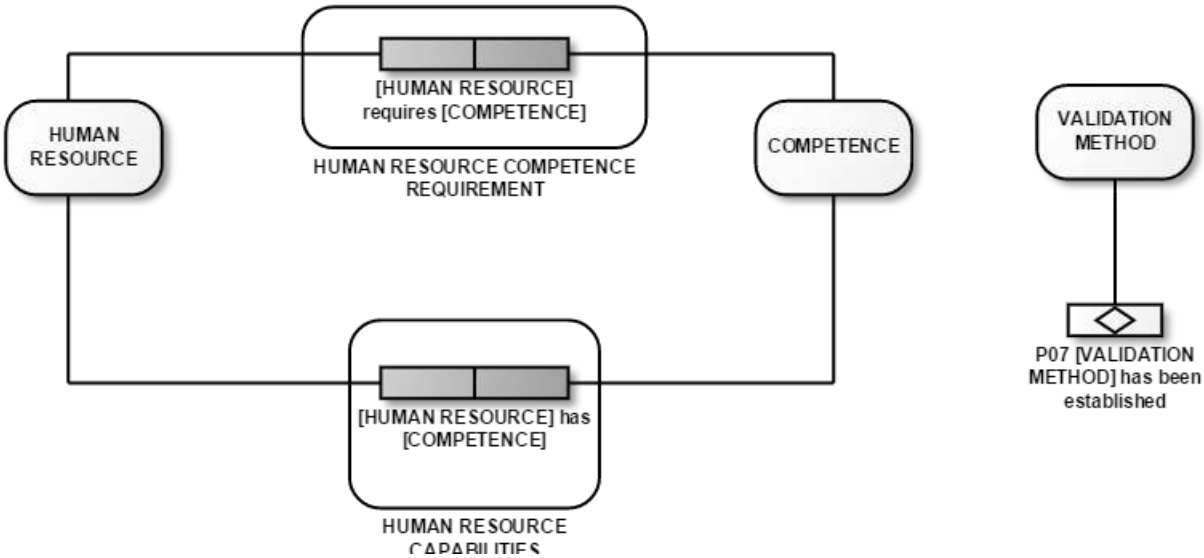


Fig. II.32: OFD of Validation of competences

II.16.5 Verification by instantiation

Human resource	Competence
Chiara	Microsoft Office knowledge
Sarah	Microsoft Office knowledge
Chiara	High intelligence

Tab. II.55: Instances of *[HUMAN RESOURCE] requires [COMPETENCE]*

Human resource	Competence
Chiara	Microsoft Office knowledge
Sarah	Microsoft Office knowledge
Chiara	High intelligence

Tab. II.56: Instances of *[HUMAN RESOURCE] has [COMPETENCE]*

Validation method
Assessment
Check certification

Tab. II.57: Instances of *P07 [VALIDATION METHOD] has been established*

Table II.56 contains all the human resource/competence combinations that are required by Table II.55. Therefore Chiara and Sarah have the required competences.

II.16.6 Remarks

- Two different views on validation are formalized in this OIV. The first is the validation if the human resource actually has the competences that he claims to have. E.g., check for certification or do assessments. The second is the validation if the human resource has the required competence to deal with the assigned agendum type. E.g., dealing with rental start is requested requires Microsoft Office knowledge and Sarah has Microsoft Office knowledge. Figure II.32 shows that the validation method is loose from the rest of the diagram. This is because it is unclear what view on validation is intended in this OIV. If it is the validation method for determining if a human resource really has a competence, then it should be considered making the validation method a separate OIV.

- The competences that are required by a human resource to deal with an agendum type can be derived via the combination of the following X-references: X-reference of human resource and functionary type, X-reference of functionary type and agendum type and X-reference of agendum type and competence. Therefore the fact type is external in Figure II.32. The set of required competences for an employee, must be a subset of the competences the human resource has.

- Matching of competences is not an easy task, as elaborated by Dietz[35]. If competences are properly defined, the X-references X-reference of agendum type and competence and X-reference of functionary type and agendum typecould provide a job description for a vacany. An organization could match their prospective human resources to the required competences, instead of the agendum types or tasks that they should perform. This could contribute to ways that competences are matched and human resources are hired in organizations.

Related OIVs

Competence
Delegation (incidental)
Sourcing

Old definition

Ways to validate if an employee has the required competences[5]

II.17 Way of dealing with an agendum type

II.17.1 Definition

Way of dealing with an agendum type is the type of fulfillment for the agendum type.

II.17.2 Examples

1. Rental start is requested is dealt with sequentially and collectively.
2. Rental end is requested is dealt with sequentially and individually.
3. Car issue is requested is dealt with concurrently and collectively.
4. Car drop off is requested is dealt with concurrently and individually.

II.17.3 Counter examples

1. Rental start is requested is dealt with sequentially and concurrently.

II.17.4 Formalization

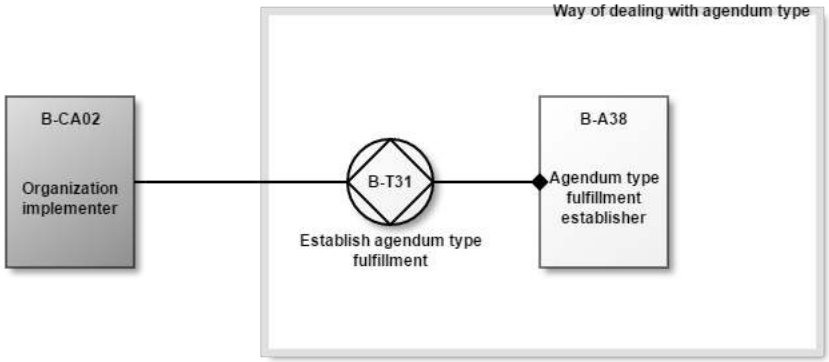


Fig. II.33: OCD of Way of dealing with an agendum type

Transaction kind	**Product kind**
B-T31 Establish agendum type fulfillment	P31 [Agendum type fulfillment] has established

Tab. II.58: Transaction Product Table

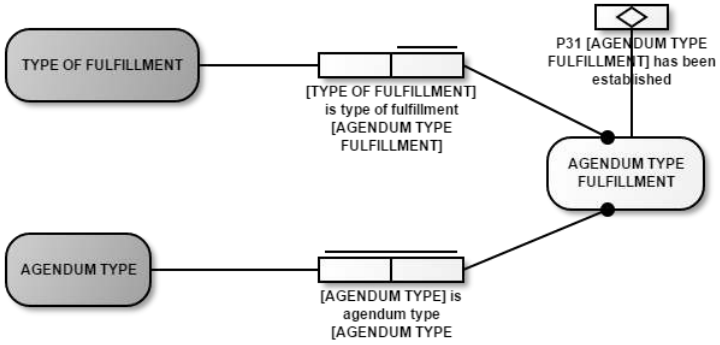


Fig. II.34: OFD of Way of dealing with an agendum type

II.17.5 Verification by instantiation

Type of fulfillment	**Agendum type fulfillment**
Sequentially and collectively	1
~~Sequentially and individually~~	~~1~~
Sequentially and collectively	2

Tab. II.59: Instances of *[TYPE OF FULFILLMENT] is type of fulfillment [AGENDUM TYPE FULFILLMENT]*

Agendum type	**Agendum type fulfillment**
AT01/rq	1
~~AT02/rq~~	~~1~~
~~AT01/rq~~	~~2~~

Tab. II.60: Instances of *[AGENDUM TYPE] is agendum type [AGENDUM TYPE FULFILLMENT]*

Agendum type fulfillment
AT01/rq - Sequentially and collectively
AT02/rq - Sequentially and individually

Tab. II.61: Instances of *P31 [AGENDUM TYPE FULFILLMENT] has been established*

II.17.6 Remarks

- Three ways of fulfillment were recognized by Dietz [20]: sequentially, concurrently and collectively. In this research we recognize a fourth way of fullfillment: individually. The ways of fulfillment are actually two dimensions: sequentially versus concurrently and collectively versus individually. In the old definition and previous formalizations only one of the four ways was possible. When implementing the RAC case it was noticed that an agendum type can we fulfilled in an combination of the two dimensions. E.g., if an agendum type is fulfilled sequentially, it can also be fulfilled individually. This resulted in four possibilities: 1) sequentially and collectively, 2) sequentially and individually, 3) concurrently and collectively and 4) concurrently and individually. Each of these possibilities is called a type of fulfillment.
- It might seem as if the definition and name of the OIV have been completely revised, though it is a minor revision that is primarily due to the usage of other terminology. Act and actor role have been replaced by dealing with an agendum type and human resource has been replaced by a human resource. Furthermore the definition is structured properly.

Related OIVs

Order of working
Rules for the assignment of an agendum

Old definition

Per act that can be performed within an organization, how does each employee fulfill this same actor role? (Way of fulfilling actor role)[5]

II.18 Work locations

II.18.1 Definition

Work location is a geographical location available to work at.

II.18.2 Examples

1. ABCstreet 123, Leiden, Netherlands is available to work at.
2. Air lane 23, Amsterdam, Netherlands is available to work at.

II.18.3 Counter examples

1. Europe (region)

II.18.4 Formalization

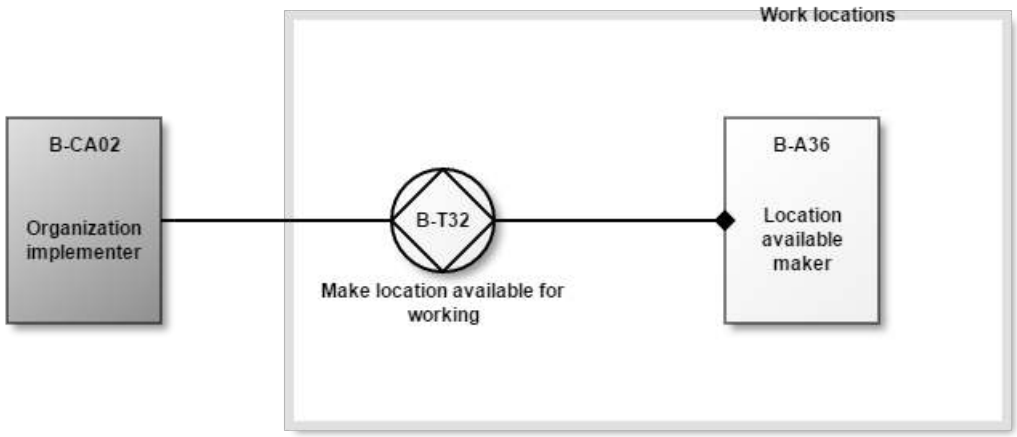


Fig. II.35: OCD of Work locations

Transaction kind	**Product kind**
B-T32 Make location available for working	P32 [Location] has been made available for working

Tab. II.62: Transaction Product Table

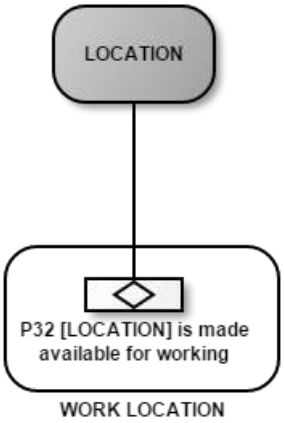


Fig. II.36: OFD of Work locations

II.18.5 Verification by instantiation

Location
ABCstreet 123, Leiden, The Netherlands
Air lane 23, Amsterdam, The Netherlands
Station road 6, Antwerp, Belgium
Businesspark 10th avenue 3, New York, U.S.A.

Tab. II.63: Instances of *[Location]*

Work location
ABCstreet 123, Leiden, The Netherlands
Air lane 23, Amsterdam, The Netherlands
Station road 6, Antwerp, Belgium

Tab. II.64: Instances of *P32 [Location] is made available for working*

II.18.6 Remarks

- In the old definition references to agendum types and references to employees were mentioned. These references are already covered in OIVs, respectively, X-reference of work locations and agendum type and X-reference of human resource and work location. Also because of similar reasoning as with Functionary type that is no longer defined by its acts, this OIV is now merely constructed by its location.
- Work locations is closely related to the OIVs jurstic person and language support, as mentioned in section II.9 and section II.10. It is also related to the OIV Region,

which is defined as the geographical area of responsibility. The region can be a reason for making a location, inside that region, available for working.

Related OIVs

Juristic person
Language support
Region
X-reference of human resource and work location
X-reference of work locations and agendum type

Old definition

Geographical location available to the employee to fulfill certain tasks.[5]

II.19 X-reference of agendum type and competence

II.19.1 Definition

X-reference of agendum type and competence is the requirement of a competence to be able to deal with an agendum type.

II.19.2 Examples

1. To deal with rental start is requested Microsoft Office knowledge is required
2. To deal with car transport is requested driving capabilities are required.

II.19.3 Formalization

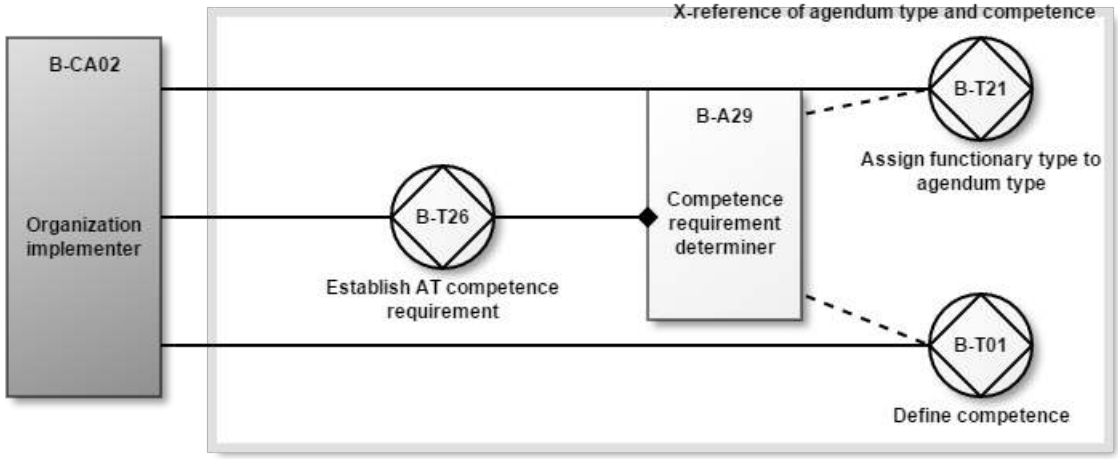


Fig. II.37: OCD of X-reference of agendum type and competence

Transaction kind	**Product kind**
B-T26 Establish AT competence requirement	P26 [Agendum type competence requirement] has been determined

Tab. II.65: Transaction Product Table

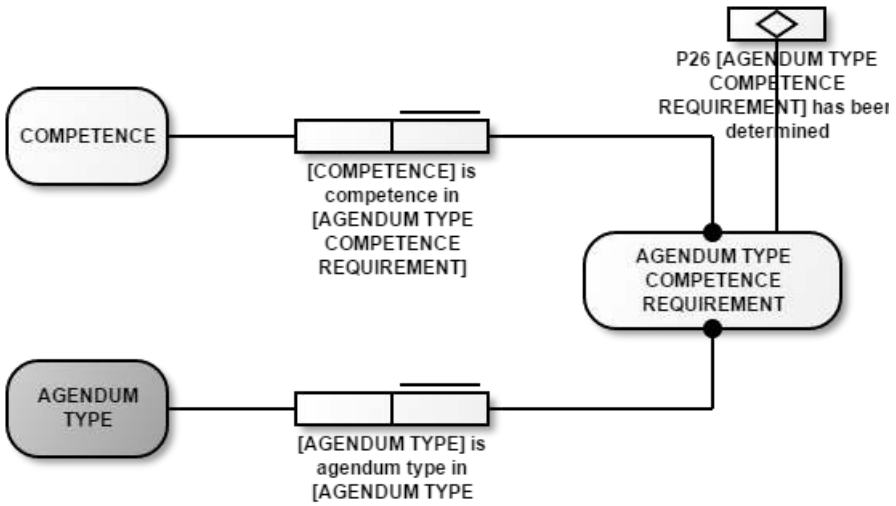


Fig. II.38: OFD of X-reference of agendum type and competence

II.19.4 Verification by instantiation

Competence	**Agendum type competence requirement**
Microsoft office knowledge	1
~~Driving capabilities~~	~~1~~
Microsoft office knowledge	2

Tab. II.66: Instances*[COMPETENCE] is competence in [AGENDUM TYPE COMPETENCE REQUIREMENT]*

Agendum type	**Agendum type competence requirement**
AT01/rq	1
~~AT02/rq~~	~~1~~
AT01/rq	2

Tab. II.67: Instances*[AGENDUM TYPE] is agendum type in [AGENDUM TYPE COMPETENCE REQUIREMENT]*

Agendum type competence requirement
AT01/rq - Microsoft Office knowledge
AT02/rq - Microsoft Office knowledge
AT01/rq - Car issuer

Tab. II.68: Instances of *P26 [AGENDUM TYPE COMPETENCE REQUIREMENT] has been determined*

II.19.5 Remarks

- The X-reference of agendum type and competence is a new OIV that we proposed in this research. In the OIV Competence, we removed the dependency between agendum types (or acts) and competences. This OIV captures the requirement of a competence for dealing with an agendum type.

Related OIVs

Competence
Validation of competences

II.20 X-reference of human resource and functionary type

II.20.1 Definition

X-reference of human resource and functionary type is the assignment of an human resource to a functionary type in combination with an assignment percentage.

II.20.2 Examples

1. Jane is assigned to desk officer with a 60% assignment percentage.
2. Chiara is assigned to head of front office with a 100% assignment percentage.
3. Mik is assigned to distributor with a 10% assignment percentage.

II.20.3 Formalization

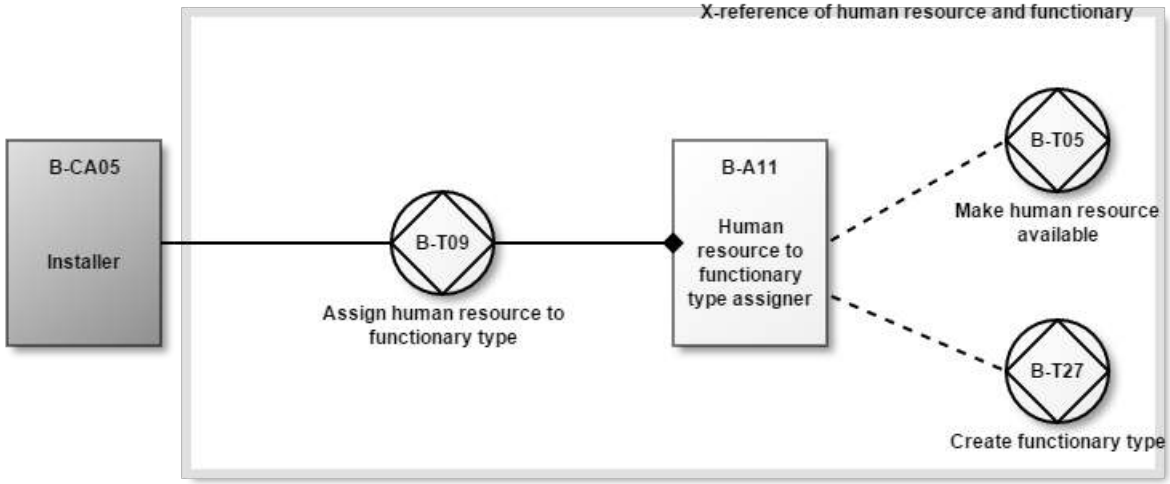


Fig. II.39: OCD of X-reference of human resource and functionary type

Transaction kind	**Product kind**
B-T09 Assign human resource to functionary type	P09 [HR - FT Assignment] has been established

Tab. II.69: Transaction Product Table

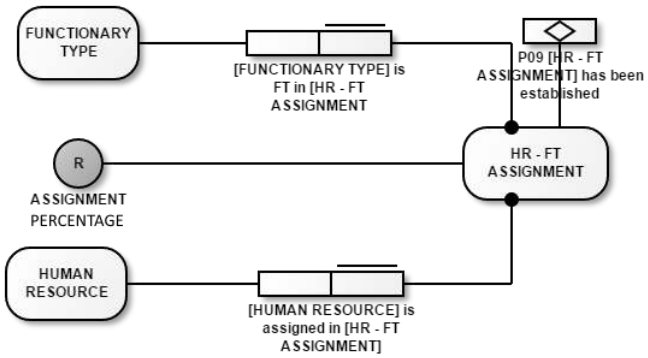


Fig. II.40: OFD of X-reference of human resource and functionary type

II.20.4 Verification by instantiation

Functionary type	**HR - FT assignment**
Distributor	1
~~Desk officer~~	~~1~~
Distributor	2

Tab. II.70: Instances*[FUNCTIONARY TYPE] is FT in [HR - FT ASSIGNMENT]*

Human resource	**HR - FT assignment**
Chiara	1
~~Mik~~	~~1~~
Chiara	2

Tab. II.71: Instances*[HUMAN RESOURCE] is assigned in [HR - FT ASSIGNMENT]*

HR - FT assignment
Mik - Distributor - 60%
Chiara - Distributor - 60%
Ferre - Distributor - 40%

Tab. II.72: Instances of *P09 [HR - FT ASSIGNMENT] has been established*

II.20.5 Remarks

- We revised the name and definition of this OIV. This is done because of changes in the OIV Sourcing. In the installation, where we placed this OIV, it only matters if a human resource is available and not if it is an employee or a hire. The assignment percentage per functionary type is also added to this X-reference. Assignment percentage is the assigned hours of work divided by the full time equivalent of the organization. The assignment percentage shows the actual allocation of FTE per functionary type.
- The sum of assignment percentages per human resource should not exceed 100%. There is a difference between an no assignment between a human resource and a functionary type, and an assignment between a human resource and a functionary type with an assignment percentage of 0. In the first assignment a human resource is not allowed to fulfill the functionary type. In the latter a human resource is allowed to fulfill the functionary type, but the human resource is currently not fulfilling the functionary type.

Related OIVs

Allocation of Full Time Equivalent
Functionary type
Sourcing
X-reference of human resource and organizational unit
X-reference of human resource and work location

Old definition

The assignment of an employee to functionary type (*X-reference employee/functionary type*)[5].

II.21 X-reference of human resource and organizational unit

II.21.1 Definition

X-reference of human resource and organizational unit is the placement of an human resource in an organizational unit.

II.21.2 Examples

1. Chiara is placed in Sales.
2. Ferre is placed in Distribution.

II.21.3 Formalization

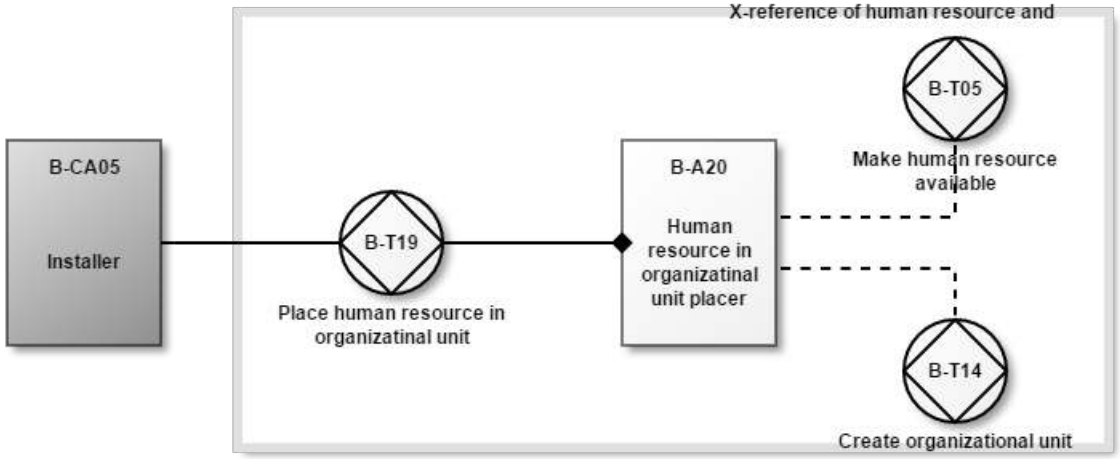


Fig. II.41: OCD of X-reference of human resource and organizational unit

Transaction kind	**Product kind**
B-T19 Place human resource in organizational unit	P19 [Human resource placement] has been established

Tab. II.73: Transaction Product Table

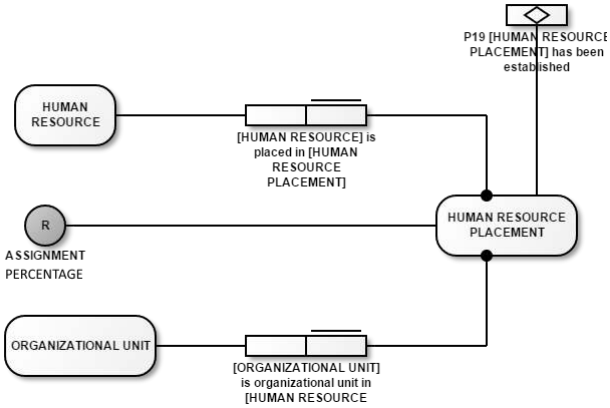


Fig. II.42: OFD of X-reference of human resource and organizational unit

II.21.4 Verification by instantiation

Human resource	**Human resource placement**
Chiara	1
~~Mik~~	~~1~~
Chiara	2

Tab. II.74: Instances*[HUMAN RESOURCE] is placed in [HUMAN RESOURCE PLACEMENT]*

Organizational unit	**Human resource placement**
Distribution	1
~~Sales~~	~~1~~
Distribution	2

Tab. II.75: Instances*[ORGANIZATIONAL UNIT] is organizational unit in [HUMAN RESOURCE PLACEMENT]*

Human resource placement
30% - Chiara - Sales
100% - Mik - Distribution
20% Chiara - Distribution

Tab. II.76: Instances of *P19 [HUMAN RESOURCE PLACEMENT] has been established*

II.21.5 Remarks

- Van Bockhooven proposed this OIV, but did not define it[5].We decided to keep this OIV in the scope and defined it. This OIV is structured in the same way as X-references X-reference of human resource and functionary type and X-reference of human resource and work location.
- The sum of assignment percentages per human resource should not exceed 100%. However it is not possible to have an assignment percentage of 0 in this OIV. We argue that it is not valuable to place a human resource in a organizational unit, while he is not working in that organizational unit.

Related OIVs

X-reference of human resource and organizational unit
X-reference of human resource and work location

II.22 X-reference of human resource and work location

II.22.1 Definition

X-reference of human resource and work location is the work location that is made available for the human resource to work at.

II.22.2 Examples

1. ABCstreet 123, Leiden, Netherlands is available for Jane to work at.
2. Air lane 23, Amsterdam, Netherlands is available for Chiara to work at.

II.22.3 Formalization

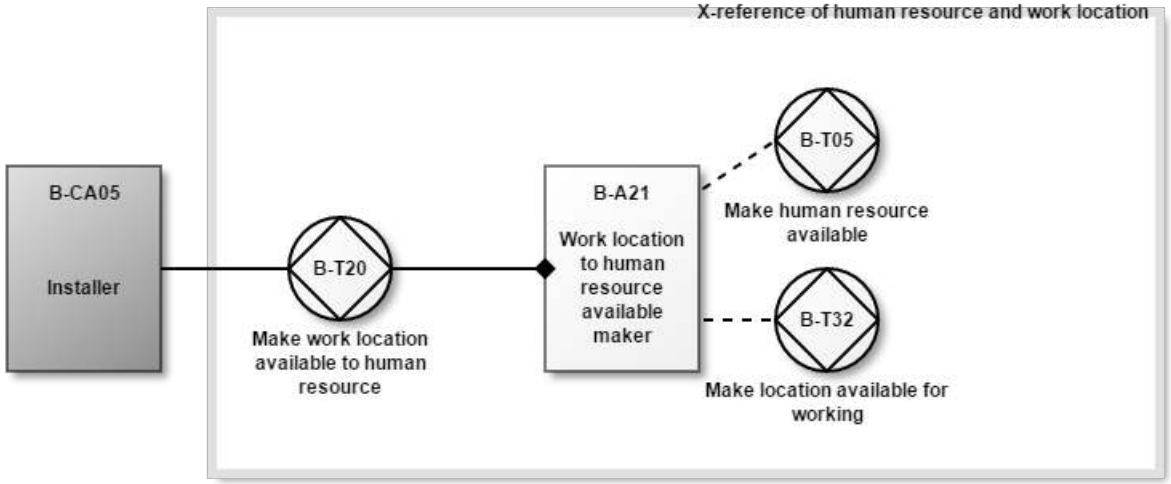


Fig. II.43: OCD of X-reference of human resource and work location

Transaction kind	**Product kind**
B-T20 Make work location available to human resource	P20 [HR Location availability] has been established

Tab. II.77: Transaction Product Table

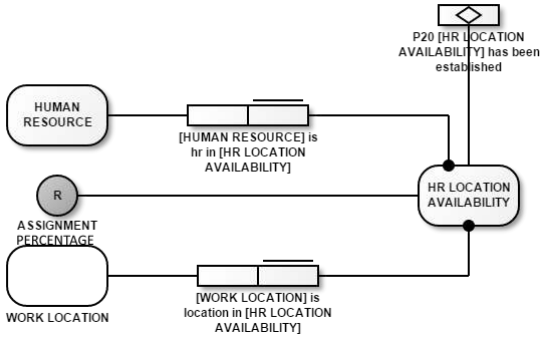


Fig. II.44: OFD of X-reference of human resource and work location

II.22.4 Verification by instantiation

Human resource	**HR location availability**
Chiara	1
~~Mik~~	~~1~~
Chiara	2

Tab. II.78: Instances*[HUMAN RESOURCE] is HR in [HR LOCATION AVAILABILITY]*

Work location	**HR location availability**
ABCstreet 123, Leiden, Netherlands	1
~~Air lane 23, Amsterdam, Netherlands~~	~~1~~
ABCstreet 123, Leiden, Netherlands	2

Tab. II.79: Instances*[WORK LOCATION] is location in [HR LOCATION AVAILABILITY]*

HR location availability
40% - Mik - ABCstreet 123, Leiden, Netherlands
100% - Carlo - ABCstreet 123, Leiden, Netherlands
60% - Mik - Air lane 23, Amsterdam, Netherlands

Tab. II.80: Instances of *P20 [HR LOCATION AVAILABILITY] has been established*

II.22.5 Remarks

- This OIV is structured in the same way as X-references X-reference of human resource and functionary type and X-reference of human resource and organizational unit. The sum of assignment percentages per human resource should not exceed 100%.

Related OIVs

Sourcing
Work locations
X-reference of human resource and functionary type
X-reference of human resource and organizational unit

Old definition

The assignment of an human resource to a work location(*X-reference employee/work location*)[5]

II.23 X-reference of functionary type and agendum type

II.23.1 Definition

X-reference of functionary type and agendum type is the assignment of a functionary type to what agendum type they can deal with, combined with a level of authority.

II.23.2 Examples

1. Desk officer is assigned to deal with rental start is requested (accountable).
2. Head of front office is assigned to deal with rental start is requested (responsible).
3. Distributor is assigned to deal with car transport is requested(accountable).

II.23.3 Formalization

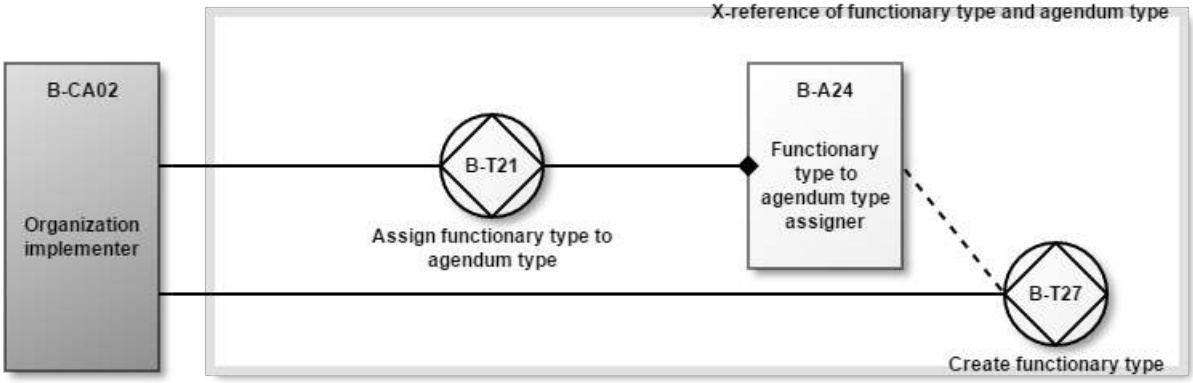


Fig. II.45: OCD of X-reference of functionary type and agendum type

Transaction kind	**Product kind**
B-T21 Assign functionary type to agendum type	P21 [FT Agendum type Assignment] has been established

Tab. II.81: Transaction Product Table

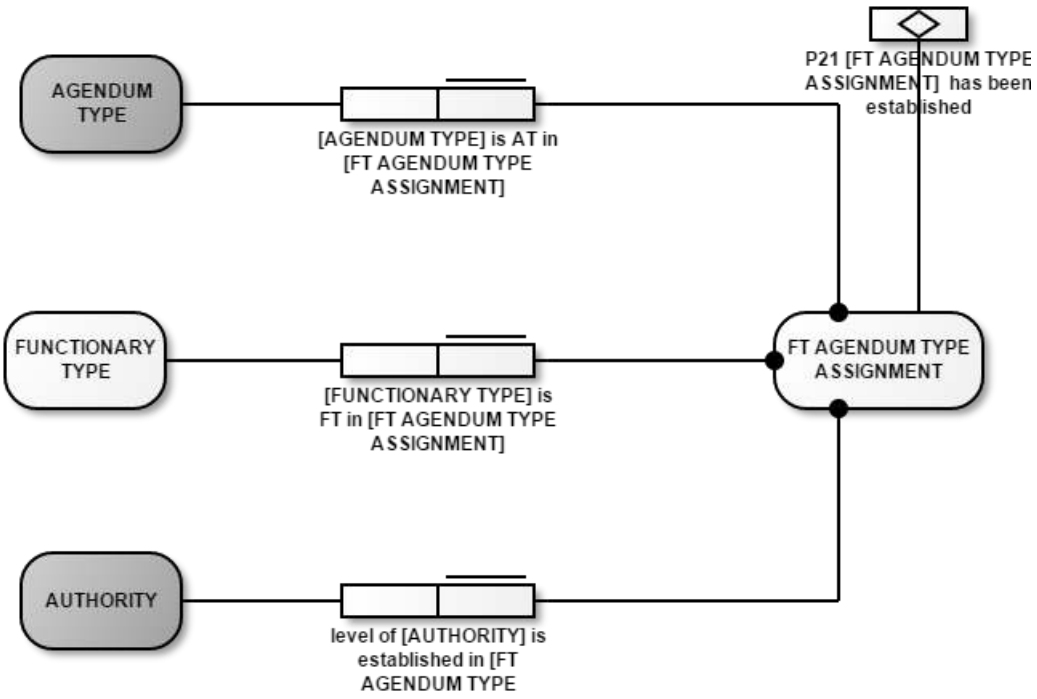


Fig. II.46: OFD of X-reference of functionary type and agendum type

II.23.4 Verification by instantiation

Agendum type	**FT Agendum type assignment**
AT01/rq	1
~~AT02/rq~~	~~1~~
AT01/rq	2

Tab. II.82: Instances*[AGENDUM TYPE] is AT in [FT AGENDUM TYPE ASSIGNMENT]*

Functionary type	FT Agendum type assignment
Distributor	1
~~Desk officer~~	~~1~~
Distributor	2

Tab. II.83: Instances*[FUNCTIONARY TYPE] is FT in [FT AGENDUM TYPE ASSIGNMENT]*

Authority	FT Agendum type assignment
Responsible	1
~~Accountable~~	~~1~~
Responsible	2

Tab. II.84: Instances*level of [AUTHORITY] is established in [FT AGENDUM TYPE ASSIGNMENT]*

FT Agendum type assignment
Responsible - Desk officer - AT01/rq
Accountable - Distributor - AT03/rq

Tab. II.85: Instances of *P21 [FT AGENDUM TYPE ASSIGNMENT] has been established*

II.23.5 Remarks

- This OIV not only concern the assignment between a functionary type and agendum type, but also the structural delegation. Structural delegation is defined as "the transfer authority of a agendum type type from one functionary type to another, while keeping the accountability". We recognize two types of authority: responsibility and authority. It is possible to recognize other types as well, such as informing and consulting[36].
- The decision to delegate an agendum type type from functionary type to another is made during the implementation of an organization, while the decision for an incidental delegation is made during the operation of an organization. The distinction between structural delegation (this OIV) and incidental delegation has been further elaborated in section II.5.
- The human resource who is fulfilling the accountable functionary type for an agendum type, is accountable for the agendum in the operation. He can delegate this agendum to a human resource that is fulfilling the responsible functionary type. That functionary type now deals with the agendum and is responsible for it, but not accountable.

Related OIVs

Delegation (incidental)
Functionary type
X-reference of agendum type and competence

Old definition

The assignment of a functionary type to what act type they can perform(*X-reference of functionary type and act type*).[5]

II.24 X-reference of functionary type and organizational unit

II.24.1 Definition

X-reference of functionary type and organizational unit is the placement of an functionary type in the boundaries of an organizational unit.

II.24.2 Examples

1. Desk officer is placed between boundaries of sales.
2. Distributor is placed between boundaries of distribution.

II.24.3 Formalization

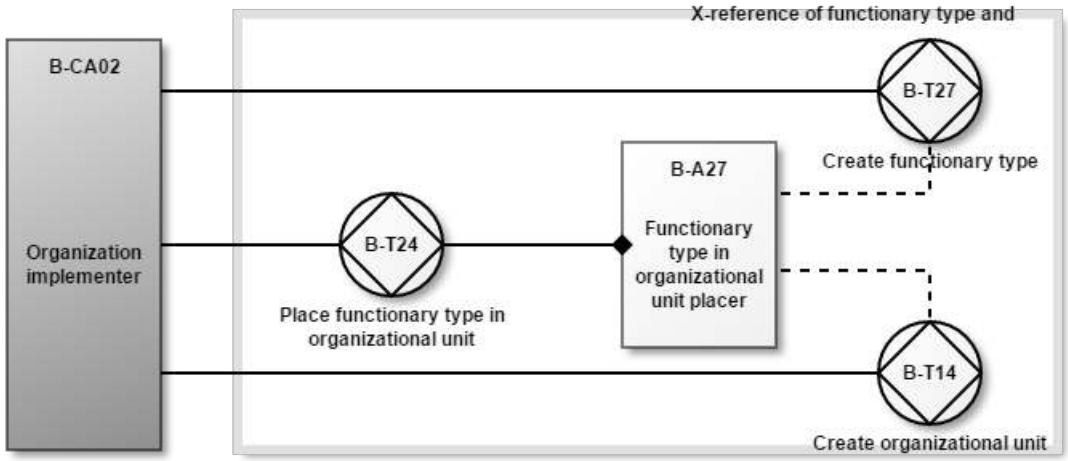


Fig. II.47: OCD of X-reference of functionary type and organizational unit

Transaction kind	**Product kind**
B-T24 Place functionary type in organizational unit	P24 [Functionary type Placement] has been established

Tab. II.86: Transaction Product Table

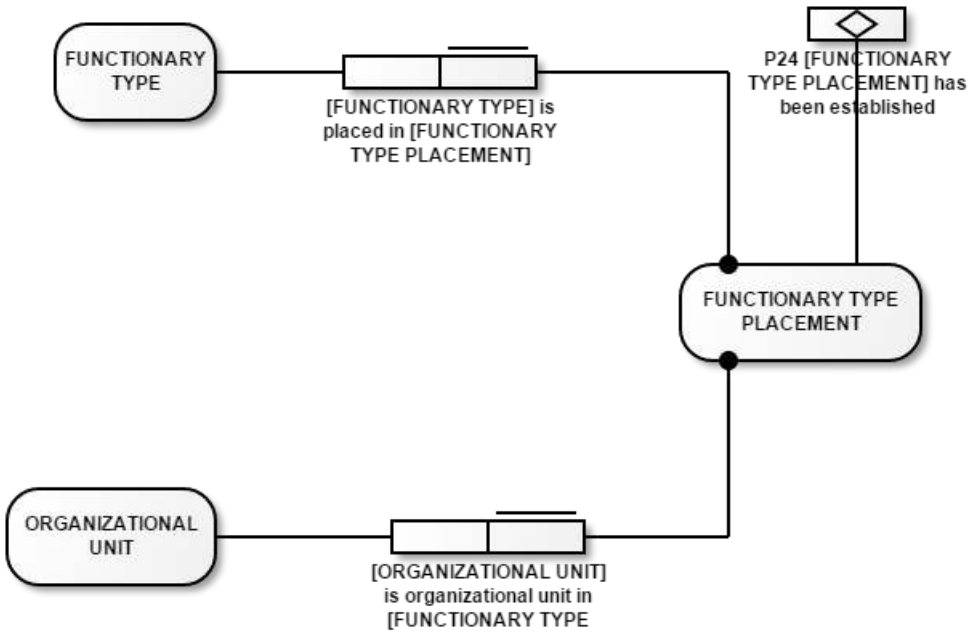


Fig. II.48: OFD of X-reference of functionary type and organizational unit

II.24.4 Verification by instantiation

Functionary type	**Functionary type placement**
Distributor	1
~~Desk officer~~	~~1~~
Distributor	2

Tab. II.87: Instances*[FUNCTIONARY TYPE] is placed in [FUNCTIONARY TYPE PLACEMENT]*

Organizational unit	Functionary type placement
Distribution	1
~~Sales~~	~~1~~
Distribution	2

Tab. II.88: Instances*[ORGANIZATIONAL UNIT] is organizational unit in [FUNCTIONARY TYPE PLACEMENT]*

Functionary type placement
Distributor - Distribution
Desk officer - Sales

Tab. II.89: Instances of *P24 [FUNCTIONARY TYPE PLACEMENT] has been established*

II.24.5 Remarks

- We proposed this OIV to make it possible to place functionary types in organizational units. We already have an OIV to place human resource in organizational units (X-reference of human resource and organizational unit), but argued to have a higher level of abstraction placed in an organizational unit. Some functionary types will only be covered by one organizational unit, while others will cover multiple organizational units. For example, one can image an organization with two organizational units, distribution and sales. The functionary type transporter is placed in distribution, while the functionary type desk officer is placed in distribution and sales.

Related OIVs

II.25 X-reference of functionary type and work location

II.25.1 Definition

X-reference of functionary type and work location is the assignment of a functionary type to a work location where it can be fulfilled at.

II.25.2 Examples

1. ABCstreet 123, Leiden, Netherlands is available for Jane to work at.
2. Air lane 23, Amsterdam, Netherlands is available for Chiara to work at.

II.25.3 Formalization

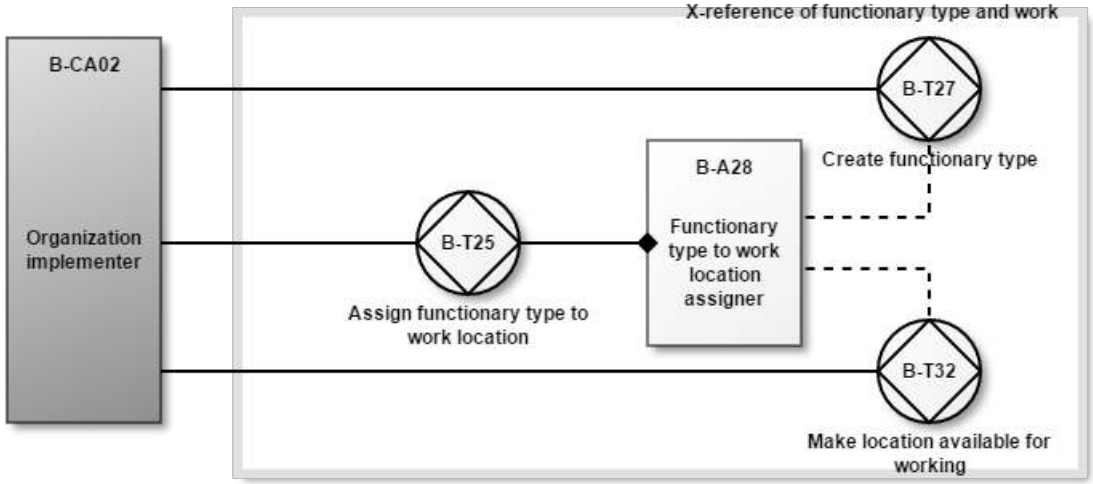


Fig. II.49: OCD of X-reference of functionary type and work location

Transaction kind	**Product kind**
B-T25 Assign functionary type to work location	B-T25 [FT Location Availability] has been established

Tab. II.90: Transaction Product Table

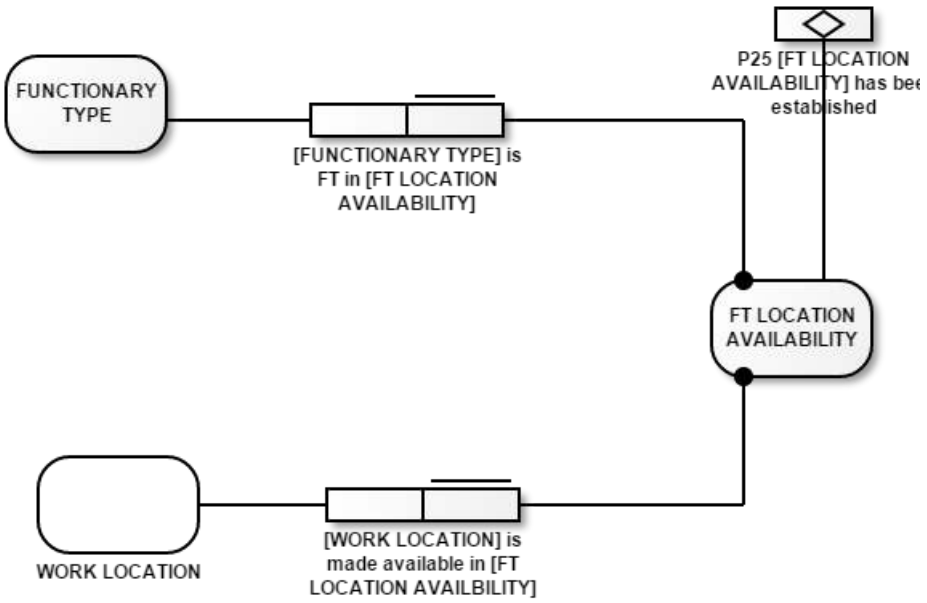


Fig. II.50: OFD of X-reference of functionary type and work location

II.25.4 Verification by instantiation

Functionary type	**FT location availability**
Distributor	1
~~Desk officer~~	~~1~~
Distributor	2

Tab. II.91: Instances*[FUNCTIONARY TYPE] is FT in [FT LOCATION AVAILABILITY]*

Work location	FT location availability
ABCstreet 123, Leiden, Netherlands	1
~~Air lane 23, Amsterdam, Netherlands~~	~~1~~
ABCstreet 123, Leiden, Netherlands	2

Tab. II.92: Instances*[WORK LOCATION] is made available in [FT LOCATION AVAILBILITY]*

FT location availability
Distributor - ABCstreet 123, Leiden, Netherlands
Transporter - ABCstreet 123, Leiden, Netherlands
Distributor - Air lane 23, Amsterdam, Netherlands

Tab. II.93: Instances of *P25 [FT LOCATION AVAILABILITY] has been established*

II.25.5 Remarks

- We proposed this OIV for the same reasons as with X-reference of functionary type and organizational unit.

II.26 X-reference of work locations and agendum type

II.26.1 Definition

X-reference of work locations and agendum type is the assignment of which work location is available to deal with an agendum type.

II.26.2 Examples

1. ABCstreet 123, Leiden, Netherlands is available to deal with rental start is requested.
2. Air lane 23, Amsterdam, Netherlands is available to deal with rental end is requested.

II.26.3 Formalization

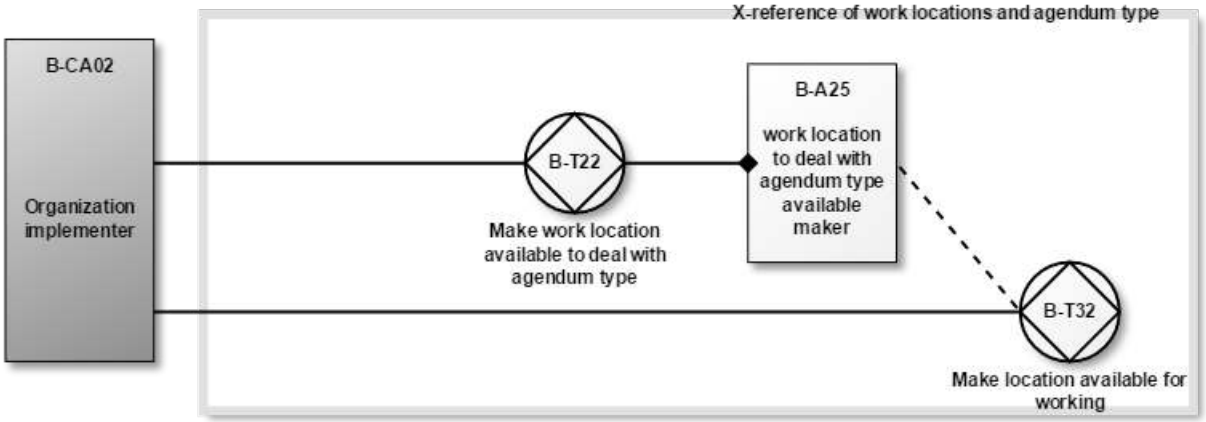


Fig. II.51: OCD of X-reference of work locations and agendum type

Transaction kind	**Product kind**
B-T22 Make work location available to deal with agendum type	P22 [AT Location Availability] has been established

Tab. II.94: Transaction Product Table

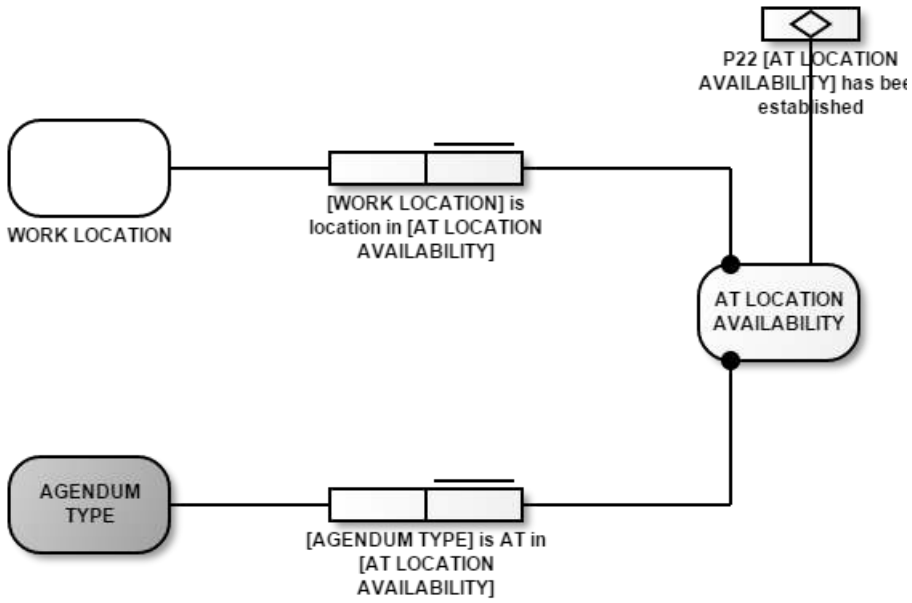


Fig. II.52: OFD of X-reference of work locations and agendum type

II.26.4 Verification by instantiation

Work location	**FT location availability**
ABCstreet 123, Leiden, Netherlands	1
~~Air lane 23, Amsterdam, Netherlands~~	~~1~~
ABCstreet 123, Leiden, Netherlands	2

Tab. II.95: Instances*[WORK LOCATION] is location in [AT LOCATION AVAILABILITY]*

Agendum type	FT Agendum type assignment
AT01/rq	1
~~AT02/rq~~	~~1~~
AT01/rq	2

Tab. II.96: Instances*[AGENDUM TYPE] is AT in [AT LOCATION AVAILABILITY]*

AT location availability
ABCstreet 123, Leiden, Netherlands - AT01/rq
Air lane 23, Amsterdam, Netherlands - AT02/rq
ABCstreet 123, Leiden, Netherlands - AT01/rq

Tab. II.97: Instances of *P22 [AT LOCATION AVAILABILITY] has been established*

II.26.5 Remarks

- This OIV does not cover whether an agendum is restricted to one location(Event location restrictions.

Old definition

Reference of which act type can be performed on which work location(X-reference of work location and act type)[5]

II.27 Out of scope

II.27.1 Region

Definition

Region is a geographical area of responsibility.

Remarks

- This OIV changed definitions many times and it should be further researched what the intended meaning of this OIV is.

II.27.2 Separation of duties

II.27.3 Definition

Governance policy according to which no human resource should be given responsibility for more than one related function.

Remarks

- It is unclear whether this OIV concern the separation of function (function perspective in the organization theorem) or the separation of agendum types (construction perspective in the organization theorem).

II.27.4 X-reference of actor role and organizational unit

Definition

X-reference of functionary type and actor role is the assignment of a functionary type to fulfill an actor role.

Remarks

- The X-reference of actor role and organizational unit is taken out of scope because it concerns actor roles.

II.27.5 X-reference of human resource and actor role

II.27.6 Definition

X-reference of human resource and actor role is fulfillment of an actor role by an human resource.

Remarks

- The X-reference of human resource and actor role is taken out of scope because it concerns actor roles.

II.28 Removed

II.28.1 Organization structure

II.28.2 Definition

Organization structure is the coherence of organizational units.

Remarks

- This OIV was removed because the OIVs already cover a structure in the organization. This is merely a representation of the structure. E.g., one could express the structure of the organization based on the relations between organizational units, or the relation of functionary types and organizational units.

II.29 Suggested OIVs

Implementation

II.29.1 X-reference of actor role and juristic person

Definition

X-reference of actor role is the assignment of an actor role to a juristic person.

Remarks

- This OIV could make outsourcing possible by assigning an actor role(an executor) to an external juristic person. If an external juristic person fulfills an actor role, the agreement between the juristic person and the organization is based on results. Organizational units might differ in the outsourcing of actor roles. If they differ, the OIV X-reference of actor role and organizational unit is needed to make a distinction between actor roles.

HR and means

II.29.2 Means

Definition

Means are the goods or services that are acquired or leased.

Remarks

- Means should be a separate OIV just as human resource. Means concern the acquiring and eliminating of goods and services. Additionally to this OIV there should be X-references between means and functionary types, organizational units,

work locations, and agendum types. Since these X-references are similar to the equivalent X-references of the human resource, it could be desirable to group these X-references together as the X-references of resources.

Installation

II.29.3 Schedule of human resources

Definition

Schedule of human resources is the placement of human resources in time and space.

Remarks

- This OIV concerns the scheduling of human resources. This is necessary to install the human resources. Without this, it is unclear at what moment human resources are actually working. Now we only know what a human resource is assigned to do, not when he is scheduled to it.
- This OIV is related to Way of dealing with an agendum type. To deal with an agendum type in a collective way, human resources need to be scheduled to work at the same time and space.

II.29.4 Schedule of means

Definition

Schedule of means is the placement of means in time and space.

Remarks

- This OIV is similar to subsection II.29.3, but concerns the scheduling of means.

II.29.5 X-reference of human resources and region

Definition

X-reference of human resources and region is the assignment of a region to a human resource.

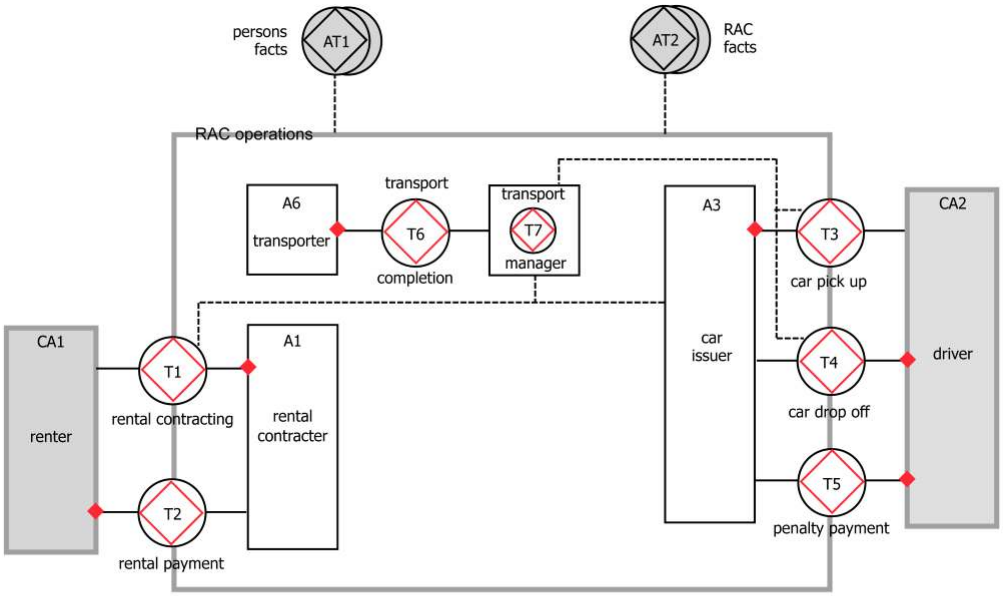
Remarks

- This OIV concerns the assignment of a region to a human resource. If this OIV is adopted it might be necessary to adopt the X-references of region and functionary types, organizational units, and work locations.

III. RENT-A-CAR IMPLEMENTATION

III.1 Introduction

In this chapter the implementation of the Rent-A-Car (RAC) case is presented[7]. The implementation is based on the narrative of the case and its organization construction diagram, as shown in Table III.1. Only the result kinds are represented in the implemented and not every fact type. We made the assumption that RAC will operate in the Netherlands and in Belgium.



transaction kind	product kind
T1 rental contracting	P1 Rental is contracted
T2 rental payment	P2 the rent of Rental is paid
T3 car pick up	P3 the car of Rental is picked up
T4 car drop off	P4 the car of Rental is dropped off
T5 penalty payment	P5 the penalty of Rental is paid
T6 transport completion	P6 Transport is completed
T7 transport management	P7 transport management for Day is done

Fig. III.1: OCD and TPT of Rent-A-Car (adapted from [7])

III.1.1 Agendum types

The agendum types, shown in Table III.1, are derived from the action model of the RAC case[7]. Not every agendum type is considered in implementing the RAC case, in order to reduce unnecessary complexity.

Transaction kind	**Agendum type**	**Notation**
T01	Rental contracting is requested	AT01/rq
	Rental contracting is stated	AT01/st
T02	Rental payment is requested	AT02/rq
	Rental payment is stated	AT02/st
T03	Car issue is requested*	AT03/rq
	Car issue is stated*	AT03/st
T04	Car drop off is requested	AT04/rq
	Car drop off is stated	AT04/st
T05	Penalty payment is requested	AT05/rq
	Penalty payment is stated	AT05/st
T06	Transport management is requested	AT06/rq
	Transport management is stated	AT06/st
T07	Transport completion is requested	AT07/rq
	Transport completion is stated	AT07/st

Tab. III.1: Agendum types in the RAC implementation

*We changed the name to car issue, because the actor car issuer produces a car that is issues in transaction three and not a picked up car.

III.1.2 Abbreviations for the RAC implementation

	Abbreviation
Actor roles	
Rental contracter	A01
Car issuer	A03
Transporter	A06
Transport manager	A07
Functionary types	
Managing director	MD
Head of front office	HFO
Desk officer	DO
Distributor	DI
Transporter	TR
Scheduler	SC
Work locations	
ABCstreet 123, Leiden, The Netherlands	Office 1
Air lane 23, Amsterdam, The Netherlands	Office 2
Station road 6, Antwerp, Belgium	Office 3
Competence	
Customer friendliness	CF
Driving capabilities	DC
Microsoft Office	MO
Good behaviour	GB
Medium intelligence	MI
Basic math	BM

III.2 Implementation

III.2.1 Allocation of Full Time Equivalent

#FTE	Functionary type	Org. Unit	Work location
2	Managing Director	Management	Office 1
1	Head of front office	Sales	Office 1
1.5	Desk officer	Sales	Office 1
1.5	Desk officer	Sales	Office 2
0.5	Desk officer	Sales	Office 3
0.25	Distributor	Distribution	Office 1
0.5	Distributor	Distribution	Office 2
0.5	Distributor	Distribution	Office 3
1.25	Transporter	Distribution	Office 1
1	Transporter	Distribution	Office 2
0.5	Transporter	Distribution	Office 3
0.5	Scheduler	Distribution	Office 1

Tab. III.2: FTE Norm

III.2.2 Competence, functionary type, and organizational unit

Competence
Customer friendliness
Driving capabilities
Microsoft Office
Good behaviour
Medium intelligence
Basic math

Tab. III.3: Competences

Functionary type
Managing director
Head of front office
Desk officer
Distributor
Transporter
Scheduler

Tab. III.4: Functionary types

Organizational unit
Management
Sales
Distribution

Tab. III.5: Organizational units

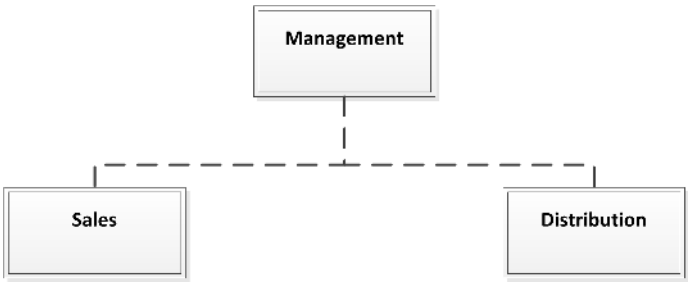


Fig. III.2: Hierarchical placement

III.2.3 Event location restrictions, rules for the assignment of an agendum, and way of dealing with an agendum type

Event location rule	**Agendum type**
Not restricted to a location	AT01/rq
Not restricted to a location	AT02/rq
Restricted to the location where the agendum is started	AT03/rq
Restricted to the location where the agendum is started	AT04/rq
Not restricted to a location	AT05/rq
Not restricted to a location	AT06/rq
Not restricted to a location	AT07/rq

Tab. III.6: Event location restrictions

Set of assignment rules	**Agendum type**
1. Dealing with agendum type is assigned to Sales 2a. Agendums from organizations are dealt with by Chiara 2b. All other agendums are assigned to a free desk officers	AT01/rq
1. Dealing with agendum type is assigned to Sales 2a. Agendums from organizations are dealt with by Chiara 2b. All other agendums are assigned to a free desk officers	AT02/st
1. Dealing with agendum type is assigned to Distribution 2. Dealing with agendum is assigned to the free distributor	AT03/rq
1. Dealing with agendum type is assigned to Distribution 2. Dealing with agendum is assigned to the free distributor	AT04/st
1. Dealing with agendum type is assigned to Distribution 2a. Agendums from organizations are dealt with by Mik 2b. All other agendums are assigned to a free distributor	AT05/st
1. Dealing with agendum type is assigned to Transportation 2. Dealing with agendums is scheduled by Mik 3. Agendum is assigned to transporter	AT06/rq
1. Agendum is assigned to Mik	AT07/rq

Tab. III.7: Rules for the assignment of an agendum

Type of fulfillment	Agendum type
concurrently and individually	AT01/rq
concurrently and individually	AT02/st
concurrently and individually	AT03/rq
concurrently and individually	AT04/st
concurrently and individually	AT05/st
concurrently and individually	AT06/rq
concurrently and individually	AT07/rq

Tab. III.8: Way of dealing with agendum type

III.2.4 Juristic person, language support, and work location

Juristic person
RAC
RAC BE
Consulting Inc.

Tab. III.9: Juristic persons

Language
Dutch
English
German
French

Tab. III.10: Supported languages

Work location
ABCstreet 123, Leiden, The Netherlands
Air lane 23, Amsterdam, The Netherlands
Station road 6, Antwerp, Belgium

Tab. III.11: Work locations

III.2.5 Order of working

Product act type	**Product act type**
T01/ex	T02/pm

Tab. III.12: Order of working (*product act type follows product act type*

III.2.6 X-references

	AT01/rq	**AT02/st**	**AT03/rq**	**AT04/st**	**AT05/st**	**AT06/rq**	**AT07/rq**
CF	x	x	x	x	x		
DC			x	x		x	
MO	x	x	x	x	x		x
GB		x			x	x	
MI	x	x			x		x
BM		x			x		x

Tab. III.13: X-reference of agendum type and competence

	AT01/rq	AT02/st	AT03/rq	AT04/st	AT05/st	AT06/rq	AT07/rq
MD							
HFO	A	A			R		
DO	A	A					
DI			A	A	A		
TR						A	
SC							A

Tab. III.14: X-reference of functionary type and agendum type

	Management	Sales	Distribution
MD	x		
HFO	x	x	
DO		x	
DI			x
TR			x
SC			x

Tab. III.15: X-reference of functionary type and organizational unit

	Office 1	Office 2	Office 3
MD	x		
HFO	x		
DO	x	x	x
DI	x	x	x
TR	x	x	x
SC	x		

Tab. III.16: X-reference of functionary type and work location

	Office 1	Office 2	Office 3
AT01/rq	x		
AT02/st	x		
AT03/rq	x	x	x
AT04/st	x	x	x
AT05/st	x	x	x
AT06/rq	x	x	x
AT07/rq	x		

Tab. III.17: X-reference of work locations and agendum type

III.3 HR and means

III.3.1 Sourcing

Employee
Janno
Ties
Chiara
Mik
Ferre
Carlo
Jane
Michael
Emma
David
Hire
Harold
Anthony

Tab. III.18: Human resource

Means
10 cars of type A
10 cars of type B
Telephone
Fax
E-mail
Web

Tab. III.19: Means

Agendum type	**Technical channel**	**Targetgroup**
AT01/rq	Telephone, fax, e-mail, and web	Human resource
AT01/st	Telephone, fax, e-mail, and web	Customer
AT02/rq	Telephone, fax, e-mail, and web	Human resource
AT02/st	Telephone, fax, e-mail, and web	Customer
AT03/rq	Walk-in	Human resource
AT03/st	Walk-in	Customer
AT04/rq	Walk-in	Human resource
AT04/st	Walk-in	Customer
AT05/rq	Telephone, fax, e-mail, and web	Customer, Human resource
AT05/st	Telephone, fax, e-mail, and web	Customer, Human resource
AT06/rq	Telephone	Human resource
AT06/st	Telephone	Human resource
AT07/rq	Telephone, fax, e-mail, and web	Human resource
AT07/st	Telephone, fax, e-mail, and web	Human resource

Tab. III.20: Technical channels

III.3.2 Validation of competences

Human resource	Competence
Janno Ties	
Chiara Jane Michael Emma David	Customer friendliness Microsoft Office Good behaviour Medium intelligence Basic math
Mik Ferre Carlo	Customer friendliness Driving capabilities Microsoft Office Good behaviour Medium intelligence Basic math
Anthony Harold	Driving capabilities Good behaviour

Tab. III.21: Competence requirements

Validation method
Assessment
Check certification

Tab. III.22: Validation methods

III.4 Installation

III.4.1 X-references

	MD	HFO	DO	DI	TR	SC
Janno	100%					
Ties	100%					
Chiara		100%				
Mik				25%	25%	50%
Ferre				50%	50%	
Carlo				50%	50%	
Jane			100%			
Michael			100%			
Emma			100%			
David			50%			
Anthony					100%	
Harold					50%	

Tab. III.23: X-reference of human resource and functionary type

	Management	Sales	Distribution
Janno	100%		
Ties	100%		
Chiara		100%	
Mik			100%
Ferre			100%
Carlo			100%
Jane		100%	
Michael		100%	
Emma		100%	
David		50%	
Anthony			100%
Harold			50%

Tab. III.24: X-reference of human resource and organizational unit

	Office 1	**Office 2**	**Office 3**
Janno	100%		
Ties	100%		
Chiara	100%		
Mik	50%	25%	25%
Ferre	25%	25%	50%
Carlo	50%	25%	25%
Jane	50%	50%	
Michael	100%		
Emma		100%	
David			50%
Anthony	25%	75%	0%
Harold	50%	0%	0%

Tab. III.25: X-reference of human resource and work location

III.5 Operation

C-act	**Addressee**
C01-23/rq	RAC
C01-23/rq	Sales
C01-23/rq	Desk officer
C01-23/rq	Jane
C01-24/rq	RAC
C01-24/rq	Sales
C01-24/rq	Chiara
C-act	**Addressee**
C03-24/rq	Distribution
C03-24/rq	Ferre
C03-23/rq	Distribution
C03-23/rq	Carlo
C-act	**Addressee**
C04-23/rq	Distribution
C04-23/rq	Carlo
C-act	**Addressee**
C02-23/rq	RAC
C02-23/rq	Sales
C02-23/rq	Desk officer
C02-23/rq	Emma
C02-24/rq	RAC
C02-24/rq	Sales
C02-24/rq	Chiara

Tab. III.26: Addressee specificity

Agendum	**Human resource**	**Delegate**
rental start #23 is requested	Jane	Michael

Tab. III.27: Delegation

III.6 RAC scenarios

Scenario 1: In this scenario, customer John wants to rent one car of type A. **Scenario 2:** In this scenario, customer Sarah wants to rent two cars of type A and three cars of type B. Sarah wants to rent these cars on behalf of Consulting Inc. Both John and Sarah are first time customers of RAC. *Date and time in day/month/year hour:minute.*

III.6.1 Rental contracting

1. John fills in and submits on online form, requesting to rent one car of type A. He would like to rent the car for one week starting the 17th of September 2014, 10AM and ending the 24th of September, 10AM at office 2. *(10/09/2014 13:00)*

2. Sarah calls to RAC , requesting to rent two car of type A and three cars of type B. She would like to rent these cars on behalf of Consulting Inc. The requested starting date would be the 16th of September 2014, 10AM at office 1 and ending the 16th of November 2014 at office 3. *(10/09/2014 13:00)*
   John's request is assigned number 23 (rental contracting#23 is requested) and Sarah's request is assigned number 24 (rental contracting #24 is requested).

3. Rental start #23 is addressed to RAC. RAC is not specific enough to evoke commitment. The reservation system addresses agendum #23 to a free desk officer Jane. The C-Act is now completed (there is an addressee specific enough to evoke the commitment).*(10/09/2014 13:01)*
   Related OIV in operation: Addressee specificity (C01-23/rq)

4. Rental start #24 is addressed to RAC. RAC is not specific enough to evoke commitment. The reservation system addresses agendum #24 to Chiara. The C-Act is now completed (there is an addressee specific enough to evoke the commitment).*(10/09/2014 13:01)*
   Related OIV in operation: Addressee specificity (C01-24/rq)

5. Chiara promises rental is started #24 to Sarah on the telephone and requests the rental payment.*(10/09/2014 13:05)*

6. Sarah signs a contract promising that Consulting Inc will pay for the rentals. Now Chiarra can state that the rental is started and Sarah accepts this.*(10/09/2014 13:10)*

7. Meanwhile, Jane, who was dealing with rental start #23, has become ill. So she has to go home. She delegates rental start #23 to Michael.*(10/09/2014 13:10)*
   Related OIV in operation: Delegation

8. Michael promises rental is started #23 to John via email and requests the rental payment.*(10/09/2014 13:15)*

9. John promises paying for the rental by letting RAC make a reservation on his credit card. Now Michael can state that the rental is started and John accepts this.*(10/09/2014 13:10)*

III.6.2 Transporting cars

1. After accepting the rental start, John and Sarah request to issue their cars at office 1.*(15/09/2014 08:00)*

2. On the 15th of September 2014 there are not enough cars available at office 1, therefore Mik schedules car transports. He calls Anthony and Harold, two students that do transportation. *(15/09/2014 08:15)*

3. Anthony is requested to go to office two and drive two cars of type A back 1. Harold is requested to go to office three and drive three cars of type B back to office 1. Both Anthony and Harold promise to do so. *(15/09/2014 08:20)*

4. By the end of the day the required amount of cars are available at office 1. *(15/09/2014 18:00)*

III.6.3 Issuing cars

1. Sarah, accompanied by five colleagues, comes into office 1 on the 16th of September, 10AM. *(16/09/2014 10:00)*

2. Ferre, working at office 1, is assigned to deal with issuing the cars to Sarah.*(16/09/2014 10:05)*
   Related implementation table:Addressee specificity(C03-24/rq)

3. Ferre promises to issue the cars to Sarah and takes her to the back of office 1 where the cars are parked.*(16/09/2014 10:05)*

4. At the back of office 1 he states which cars are reserved for Consulting INC. Sarah accepts this. *(16/09/2014 10:15)*

5. Ferre requests Sarah to drop off the cars at the agreed date and place and Sarah promises this. *(16/09/2014 10:30)*

6. John comes into office 1 on the 17th of September, 10AM. *(17/09/2014 10:00)*

7. Carlo, working at office 1, is assigned to deal with issuing the car to John.*(17/09/2014 10:05)*
   Related implementation table:Addressee specificity(C03-23/rq)

8. Carlo promises to issue the car to John and takes him to the back of office 1 where the cars are parked.*(17/09/2014 10:05)*

9. At the back of office 1 he states which car is reserved for John. John accepts this. *(17/09/2014 10:15)*

10. Carlo requests John to drop off the cars at the agreed date and place and John promises this. *(17/09/2014 10:30)*

III.6.4 Dropping off cars

1. As promised, John returns to drop off the car at office 2. He states that he dropped off the car. *(17/09/2014 9:00)*

2. Carlo is assigned to accept the state. He first checks out the car and then accepts the state.*(17/09/2014 9:01)*
Related implementation table:Addressee specificity(C04-23/rq)

3. As promised, Sarah returns to drop off the cars at office 3. She states that she dropped off the cars to Mik. *(16/10/2014 9:00)*

4. Mik is assigned to accept the state. He first checks out the cars and then accepts the state.*(16/10/2014 19:00)*

III.6.5 Ending rentals

1. To end the rental, John must first pay. He already promised on doing so and now the money credited from his credit card. John states he paid. *(24/09/2014 09:30)*

2. Emma deals with the state that rental #23 has been paid for. She accepts the payment by John and therefore states that the rental ended. *(24/09/2014 09:35)*
Related implementation table:Addressee specificity(C02-23/rq)

3. John accepts this. *(24/09/2014 09:35)*

4. To end the rental, Consulting Inc must first pay. They had already promised on doing so and now the money credited from Consulting Inc. Sarah states Consulting Inc paid. *(18/11/2014 08:30)*

5. Chiara deals with the state that rental #24 has been paid for and with the request to end the rental. She accepts the payment by Consulting Inc and therefore states that the rental ended.*(18/11/2014 08:30)*
Related implementation table:Addressee specificity(C02-24/rq)

6. Sarah accepts this.*(18/11/2014 08:30)*

IV. RENT-A-CAR 2.0

IV.1 Introduction

In this chapter we present a different implementation of RAC. The same assumptions are made as in the Rent-A-Car implementation. The new situation is as follows: *Business is not going well for RAC, because the tourist industry has collapsed. Therefore they had to reorganize. The functionary type 'desk officer' and the third office is made unavailable. No human resources have been fired yet. Customer Sarah wants to drop the cars off at 'location 2'.*

IV.2 Implementation

IV.2.1 Allocation of Full Time Equivalent

#FTE	**Functionary type**	**Org. Unit**	**Work location**
2	Managing Director	Management	Office 1
1	Head of front office	Sales	Office 1
0.25	Distributor	Distribution	Office 1
0.5	Distributor	Distribution	Office 2
1.25	Transporter	Distribution	Office 1
1	Transporter	Distribution	Office 2
0.5	Scheduler	Distribution	Office 1

Tab. IV.1: FTE Norm

IV.2.2 Competence, functionary type, and organizational unit

Competence
Customer friendliness
Driving capabilities
Microsoft Office
Good behaviour
Medium intelligence
Basic math

Tab. IV.2: Competences

Functionary type
Managing director
Head of front office
Distributor
Transporter
Scheduler

Tab. IV.3: Functionary types

Organizational unit
Management
Sales
Distribution

Tab. IV.4: Organizational units

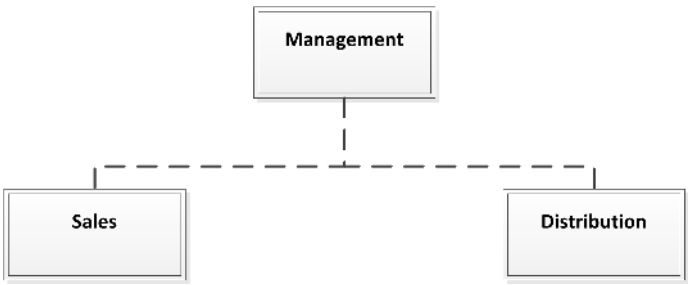


Fig. IV.1: Hierarchical placement

IV.2.3 Event location restrictions, rules for the assignment of an agendum, and way of dealing with an agendum type

Event location rule	**Agendum type**
Not restricted to a location	AT01/rq
Not restricted to a location	AT02/rq
Restricted to the location where the agendum is started	AT03/rq
Restricted to the location where the agendum is started	AT04/rq
Not restricted to a location	AT05/rq
Not restricted to a location	AT06/rq
Not restricted to a location	AT07/rq

Tab. IV.5: Event location restrictions

Set of assignment rules	**Agendum type**
Dealing with agendum is assigned to Chiara	AT01/rq
Dealing with agendum is assigned to Chiara	AT02/st
1. Dealing with agendum type is assigned to Distribution 2. Dealing with agendum is assigned to the free distributor	AT03/rq
1. Dealing with agendum type is assigned to Distribution 2. Dealing with agendum is assigned to the free distributor	AT04/st
1. Dealing with agendum type is assigned to Distribution 2a. Agendums from organizations are dealt with by Mik 2b. All other agendums are assigned to a free distributor	AT05/st
1. Dealing with agendum type is assigned to Transportation 2. Dealing with agendums is scheduled by Mik 3. Agendum is assigned to transporter	AT06/rq
1. Agendum is assigned to Mik	AT07/rq

Tab. IV.6: Rules for the assignment of an agendum

Type of fulfillment	Agendum type
concurrently and individually	AT01/rq
concurrently and individually	AT02/st
concurrently and individually	AT03/rq
concurrently and individually	AT04/st
concurrently and individually	AT05/st
concurrently and individually	AT06/rq
concurrently and individually	AT07/rq

Tab. IV.7: Way of dealing with agendum type

IV.2.4 Juristic person, language support, and work location

Juristic person
RAC
Consulting Inc.

Tab. IV.8: Juristic persons

Language
Dutch
English

Tab. IV.9: Supported languages

Work location
ABCstreet 123, Leiden, The Netherlands
Air lane 23, Amsterdam, The Netherlands

Tab. IV.10: Work locations

IV.2.5 Order of working

Product act type	Product act type
T01/ex	T02/pm

Tab. IV.11: Order of working (*product act type follows product act type*

IV.2.6 X-references

	AT01/rq	AT02/st	AT03/rq	AT04/st	AT05/st	AT06/rq	AT07/rq
CF	x	x	x	x	x		
DC			x	x		x	
MO	x	x	x	x	x		x
GB		x			x	x	
MI	x	x			x		x
BM		x			x		x

Tab. IV.12: X-reference of agendum type and competence

	AT01/rq	AT02/st	AT03/rq	AT04/st	AT05/st	AT06/rq	AT07/rq
MD							
HFO	A	A			R		
DI			A	A	A		
TR						A	
SC							A

Tab. IV.13: X-reference of functionary type and agendum type

	Management	Sales	Distribution
MD	x		
HFO	x	x	
DI			x
TR			x
SC			x

Tab. IV.14: X-reference of functionary type and organizational unit

	Office 1	Office 2
MD	x	
HFO	x	
DO	x	x
DI	x	x
TR	x	x
SC	x	

Tab. IV.15: X-reference of functionary type and work location

	Office 1	Office 2
AT01/rq	x	
AT02/st	x	
AT03/rq	x	x
AT04/st	x	x
AT05/st	x	x
AT06/rq	x	x
AT07/rq	x	

Tab. IV.16: X-reference of work locations and agendum type

IV.3 HR and means

IV.3.1 Sourcing

Employee
Janno
Ties
Chiara
Mik
Ferre
Carlo
Jane
Michael
Emma
David

Tab. IV.17: Employee

Hire
Harold
Anthony

Tab. IV.18: Hire

Means
10 cars of type A
10 cars of type B
Telephone
Fax
E-mail
Web

Tab. IV.19: Means

Agendum type	**Technical channel**	**Targetgroup**
AT01/rq	Telephone, fax, e-mail, and web	Human resource
AT01/st	Telephone, fax, e-mail, and web	Customer
AT02/rq	Telephone, fax, e-mail, and web	Human resource
AT02/st	Telephone, fax, e-mail, and web	Customer
AT03/rq	Walk-in	Human resource
AT03/st	Walk-in	Customer
AT04/rq	Walk-in	Human resource
AT04/st	Walk-in	Customer
AT05/rq	Telephone, fax, e-mail, and web	Customer, Human resource
AT05/st	Telephone, fax, e-mail, and web	Customer, Human resource
AT06/rq	Telephone	Human resource
AT06/st	Telephone	Human resource
AT07/rq	Telephone, fax, e-mail, and web	Human resource
AT07/st	Telephone, fax, e-mail, and web	Human resource

Tab. IV.20: Technical channels

IV.3.2 Validation of competences

Human resource	Competence
Janno Ties	
Chiara	Customer friendliness Microsoft Office Good behaviour Medium intelligence Basic math
Mik Ferre Carlo	Customer friendliness Driving capabilities Microsoft Office Good behaviour Medium intelligence Basic math
Anthony Harold	Driving capabilities Good behaviour

Tab. IV.21: Competence requirements

Validation method
Assessment
Check certification

Tab. IV.22: Validation methods

IV.4 Installation

IV.4.1 X-references

	MD	HFO	DO	DI	TR	SC
Janno	100%					
Ties	100%					
Chiara		100%				
Mik				25%	25%	50%
Ferre				50%	50%	
Carlo				50%	50%	
Jane						
Michael						
Emma						
David						
Anthony					100%	
Harold					50%	

Tab. IV.23: X-reference of human resource and functionary type

	Management	Sales	Distribution
Janno	100%		
Ties	100%		
Chiara		100%	
Mik			100%
Ferre			100%
Carlo			100%
Jane			
Michael			
Emma			
David			
Anthony			100%
Harold			50%

Tab. IV.24: X-reference of human resource and organizational unit

	Office 1	**Office 2**
Janno	100%	
Ties	100%	
Chiara	100%	
Mik	50%	25%
Ferre	25%	25%
Carlo	50%	25%
Jane		
Michael		
Emma		
David		
Anthony	25%	75%
Harold	50%	0%

Tab. IV.25: X-reference of human resource and work location

IV.5 Operation

C-act	**Addressee**
C01-23/rq	RAC
C01-23/rq	Chiara
C01-24/rq	RAC
C01-24/rq	Chiara
C-act	**Addressee**
C07-12/rq	Anthony
C07-13/rq	Harold
C-act	**Addressee**
C03-24/rq	Distribution
C03-24/rq	Ferre
C03-23/rq	Distribution
C03-23/rq	Carlo
C-act	**Addressee**
C04-23/rq	Distribution
C04-23/rq	Carlo
C04-24/rq	Mik
C-act	**Addressee**
C02-23/rq	RAC
C02-23/rq	Chiara
C02-24/rq	RAC
C02-24/rq	Chiara

Tab. IV.26: Addressee specificity

IV.6 RAC scenarios

Scenario 1: In this scenario, customer John wants to rent one car of type A. **Scenario 2:** In this scenario, customer Sarah wants to rent two cars of type A and three cars of type B. Sarah wants to rent these cars on behalf of Consulting Inc. Both John and Sarah are first time customers of RAC. *Date and time in day/month/year hour:minute.*

IV.6.1 Rental contracting

1. John fills in and submits on online form, requesting to rent one car of type A. He would like to rent the car for one week starting the 17th of September 2015, 10AM and ending the 24th of September, 10AM at office 2. *(10/09/2015 13:00)*

2. Sarah calls to RAC , requesting to rent two car of type A and three cars of type B. She would like to rent these cars on behalf of Consulting Inc. The requested starting date would be the 16th of September 2015, 10AM at office 1 and ending the 16th of November 2015 at office 3. *(10/09/2015 13:00)*
   John's request is assigned number 23 (rental contracting#23 is requested) and Sarah's request is assigned number 24 (rental contracting #24 is requested).

3. Rental start #23 is addressed to RAC. RAC is not specific enough to evoke commitment. The reservation system addresses agendum #23 to a free desk officer Chiara. The C-Act is now completed (there is an addressee specific enough to evoke the commitment).*(10/09/2015 13:01)*
   Related OIV in operation: Addressee specificity (C01-23/rq)

4. Rental start #24 is addressed to RAC. RAC is not specific enough to evoke commitment. The reservation system addresses agendum #24 to Chiara. The C-Act is now completed (there is an addressee specific enough to evoke the commitment).*(10/09/2015 13:01)*
   Related OIV in operation: Addressee specificity (C01-24/rq)

5. Chiara promises rental is started #24 to Sarah on the telephone and requests the rental payment.*(10/09/2015 13:05)*

6. Sarah signs a contract promising that Consulting Inc will pay for the rentals. Now Chiarra can state that the rental is started and Sarah accepts this.*(10/09/2015 13:10)*

7. John promises paying for the rental by letting RAC make a reservation on his credit card. Now Chiara can state that the rental is started and John accepts this.*(10/09/2015 13:10)*

IV.6.2 Transporting cars

1. After accepting the rental start, John and Sarah request to issue their cars at office 1.*(15/09/2015 08:00)*

2. On the 15th of September 2015 there are not enough cars available at office 1, therefore Mik schedules car transports. He calls Anthony and Harold, two students that do transportation. *(15/09/2015 08:15)*

3. Anthony is requested to go to office two and drive two cars of type A back 1. Harold is requested to go to office three and drive three cars of type B back to office 1. Both Anthony and Harold promise to do so. *(15/09/2015 08:20)*

4. By the end of the day the required amount of cars are available at office 1. *(15/09/2015 18:00)*

IV.6.3 Issuing cars

1. Sarah, accompanied by five colleagues, comes into office 1 on the 16th of September, 10AM. *(16/09/2015 10:00)*

2. Ferre, working at office 1, is assigned to deal with issuing the cars to Sarah.*(16/09/2015 10:05)*
   Related implementation table:Addressee specificity(C03-24/rq)

3. Ferre promises to issue the cars to Sarah and takes her to the back of office 1 where the cars are parked.*(16/09/2015 10:05)*

4. At the back of office 1 he states which cars are reserved for Consulting INC. Sarah accepts this. *(16/09/2015 10:15)*

5. Ferre requests Sarah to drop off the cars at the agreed date and place and Sarah promises this. *(16/09/2015 10:30)*

6. John comes into office 1 on the 17th of September, 10AM. *(17/09/2015 10:00)*

7. Carlo, working at office 1, is assigned to deal with issuing the car to John.*(17/09/2015 10:05)*
   Related implementation table:Addressee specificity(C03-23/rq)

8. Carlo promises to issue the car to John and takes him to the back of office 1 where the cars are parked.*(17/09/2015 10:05)*

9. At the back of office 1 he states which car is reserved for John. John accepts this. *(17/09/2015 10:15)*

10. Carlo requests John to drop off the cars at the agreed date and place and John promises this. *(17/09/2015 10:30)*

IV.6.4 Dropping off cars

1. As promised, John returns to drop off the car at office 2. He states that he dropped off the car. *(17/09/2015 9:00)*

2. Carlo is assigned to accept the state. He first checks out the car and then accepts the state.*(17/09/2015 9:01)*
   Related implementation table:Addressee specificity(C04-23/rq)

3. As promised, Sarah returns to drop off the cars at office 3. She states that she dropped off the cars to Mik. *(16/10/2015 9:00)*

4. Mik is assigned to accept the state. He first checks out the cars and then accepts the state.*(16/10/2015 19:00)*

IV.6.5 Ending rentals

1. To end the rental, John must first pay. He already promised on doing so and now the money credited from his credit card. John states he paid. *(24/09/2015 09:30)*

2. Chiara deals with the state that rental #23 has been paid for. She accepts the payment by John and therefore states that the rental ended. *(24/09/2015 09:35)*
   Related implementation table:Addressee specificity(C02-23/rq)

3. John accepts this. *(24/09/2015 09:35)*

4. To end the rental, Consulting Inc must first pay. They had already promised on doing so and now the money credited from Consulting Inc. Sarah states Consulting Inc paid. *(18/11/2015 08:30)*

5. Chiara deals with the state that rental #24 has been paid for and with the request to end the rental. She accepts the payment by Consulting Inc and therefore states that the rental ended.*(18/11/2015 08:30)*
   Related implementation table:Addressee specificity(C02-24/rq)

6. Sarah accepts this.*(18/11/2015 08:30)*

V. OIV TABLES FROM PREVIOUS RESEARCH

This chapter shows the OIV tables from previous research. Table V.1 shows the list of variables as proposed by Op 't Land and Krouwel. Table V.2 shows the list of OIVs as proposed by van Bockhooven. Table V.3 shows Table V.2 is derived from Table V.1 by van Bockhooven.

	Business	Informational	Documental
Parties & People	Organization structure: organizational/legal entity		
	Employees and Sourcing		
	Delegation		
	Competences/certification		
	Addressee specificity		
	Departments		
	Organizational structure		
	Functionary types		
	X-ref Employee/functionary type		
	X-ref Functionary type/act type		
	#FTE		
	Way of fulfilling actor role		
	Separation of function		
	Order of working		
	Assignment of tasks		
		Language support	
ICT & other means	Workplaces		
	Equipment		
	X-ref workplace/act type		
	Event location restrictions		
	Applications		
	X-ref Employee/Workplace		
		Media (entering, gathering, saving, receiving)	
			Channels
			Denotation

Tab. V.1: Organizational implementation variables proposed by Op 't Land and Krouwel [2]

V	Variable	Part 1	Part 2
V1	Addressee specificity	yes	
V2	Competences	yes	
V3	Delegation		yes
V4	Employee	yes	yes
V5	Event location restrictions		
V6	FTE	yes	
V7	Functionary type	yes	
V8	Language support		yes
V9	Legal entity	yes	
V10	Order of working		
V11	Organization structure	yes	yes
V12	Organizational unit	yes	yes
V13	Rules for assignment of tasks		
V14	Separation of duties		yes
V15	Sourcing	yes	yes
V16	Technical Channels	yes	yes
V17	Validation of competences	yes	
V18	Way of fulfilling actor role		
V19	Work locations	yes	
V20	X-ref employee/functionary type		
V21	X-ref employee/work location		
V22	X-ref functionary type/act type	yes	
V23	X-ref work locations/act type		
V24	X-reference employee/actor role		new
V25	X-ref employee/organizational unit	new	
V26	X-ref actor role/organizational unit	new	
V27	Region	new	

Tab. V.2: The list of OIVs as proposed and validated by van Bockhooven[5]

Variables from table 3/4	**New variables**
Organization structure: organizational/legal entity	Organization structure
	Legal entity
	Organizational unit
Employees and sourcing	Employee
	Sourcing
Delegation	Delegation
Competences/certification	Validation of competences
	Competences
Addressee specificity	Addressee specificity
Departments	(dropped)
Organizational structure	(dropped)
Functionary types	Functionary types
X-ref employee/functionary type	X-ref employee/functionary type
X-ref functionary type/act type	X-ref functionary type/act type
Full time equivalent (#FTE)	Full time equivalent
Way of fulfilling actor role	Way of fulfilling actor role
Separation of function	Separation of duties
Order of working	Order of working
Assignment of tasks	Rules for assignment of tasks
Language support	Language support
Workplaces (including locations of offices)	Work locations
X-ref workplace/act type	X-ref work location/act type
Event location restrictions	Event location restrictions
X-ref employee/workplace	X-ref employee/work location
Channels	Technical channels

Tab. V.3: List with new variables compared to old list[5]