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1 Summary

The deliverable D4.3-“Requirements Specification for Process Landscaping Methodology” presents the requirements for the development of the Process Landscaping Methodology. These requirements were derived from the different sources described in the following.

Chapter 2 presents the requirements which were derived by analysing other, former work packages. The work packages that were analysed are WP1, which focused on the identification of the Process Building Blocks, and WP3, in which the ICT Impact Measurement Methodology was developed. Furthermore we go back to WP2 and analyse the ICT-Guidelines from an organisational- or process-oriented-view. Organisational and technological requirements were derived from the implications of a decentralised modelling scenario which is a basic characteristic of the PICTURE idea.

In Chapter 3 a literature review was performed. Thereby characteristics of the Public Administration domain and the challenges and opportunities that come with them are identified and general guidelines for modelling languages are presented. Further on it is shown why generic modelling languages are not suited to meet the special requirements of public administrations. The chapter concludes with a number of requirements for the PICTURE Process Landscaping Methodology which were deducted from the previous results.

Chapter 4 is concerned with the identification of user requirements regarding layout, symbols, visualisation and terminology of the Process Landscaping Methodology. To identify those requirements a questionnaire was developed and used in workshops with different public administrations. We performed workshops in CoL and CoM, moreover we interviewed officials in cities around CoM with and without modelling background to get as much feedback as possible in respect of the wishes of Public Administrations’ staff.

Chapter 5 presents a short summary of the results of this deliverable. Furthermore it describes future work for the development of the Process Landscaping Methodology.

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2 Analysis of Work Package Results and Implications of decentralised modelling

2.1 Analysis of WP1-results

The topic of WP1 was the identification of an appropriate set of Process Building Blocks (PBBs) which are the main elements of the Process Landscaping Methodology. Further steps in WP1 were a survey regarding the process modelling activities in municipalities, an analysis of existing process modelling techniques and the evaluation of existing process models in the cities participating in the PICTURE-Project. The main outcomes for our work package are:

- *Survey:* The main results from the survey can be summarized as follows: About 75% of the Public Administrations which participated did not model processes yet (it should be mentioned, that mainly bigger Administrations modelled their processes). The main reasons why they do not model processes are no money for such projects, no adequate personnel, no know-how, and no adequate software solution. If processes are modelled, the information is used for organisational reorganisation projects or the introduction and configuration of information technology. The main persons modelling the processes are own staff with modelling know-how. The main requirements the participants of the survey had regarding a process modelling technique are a simple language, which can be used and understood by the staff.
- *Existing modelling notations:* WP1 examined the five modelling languages Business Process Modelling Notation (BPMN) [13], Communication Structure Analysis (CSA) [22], Event-driven Process Chains (EPC) [20], Petri Nets (PN) [15], Unified Modelling Language (UML) [12], and mentioned some more. The main outcomes for the design of the Process Landscaping Methodology are: these generic modelling languages seem to be quite complex from a non-experts-view, the level of detail is not determined; some of the languages are very formal and technical approaches. We will discuss these outcomes in detail in chapter 3 within the literature review.
- *Existing process models in the cities:* Looking at the existing process models in D1.2 we can point out, that several modelling languages are in use. Besides BPMN and EPC, CoA described their processes in a textual way. The problem with these textual descriptions is that they cannot be analysed in an automatic way. The main conclusion of the results from the other cities is that they had to define modelling guidelines outside the modelling methodology which had to be followed by the modellers. There is a break between the conventions and the modelling methodology and also automatical analysis of the models cannot be based on these conventions. So the PICTURE Process Landscaping Methodology has to include the conventions into the language. We will discuss this in chapter 3 when talking about necessary language characteristics.

2.2 Analysis of WP3-results

As the later deliverables of WP3 were postponed, the analysis of the work package results is based on D3.2 - "Requirements Specification for ICT Impact Measurement Methodology". Here a number of requirements for the ICT Impact Measurement Methodology were identified. Furthermore, in D3.2 a number of principles for the ICT Impact Measurement Methodology were identified which partly also should hold for the Process Landscaping Methodology. The relevant principals are:

- *User driven approach:* The Process Landscaping Methodology should also be developed with the aim to meet the needs and requirements of the users and to bring information

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for measurable process improvements for the Impact Measurement Methodology. The identification of these user requirements is the goal of this deliverable.

- *User-friendliness:* The Process Landscaping Methodology as well as the Impact Measurement Methodology should be easy-to-use with clear steps and intuitive support. The users should be able to use the PICTURE methodology in general and especially the Landscaping Methodology by themselves without extensive training.
- *Generic cross-PA applicability:* The Process Landscaping Methodology should be applicable across Public Administrations from different countries in Europe. Therefore feedback from different Public Administrations is needed while developing the methodology.

Besides those, there are three further principles: (1) Comparative applicability across time, (2) Focused impact generation especially for PA processes, and (3) an unbiased approach for measurement. In particular the principles (1) and (3) should be supported by the Landscaping Methodology as this delivers the relevant information.

The principles conducted in WP3 are based on user requirements concerning the information the users wish to get from the Impact Measurement Methodology. The Process Landscaping Methodology has to capture the information in order to support the ICT Impact Measurement and thereby the process reorganisation in the Public Administrations. The following main areas of information requirements were identified in WP3:

- *Time Savings:* To identify time savings through the introduction of ICT the Process Landscaping Methodology has to capture detailed information about the time needed to perform a process. To get as detailed information as possible the time should be recorded on the level of PBBs as they represent atomic steps of work. However it might not be necessary to record times on every PBB as some PBBs like e.g. "Receive" rather represent an event than an actual step of work: For a detailed analysis by the ICT Measurement Methodology it is useful to distinguish different types of time. Those types are *processing time* which represents the time of active work, *waiting time* (e.g. for a response by a citizen) and *times for the internal and external delivery of documents*. To assess the time savings not only on the basis of a single process but for the Public Administration, e.g. per year, it is also necessary to capture how often a process and its sub-processes are executed per year.
- *Cost Savings:* To identify the cost savings two steps are necessary: First the Process Landscaping Methodology must capture the cost drivers for the processes. This includes processing times as well as printed pages, channels from which the information comes in, or external sources which are taken into account for investigation. This information can be gathered through attributes on PBB-level. Second PICTURE must provide possibilities to specify cost rates for the cost drivers (e.g. printing cost, cost for external investigation or information about hourly wages). As these cost rates may vary between different organisational units and positions of a Public Administration the information must be captured at the required level of detail. As already specified for the time savings the yearly number of process executions must be captured to assess the cost savings for the community per year.
- *Elimination of manual steps:* To provide this information it is necessary to first identify manual steps. Therefore for each PBB it must be recorded if it is supported by ICT or if it is performed completely manually. This includes the capturing of communication channels for PBBs which receive or send information. As it is possible that incoming information can be received via different channels it this should also be recorded along with the percentage of distribution over the channels.

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- *Elimination of media breaks:* To provide this information it is necessary to identify media breaks. Media breaks represent the manual transfer of information from one medium into another one. Therefore media breaks are characterised by certain PBBs or sequences of PBBs. Examples for this are sequences like "Print" (out of one system) followed by "Capture/Enter" (into another system), "Receive" (e.g. via post or email) by "Capture/Enter" or just "Capture/Enter" if information is manually transferred from one information system into another system. As there may be other reasons for these sequences of PBBs it is also important to capture the involved ICT systems for each PBB and especially source and target for the PBB "Capture/Enter". Furthermore the *processed object* should be identified for each PBB to be able to identify if two PBBs operate on the same process object and therefore facilitate easier identification of media breaks.
- *Customer satisfaction:* To capture information about this it is useful to first identify the process steps in which the customer is involved in the process. Therefore PBBs which represent interaction with the customer should document this. Furthermore it is useful to identify the kind of customer (citizen, company or even organisational units of the Public Administration, other public administrations) when possible. Furthermore the role the customer fulfils should be recorded (e.g. sender, receiver). Further information like the number of customer complaints or the tasks which have to be performed by the customer can be recorded while modelling the processes
- *Risks/Errors:* To get information how much errors are occurring on average or how risky some decisions are, the PBBs can be equipped with appropriate attributes. Especially the risks should be annotated at the PBB for checking related to the content. If the values for these attributes are standardised it is possible to analyse the risks or the error rates.

2.3 Decentralised information collection / Technological requirements

As the name already implies, the Process Landscaping Methodology should be able to model the entire Process Landscape of a Public Administration as a whole. Furthermore the domain experts who have the knowledge about the processes should be able to model the processes they are concerned with by themselves. Therefore the Process Landscaping Methodology must allow for the modelling to be performed in a distributed, decentralised manner. This implies that the modelling is performed locally as well as temporally distributed. This results in specific requirements for the Process Landscaping Methodology.

2.3.1 Organisational requirements

Organisational requirements deal with the consequences of a decentralized modelling approach for the organisation of the modelling process, in other words: the procedure model of PICTURE. The following organisational requirements have been identified:

- *Decomposition of Processes:* Processes in Public Administrations often involve several domain experts from different organisational units. Each domain expert is only familiar with her part of the process (local view). Therefore the domain expert should only model the steps of work he has expertise in. To support this, the Process Landscaping Methodology should enable the decomposition of processes in smaller units (sub-processes, cf. e.g. [19]) which encapsulate the related work performed by a single domain expert. Following this way the domain experts are able to model their parts of the processes independently from each other. Furthermore the Process Landscaping Methodology must provide a mechanism to model the interdependences between the different sub-processes so that the whole process can be constructed from its parts (global view).

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- *Role concept:* The people involved in the capturing of the process landscape fulfil different roles. Domain experts who have the respective expert knowledge model the processes. Supervisors have to identify the processes which should be modelled and who should model them. Decision makers have to analyse the process models especially concerning their support through ICT. Administrators have to set up user accounts and fulfil other task related to the maintenance of the modelling tool. The Process Landscaping Methodology must provide each role with appropriate information for their respective tasks e.g. by presenting according views on the process models.
- *Modelling coordination:* As described above the knowledge about parts of a process is distributed throughout different organisational units of the public administration. To allow for efficient modelling the process landscaping methodology must provide mechanisms to coordinate the modelling activities. This includes the possibility for a supervisor to create modelling tasks for sub-processes and to assign them to the appropriate domain expert. Furthermore the supervisor should be able to follow the status of the modelling task. As a specific process may involve different organisational units and the supervisor might not have a complete overview about this the Process Landscaping Methodology must allow the modelling domain experts to document further modelling tasks which they encounter during the modelling (e.g. when sending a document to an organisational unit which does not yet have a modelling task for the process). Moreover the process landscaping methodology has to provide mechanisms to resolve conflicts between domain experts who model the same process (e.g. regarding the interfaces between the sub-processes). If a conflict cannot be resolved it has to be escalated to the responsible supervisor.
- *Quality Control:* The process landscaping methodology should contain mechanisms to assure the quality of the process models. Because only the domain experts have the expertise about the processes only they can assess their semantic correctness. Therefore the quality control by the methodology should focus on the syntactic level of the process models. This includes constraints for PBBs e.g., that certain PBBs cannot occur together or in a certain sequence. Additionally supervisors could specify specific properties for a (sub-)process along with the modelling task (e.g. by law as "to be archived") which have to be checked after the process models are created. The Process Landscaping Methodology should integrate the quality controls through guided modelling mechanisms whenever possible (e.g. by only showing the subset of PBBs which are allowed after a certain PBB) so that the creation of incorrect process models can be avoided beforehand.
- *Mechanisms to organise and retrieve processes:* As PICTURE aims at capturing the whole process landscape of a Public Administration a large number of processes will be modelled (at least several hundred or even about thousand). Therefore the Process Landscaping Methodology must provide mechanisms to find and retrieve the modelled processes in order to be useful for the Public Administration. This includes a search functionality to search names and descriptions of the processes for given search strings. Furthermore it should be possible to organise the processes according to different criteria. Examples are the organisational units which perform a certain process or part of a process as this can be captured during the modelling. Other possibilities are product catalogues or life events in which the processes are used by the citizens. Potential ways to realize the structuring of the processes are the classification of processes in hierarchies or the marking of the processes with tags.

2.3.2 Technological requirements

The technological requirements describe the consequences the decentralised modelling

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scenario has for an implementation of the Process Landscaping Methodology. The following technological requirements have been identified:

- *Support for parallel modelling:* As the modelling is performed at geographically distributed places and as several domain experts are involved in modelling a process the Process Landscaping Methodology must provide mechanisms to avoid inconsistent process models. Possibilities to achieve this could be to lock certain parts of a process model or to mark those models to indicate to the user that other persons are as well working on the process. These mechanisms should restrict the domain experts in their modelling activities as little as possible.
- *Easy accessibility:* The implementation of the process landscaping methodology has to be accessible from different workplaces throughout the public administration to allow for a decentralised modelling of the process landscape. Ideally each domain expert should be able to create his process models at his workplace so that he can integrate the modelling activities as easily as possible in his normal work routine. Therefore it must be possible to distribute the process modelling application to many different workplaces with as little effort as possible. This results in a need for a web-based implementation of the PICTURE Modelling Methodology as this is the easiest way to allow for hardware independent and distributed capturing of the process information.
- *Heterogeneous environment:* As the PICTURE implementation should be accessible at different workplaces as described above it has to be able to cope with different hardware and software environments. Therefore the implementation should be independent from a specific platform, server system, or operating system. Moreover experiences from expert interviews and modelling workshops have shown that Public Administrations in most cases do not use "cutting-edge" IT-systems. On that account the hardware requirements for the PICTURE implementation should be as small as possible to guarantee that the tool can be used throughout the public administration.

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3 Literature review

3.1 Characteristics of Public Administrations

Public administrations differ from the private sector in their structure, their spectrum of tasks and their set of objectives (cf. for example the results of the ICTE-PAN project, funded by the European Commission in 2002-2005 [21])¹. The subject *business process management* and consequently the sub areas of process recording, modelling, reengineering and continuous surveillance and analysis originally stem from the private sector and especially from the areas of industry and logistics. As opposed to public administrations these areas are underlying a market-oriented system, where participating companies have to differentiate. This results in companies that are positioned very variedly to gain competitive advantages. The heterogeneity is primarily shown by the conducted activities or processes and the basic principles of operations. The "classic" process modelling methodologies have to cope with this heterogeneity and therefore are not specialised to a certain types of enterprise, a certain area or specific companies. Thus they are "universal" process modelling methodologies.

In Public Administrations there are several conditions and challenges, which should be addressed by a special process modelling methodology. The specific conditions provide new opportunities, which allow for process modelling activities to be conducted faster, with fewer resources and in a higher quality. Modernisation projects and process modelling projects can realise their essential benefits only if both these aspects are considered. To identify how Public Administrations should perform their processes, we took the local ICT-guidelines like MoReq (EU), Domea (Germany), Gever (Switzerland), ELAK (Austria), PRO/TNA (UK), Protocollo Informatico / CNIPA (Italy), ReMANO (Netherlands) or NOARK-4 (Norway) into account, which are described in D2.2.

3.1.1 Challenges from public administrations to process modelling

- *Great number of products and administrative processes:* The great number and heterogeneity of offered products inevitably lead to a great number of underlying administrative processes. Therefore the process modelling technique should be particularly cost-effective, e.g. it should be possible to achieve the favoured project objective with as little effort as possible. This can for example be supported by a standardization of the used elements. It should also be kept in mind that only facts, which are relevant for the predefined project goals are included in the process model. The distribution of modelling activities is another possibility to speed up the modelling process.
- *Weak points and modernisation activities are all-over the organizations:* Administrative processes are structurally similar, independent from their individual functional orientation. Hence the weak points and therefore the possible modernisation activities often can be found in the non-functional elements. This is why they are all-over the organization.
- *Administrative processes often proceed across departments:* By needing statements, expertises and examinations from different functional areas administrative processes often involve several departments. This fragmentation of work also calls for an involvement of domain experts from the accordant departments in the modelling process. Furthermore the locally recorded processes should be modelled in a comparable way, so that overall analyses are possible.
- *The workflow of administrative processes is normally semi-structured [9]:* Administrative processes

¹ For more information about the ICTE-PAN project please visit: <http://www.eurodyn.com/ict-e-pan/>

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can rarely be described completely in a structured way with regard to their workflow. With a workflow we mean a predefined sequence of activities within an organisation. Certain administrative latitude of judgement exists depending on the task and each individual case. It follows that the exact control flows in process models are hard to describe. So the question comes up how much effort should be investigated to capture the control flow and what is the real benefit regarding to the impact measurement of capturing the control flow? Therefore we propose a more information-flow-driven approach. As Public Administrations mostly deal with information and not with physical goods the view on the information is much more useable for us as we can collect the needed information about the activities performed while following only the information-flow in a more efficient way.

3.1.2 Opportunities for process modelling in public administrations

- *Administrative processes consist of similar activities and documents:* Irrespective of their concrete functional orientation activities in administrations are geared to activities of office work. Hence it is possible to standardise the elements of the modelling technique with regards to content by predefined abstract activity descriptions.
- *Processes follow the rules of document management and task processing:* Administrative processes follow these two principles independently from the concrete task of generating a product. Because of this, bigger connections like sub processes can be standardised along with the activities. Generally this leads to an increased comparability of models and hence to better analysing opportunities.
- *Staff members have local domain and process knowledge:* The previously mentioned distribution of modelling activities is possible in administrations, because the local domain and process knowledge, which needs to be depicted in process models, is available in the particular departments. Therefore the active participation of staff members in modelling activities is feasible and necessary.
- *Product definitions exist and serve the purpose of process delimitation:* Administrative processes should be depicted in a way which clearly presents their contribution for achievement, i. e. their product, which creates a directly identifiable value for the customer (citizen, company or another official institution). Hence existing product catalogues can be refined for the purposes of process modelling and used to consistently delimit processes.

The discussed special challenges and opportunities represent only an excerpt and surely apply not exclusively to the area of public administrations. However, these considerations should be taken into account in the scope of a holistic process orientation, i. e. the examination of a great part of the process landscape and the interdependencies existing there. Especially the aspects of an extensive process landscape, the need for comparability of process models and the standardisation of elements and proceedings required for this purpose are vital for projects in public administrations.

3.2 The Guidelines of Modelling

Becker and Schütte developed the "Guidelines of Modelling" (GoM) in order to improve the quality of information models (cf. in the following e.g. [3, 4]). These guidelines are independent of certain modelling techniques, project goals or application areas. We want to introduce these guidelines for a common understanding of general needs regarding modelling languages.

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3.2.1 Description

The GoM convey a normative and customer oriented grasp of quality: "The quality of the model is the higher the smaller the difference between the requirements of the user addressed by the model and the power of the model for problem solving is." So the quality is measured by the overlay factor between modelling purpose and purpose fulfilment. To keep the discrepancy low, the Guidelines with the six principles shown in Figure 1 were developed. The principles are discussed in the following.

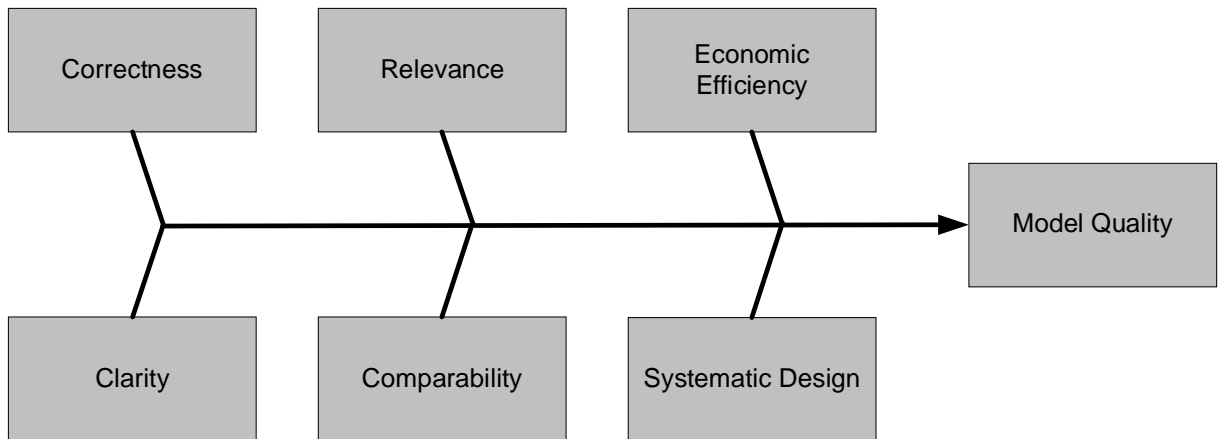


Figure 1: Framework of the Guidelines of Modelling [4]

- *Principle of correctness:* The principle of correctness consists of the two dimensions syntactic and semantic correctness. A model is considered syntactically correct, if it is built according to the rules of the underlying modelling technique. These rules determine which elements can be connected to each other under which circumstances. The semantic correctness refers to the degree of accordance between the created representation and the underlying original. Because of the nature of models that they are abstract figures from a part of the (real) world the representation does not have to fully match the original items. Nevertheless the elements included in the representation should have an adequate "complement" in the original. As the terms within the model freely can be chosen by the modeller, the semantic correctness can only be discussed in a discourse of all participants.
- *Principle of relevance:* This principle says that all the elements represented in the model should be relevant with regard to the modelling purpose. The model should not be overloaded with not needed information and thus represent more than is necessary for the later use of the model. It should be mentioned that a model should also not suppress relevant information, as the modelling purpose cannot be fulfilled in this case.
- *Principle of economic efficiency:* As the process of modelling causes costs, these costs need to be opposed to the utility of the construction of the models. The principle of relevance says, that the utility of modelling, e.g. the emerging qualitative, quantitative and monetary benefits achieved through the use of the models, should overcompensate the emerging costs of modelling. The measurability of this principle is problematic: neither the modelling costs, which are in large part personnel costs nor the utility of the modelling can be predicted in the run-up to the modelling. Nevertheless this principle needs to be considered, when decisions are discussed such as an increase of the modelling precision or quality management activities. The particular additional benefit and the resulting costs should be critically considered.

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- *Principle of clarity:* This principle comprises the clearness, readability, and comprehensibility of the models. This applies both to the modeller and to the model users. The clearness and readability of models aims primarily at an intuitive arrangement of the model elements and an adequate presentation of large models. As an example, similar model constituents should be represented in a similar way, and edges between elements should not overlap. Beside these layout aspects it is called for comprehensibility of the models. Thus the selected modelling technique with its rules and denotations should be understood by all participants. Also, domain experts are not likely to understand to formal models.
- *Principle of comparability:* Extensive projects using modelling methodologies need a large number of information models, which are constructed by different persons. To complete the entire task these models have to be considered in an integrated way as well as related with regard to their content. It is a problem if different application procedures are used. Models should be comparable in such terms so that similarities and differences can be recognised and statements can be made regarding the “degree of congruence”. As far as similarities and differences are recognised in models it should be possible to trace them back to similarities and differences within the original, instead of varying representation manners of the modellers. According to this, there should be actual differences of the object of modelling and not merely differences in the models.
- *Principle of systematic design:* The complexity of the investigated areas often calls for specific modelling views. A dimension of a problem denotes a homogenous approach to the subject, which focuses on exactly one aspect and consciously disregards others. Within the scope of information modelling projects usually the dimensions of data, functions, organisation and processes are used. The systematic construction of the entire model requires an integrated consideration of these different dimensions. Thus it is necessary to be able to establish relationships between the separate dimensions through clearly defined interfaces in order to avoid duplications of work and inconsistencies.

3.2.2 Activities to implement the GoM

The presented principles are goals which have to be realised during modelling through adequate measures and conventions. These can be conducted on levels of different concreteness. The following levels of measures, which are performed outside of the selected modelling technique, can be distinguished:

- Measures which are independent of concrete project goals and modelling languages, like communication rules as well as generic procedure models and guidance.
- Measures which can be used for specific modelling techniques only; e.g. the determination of modelling conventions to consort the use of the modelling technique.
- Measures conducted in connection with concrete project goals and selected modelling techniques, as well as a fixed software support, for example the determination of layout conventions and filing rules for the constructed models.
- Beside these “external” measures the models can be fitted to the requirements of the GoM by an accordant standardisation of the modelling technique. The PICTURE Process Landscaping Methodology should include certain mechanisms within its procedure model and its elements, which should enable the creation of models of higher value.

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3.3 Deficits of generic modelling techniques

Single process analyses, which are conducted in a very detailed way without a specific purpose, can be good accomplished with the aid of generic modelling techniques. Modernisation projects, which follow the Process Landscaping idea, should consider the following properties, which can constrain the benefits of process modelling, when using these methods

- *High degrees of freedom:* There are high degrees of freedom when depicting workflows, i. e. the same issue can be depicted in the model in very different ways. This problem is primarily caused by the fact, that the elements of universal methods are very abstract and thus can be applied for a wide variety of purposes like e. g. "functions" and "events". The modeller is completely free regarding the definition of the contents, the usage and the naming of the elements. The application of the highly flexible elements for designing the control flow also has high degrees of freedom.
- *Inconsistent level of detail:* Most methods allow a refinement (vertical breakdown) of elements, which describe activities, like for example the function refinement of the EPC [20] and the sub-processes of the BPMN [13, 18]. But there is no fixed description level a modeller could refer to. This leads to models, which contain elements of different level of detail on the same process level, or to models, in which certain elements are refined in a very detailed way, whilst others are kept very abstract. The determination of the level of detail is conducted individually by every participating modeller.
- *Absent delimitation of the modelling object:* The subject matter of the "process" is not delineated adequately in most cases. For example, there are no specifications concerning the idea of "process" or "sub-process" or regarding the question, which elements should be included or excluded. The process delimitation (horizontal breakdown) is incumbent on the particular modeller.
- *Absent comparability:* Both the various possibilities for an individual design of the vertical and horizontal breakdown and the high degrees of freedom in using and naming elements lead to a reduced comparability of the resulting process models. Hence the observed weak points and potential solutions cannot be transferred to other process models and processes. Analyses and reengineering activities therefore are "local" and cannot be interpreted in the content of the bigger picture. This contradicts the holistic modernisation principle of process design.
- *No technical terms from the administration:* On the one hand universal methods are considered "simple", as they only offer few abstract elements, e. g. functions. On the other hand because of this they lack a functional relation to the domain of application, like for example the administration. Technical terms are not included in the models until the modelling process itself and are determined individually by the modellers through the names of the elements. This missing standardisation can complicate the interpretation of the models due to an inconsistent naming of elements.
- *Strongly concentrated on the control flow:* Specially highlighted strong points of universal methods are their rich and flexible possibilities to depict the control flow (the operational logic). For this purpose there often are "logical connectors", which can be combined among themselves. Providing the potential to depict complex workflows can lead to a situation, where details of operational or decision situations are depicted, which are not relevant for later analyses. Hence a "healthy relation" between the large efforts to depict complex operational rules and the value of this depiction can hardly be realised in most cases.

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3.4 Deducted requirements

Based on the special challenges of Public Administrations and of the weaknesses of generic Modelling Methodologies we conducted several requirements for the PICTURE Process Landscaping Methodology. Additionally we performed a literature review to support the discussion from a scientific view. There are two core requirements (1 and 2) which are split up in detail in the following discussion:

1. The PICTURE Methodology allows for a more efficient representation of the public administration domain than established approaches.
 2. The PICTURE Methodology achieves transparency of a process landscape and can be used to measure reorganization potential with a similar or better outcome than established approaches.
- *The semantics of the modelling language constructs have to be easily comprehensible for a domain expert:* In order to be able to apply a certain modelling language it is necessary to understand all constructs the language comprises. To be unaware of the meaning of a construct makes it hard to identify its counterpart in the real world. Thus, for a domain expert it is not possible to describe processes by means of a modelling language without understanding its semantics. He knows the processes but would require training in describing them adequately. Therefore, modelling experts are employed to capture the processes. However, these modelling experts are mostly not familiar with the processes of an organization. Therefore, a modelling language with a very simple semantics may enable a domain expert to apply the modelling language on his or her own. As both consulting and training causes additional costs this would increase modelling efficiency.
 - *The syntax of the modelling language must be easy to grasp for a domain expert:* Knowing which modelling language constructs to pick in a certain situation does not mean to know of how to combine them. Therefore syntactical rules of the language must also be as simple as possible to enable domain experts to model their processes on their own. In order to achieve this requirement, the modelling language should exhibit a minimal set of constructs [14]. Not required constructs unnecessarily increase the complexity of the language. Furthermore, possible options of connection constructs should be limited to a minimum as they also extend complexity. A less complex modelling language is easier to learn and thus allows for more efficient modelling.
 - *The modelling method allows for the creation of maintainable process models:* Especially for usage scenarios within administrations, such as a model-based knowledge-management, maintenance of information technology, or continuous improvement of the business processes, actual models of the processes are important. To make sure that the process models are always up to date, the maintenance of the models has to be achievable with minimal efforts. As the modelling of processes is not the main business of officials in a public administration the models should be less complex and easy to grasp.
 - *The modelling language can be aligned goal oriented:* The more details are collected the more effort is necessary to gather all these information. Therefore, it is not efficient to collect all information a modelling language is able to acquire. In fact, the goals of a project shall rather determine the required section of the information space. Thus, a modelling language should provide a mechanism to be aligned to the goals of a project. If the modelling language only permits the enquiry of relevant information, the modelling process becomes more efficient.
 - *The modelling method facilitates capturing the entire process landscape:* A detailed analysis of a single

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process allows for identification of weaknesses that are specific to a particular process. For example it is possible to reveal that a couple of activities in a process are unnecessary in order to fulfil its objective or a change of order would increase the efficiency. Experiences from reorganization projects in the public sector domain [1] show however, that in order to disclose reorganization potentials, it is important to capture more than a single process. Collecting only a few detailed process models does not allow for getting transparency over the entire set of processes. To achieve transparency in this context means having an overall perspective on the processes. Assuming that public administrations conduct more than 1,000 different services, from an efficiency perspective transparency cannot mean to perform an in depth analysis of all these processes but rather to reach a general overview. If multiple processes are acquired it is feasible to get a snapshot of the organization and the interactions between the processes. Patterns which affect the entire process landscape can be identified and analyzed. Therefore, to capture the complete set of processes in a coarse granular way fosters identification of reorganization potential.

- *The resulting models are syntactically and semantically comparable:* A reason why employees cannot improve their processes on their own is that not all of them have detailed knowledge about other employees' processes. Therefore, it is not sufficient to analyze the process models of an organization independently from each other. Rather, it is essential to identify similar or deviating structures in process models [7]. Thus, the models must be syntactically and semantically comparable. However, if two models are compared, type conflicts, naming conflicts and structural conflicts can arise [2, 10, 16]. Type conflicts occur whenever the same fact of an application domain is represented by using different constructs of a modelling language. Naming conflicts emerge due to the use of synonym and homonym terms in conceptual models. Structural conflicts result from description of reality at diverse levels of abstraction (abstraction conflict) or whenever domain terms are modelled differently detailed (conflict of detail) [7]. Therefore, in order to identify common patterns and weaknesses which occur in multiple processes it is necessary to address these conflicts to make the models syntactically and semantically comparable. The comparison of processes facilitates an identification of reorganization potential by enabling an analysis of the entire process landscape. The modelling method itself should ensure that the same issue in two different cases and considered from two different persons is modelled the same way [4]
- *The method contains information about reorganization potentials which can be mapped on process models:* In order to identify reorganization potential it is not sufficient to analyze a current state of the acquired processes. It is rather necessary to know what reorganization measures do affect these processes and to what extent. Therefore, a connection must be made between process patterns (WP4) and inefficiency patterns (WP3). Reorganization potential can then be estimated based on a summation of expected savings through newly introduced ICT addressing certain weaknesses in the process landscape.
- *The modelling method allows for efficient modelling:* The collection of the process landscape of an administration requires not only a large modelling team but also the inclusion of many domain experts. Therefore, the modelling method has to create as little efforts as possible while gathering the process models within the public administration.

Based on the requirements, different characteristics can be derived which meet these conditions. However, we found the following bundle of characteristics which have to be fulfilled by the PICTURE-approach:

- *The modelling language is domain-specific:* A modelling language can be considered as domain

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specific if it contains constructs that stem from the vocabulary of a particular domain [6, 11, 17]. There is a need for elements enriched with domain semantics. Words like “letter” or “invoice” are easier to understand as they have a physical or notional counterpart in this domain. Therefore, the modelling language should apply the domain vocabulary to define its constructs. Terms which are not common in the domain should not be included in the modelling language. In order to avoid confusing the domain expert, modelling language constructs must be semantically distinct from each other [5]. Distinct constructs simplify the selection of an appropriate modelling language construct and thus, make an application of the language less difficult. As a consequence, every modelling construct should be intuitively understandable for a domain expert because all of them stand for well known concepts.

- The modelling language is based on process building blocks:* Process building blocks are generic, coarse-granular activities that can be augmented by attributes which are relevant for an automatic analysis of the model. They constitute a particular class of modelling language constructs. The actual set of PBB can be found in Deliverable 1.7. Attributes can be optional or required. An optional attribute of a process building block is a label. The labelling is per definition not relevant for the semantics of a model and hence, need not to be included in the analysis. Relating to other attributes like “channel” as Sub-Attribute of “paper-based” which is an attribute of the Process Building Block “Receive”, attributes can be declared as required or not required depending on different goals for a modelling project. By configuring the set of attributes of a building block, the method allows for goal oriented modelling. As natural language statements in form of labels do not contribute a significant part to the semantics of a process model, naming conflicts can be completely avoided. Usage of homonyms and synonym as names of model elements is no longer relevant. Distinction between optional and required attributes reduces conflicts of detail, as required attributes must be specified in all instances of a process building block. This results in easily comparable models. If a domain expert can make a clear distinction between two terms of the domain vocabulary he is also able to distinguish the corresponding modelling language constructs. Consequently, a mix-up of constructs is avoided. Process building blocks are the main sort of constructs that the modelling language comprises. This keeps the syntax of the language simple and fosters its acceptance by domain experts. As the modelling constructs are easy to grasp for domain experts, modelling effort is reduced because the time needed for understanding is reduced. The building blocks combine several activities of the domain. This leads to shorter process models and allows for a faster modelling compared to existing approaches and facilitates capturing of a whole process landscape.
- The modelling language contains only constructs for sequential modelling within the core modelling area:* Even if process building blocks tackle most of the problems which arise during a model comparison, some structural conflicts remain. If a business process contains alternative paths then there are different possibilities to represent them. Activities which occur in both paths could be modelled separately in each of the paths. Instead, the paths could also be temporarily merged and only one common activity is specified. In order to avoid such problems the language should stipulate a strictly sequential order of the modelling language constructs. Hence, alternative paths in sub-processes are impossible. If junctions in a sub-process model cannot be avoided two paths can be represented as two different versions of the original model. This keeps the syntax of the language simple and thus, eases the modelling process. Also readability for the domain expert increases as the sequential sub-process models are easier to understand because they are less complex.
- The whole method provides a separated modelling part and a measurement part:* The properties of the modelling part of the method are described by the characteristics. To measure

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reorganization potential of the process landscape and to create transparency in this way, the method has to contain predefined, schema-based reports which are mapped on process building blocks and their attributes [8]. An example for such a report might be a listing of all processes with organizational breaks. The processes can be sorted by the number of organizational breaks or grouped by their affiliation with organizational units. Other reports may refer to changes of a medium and refer to attributes like "Number of pages". For substantiated conclusions reports have to include as much information as possible. This aim can be achieved by exploring the whole process landscape. To measure reorganization potential, the syntax and the semantics of this constructs must be comparable. Otherwise the results are not reliable. This reporting mechanism helps decision makers in public administrations to get a quick overview over weaknesses in the whole process landscape.

- *The modelling method allows for the construction of (semi-)automatically analysable of process models:* An examination of a single process facilitates the identification of weaknesses that are specific to this particular process. However, in order to discover the overall reorganisation potential it is not sufficient to analyse only the current state of a single process, but an examination of the process landscape is required. Analysing the whole process landscape of a public administration means working with a large set of data. Therefore, it is necessary to provide mechanisms within the method which allow for automatic or semiautomatic analysis of the data. Analyses of process models are made for measuring weaknesses as well as reorganisation potential. An example is the identification of so called „Ping-Pong“-processes. By counting the alternations between organisational units within the models these weaknesses can be identified, even in an automatic way.

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4 Analysis of expert interviews

4.1 Proceeding and Goals of expert interviews

In order to identify requirements respectively gain feed back concerning layout, symbols, visualization and terminology to be used in the process landscaping methodology a questionnaire was prepared which should be used as a complement for process modelling workshops with domain experts. The questionnaire consists of four different sections which target the different areas:

Section I deals with terminology. The goal of this section is to identify which terminology the experts use in their domain to describe processes and related concepts. It should also be evaluated what they understand under the term "process". Furthermore we are interested in information about views on a process the experts are interested in. A number of guiding questions were provided to guide the expert interviews and modelling sessions. To retrieve as much information as possible the people who conducted the workshops were advised to keep the questions as open ended as possible. The following guiding questions were provided for this section:

- Are experts familiar with the term/concept "process"?
- What is their understanding of the concept "process" (in terms of scope and limits of the process)?
- What other terms are they using?
- How would they structure/divide a process, which criteria would they use (time, person/organisational unit in charge...)?
- Which aspects of/information about/views on a process are the experts interested in (involved organisational units/employees, IT-systems/documents/other resources, performed working steps)?
- If the process landscape of a Public Administration is captured (which is likely to have a few hundred or even thousand processes) which are the criteria the experts would like the processes to be organised by (to find them easily)? (e.g. product catalogue, organisational structure, life events like birth of child, marriage)
- Are there already things like product catalogues or categories of life events to structure and organise processes? Which criteria are used in them?

Section II is concerned with the representation of process building blocks. The goal of this section is to check the visualisation of PBBs in general and especially the symbols of the PBBs. The symbols which should be evaluated are shown in Table 1. Three different methods were proposed to check the symbols of the PBBs:

1. Show the symbols to experts and ask them what they think what the symbols mean.
2. Let the experts assign the symbols to the PBBs.
3. Let the experts model processes with provided shapes which include the symbols.






































Receive		Print		Coordinate	
Send / Give		Scan		Consult (external)	
Retrieve / Gather / Enquire		Copy		Discuss (internal)	
Capture / Enter		Pay		Examine / Analyze	
Produce / Create / Generate		Encash		Calculate	
Certify / Legalize		Check / Verify		Cancel	
Assign		Decide		Invalidate	
Take from		Take notice / To be informed		Forward / Delegate	
Registrate		Sign		Reserve / Book	
Start / Open		Archive		Reconfirm / To Follow Up	
Change / Update		Dispose		Publish	
Close		Wait until		Document	
		Onsite Visit			

Figure 2: Symbols for PBB

Furthermore, a number of guiding questions were provided to gather further information:

- Are the symbols suitable for the PBBs?
- Which symbols are always assigned to the same PBBs, which are assigned to different PBBs?
- Are there symbols which are too similar?
- If symbols are mixed up, do experts see a difference between the corresponding PBBs and what is this difference?
- Do symbols help the experts to pick the right PBB faster?
- Is the proposed overall layout of the PBBs okay (symbol on the left, name and description in the middle, further attributes on the right)?

Additionally some questions were provided to identify possible constraints for the usage of process building blocks:

- Are there sequences of process building blocks which occur often?
- Do experts think that a PBB can only be followed by a certain subset of PBBs from the complete list?

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- Are there PBBs which have to be used if another PBB was used before?

The main objective of Section III is to get user feedback for the visualisation of alternative process flows. As discussed in chapter 2 we propose a strict sequential modelling approach regarding the pure modelling view on the process parts (sub-processes). Only in the overall view on the processes there should be branches or parallel process flows. Therefore it should be checked if a domain expert is able to understand the different visualisations of process flows in the different views. The domain experts should give positive as well as negative feedback for each visualisation. Therefore the colleagues conducting the workshops were advised to vary the order in which the visualisations are presented. In case of any problem in understanding the different visualisations, the domain experts should try to describe the cause of the problem and try to give an advice how it could be solved.

Three different visualisations of the same example process were provided. The first visualisation makes use of branches with connectors similar to universal process modelling techniques like EPC or BPMN. The process flow is modelled using constructs like exclusive OR to show alternative process branches and arrows to show the flow of PBBs. This is the most detailed and complex visualisation (cf. Figure 2).

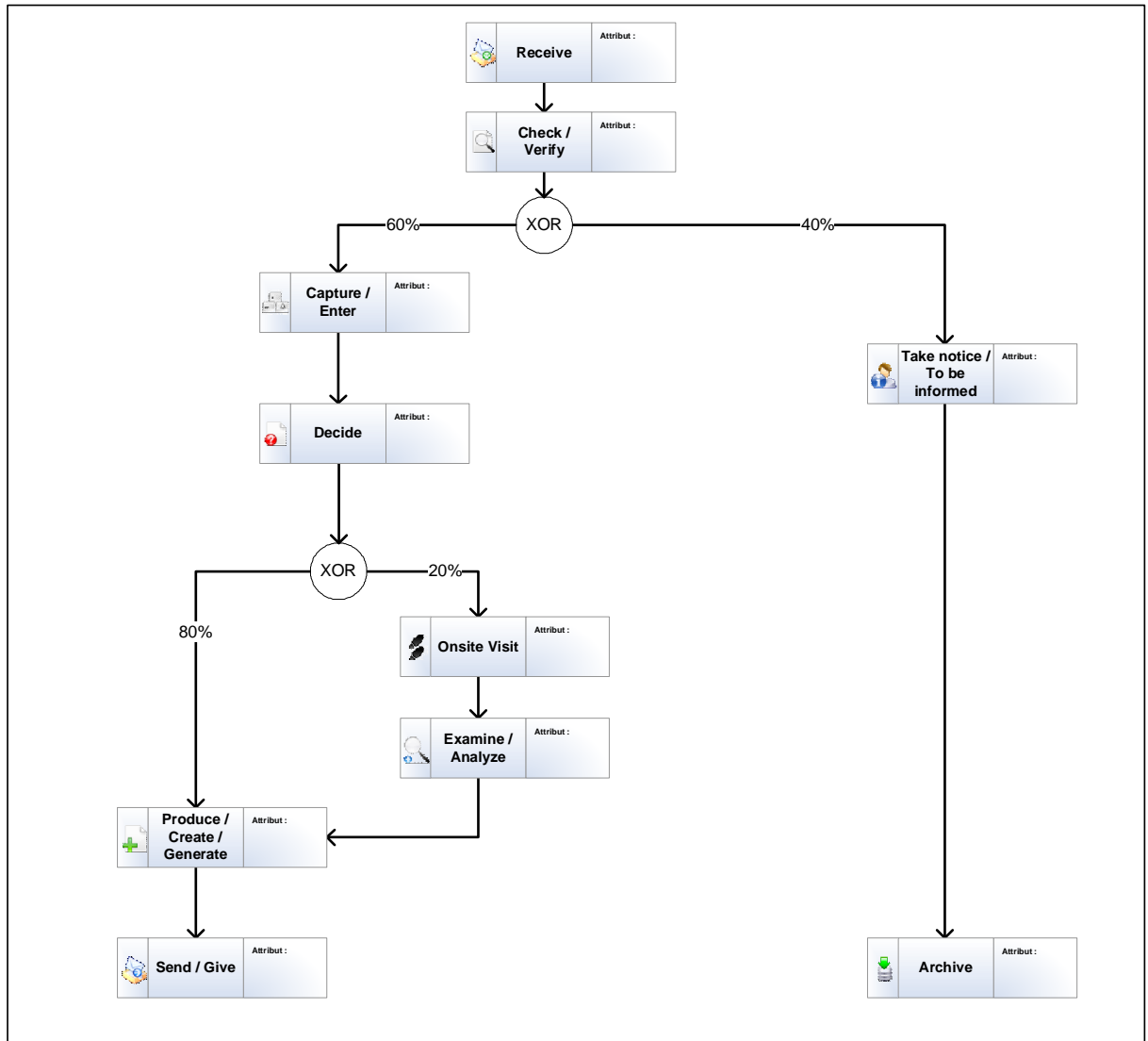


Figure 3: Visualisation with detailed branching

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The second visualisation reduces the complexity by dividing the process into two different variants. The left variant represents the long part of the process flow and the right part the short part of the process flow. PBBs that are performed before the branch are used in both variants. Small branches after PBBs which force additional or different activities like "Decision" or "Check" are modelled within the variant (cf. Figure 3).

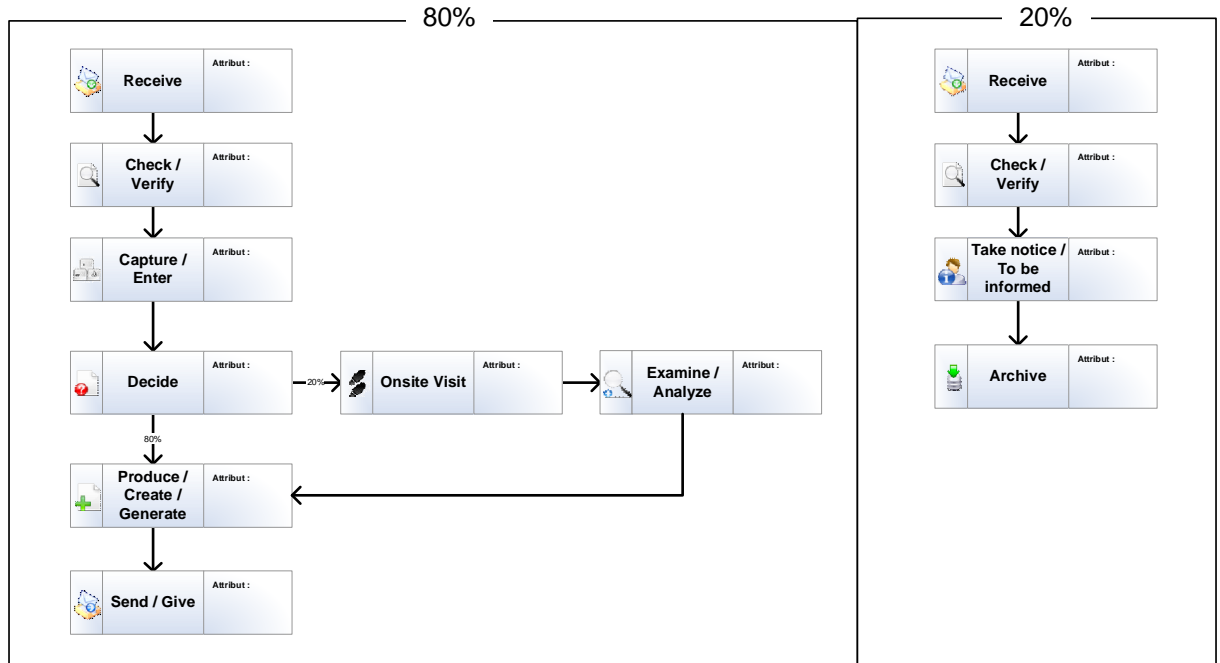


Figure 4: Visualisation using variants and small branches

The third visualisation abstracts from small Branches within a variant and shows the way we imagine the pure modelling view. Different activities after a specific Process Building Blocks like "Decision" or "Check" are not modelled. If the varieties in flow of activities are important a new variant has to be created (cf. Figure 4).

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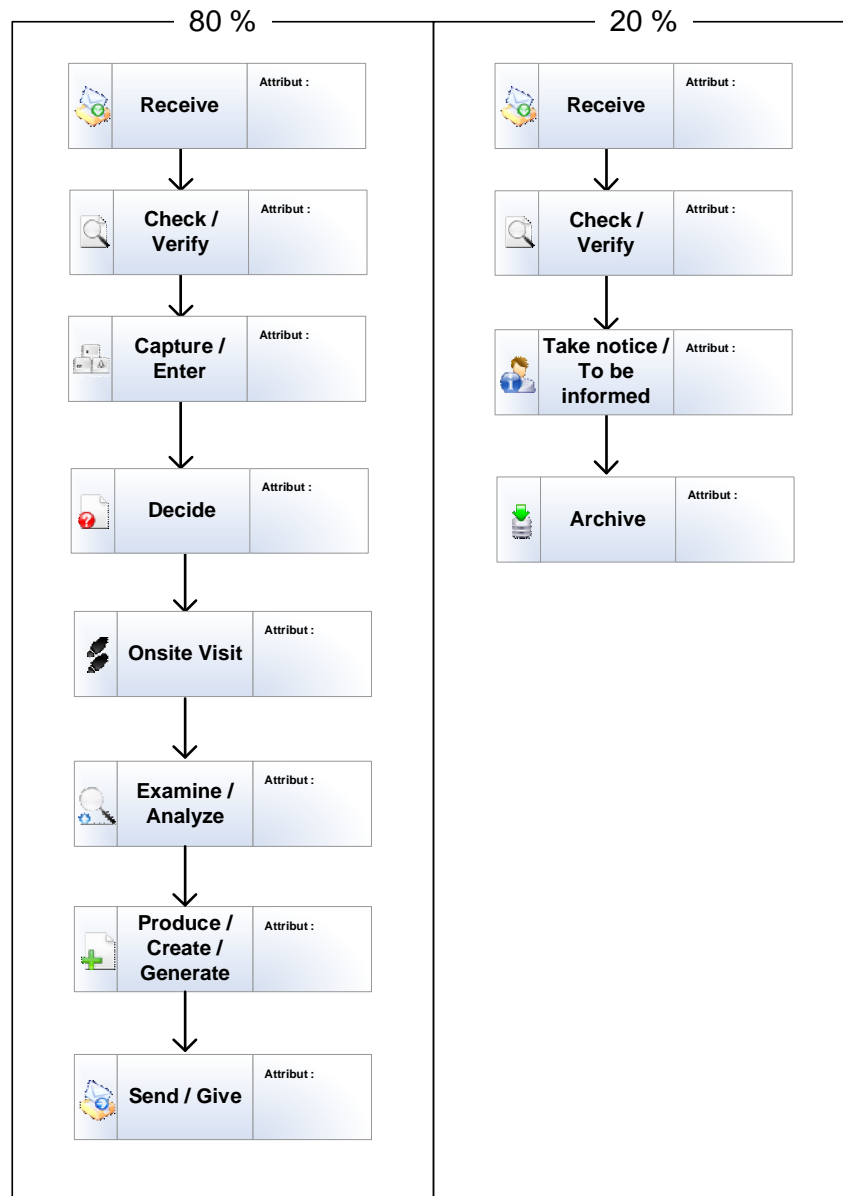


Figure 5: Visualisation using only variants

Some guiding questions were provided to lead the interviews with the domain experts.

- Are domain experts able to understand the visualisations (e. g. process flow, frequency of process runs) and is the process clearly represented?
- Which visualisation do domain experts prefer and what are the positive and negative aspects of each visualisation?
- What should be changed to make each visualisation easier to understand?
- Are the constructs expressive enough to achieve the main goal of the process flow or is any necessary information missing?
- How relevant are small process branches in the modelling view for public administrations?
- Are small Branches only necessary after specific PBBs?

In Section IV different possibilities of sub-process visualisation is researched. The main

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aspect is to find the right abstraction level for the visualisation and find the appropriate visualisation for process structures. Therefore the different visualisation should be used. The domain expert should be able to understand the process structure and to express the interaction of sub-processes. In case of any problem in understanding the domain expert should describe the cause of the problem and try to give an advice how it could be solved.

Three different visualisations with different levels of detail were provided. The first shows sub-process as well as variants and PBBs (Figure 5). The second only shows different variants within the sub-processes (Figure 6). Finally the third visualisation shows only sub-processes and their interactions (Figure 7).

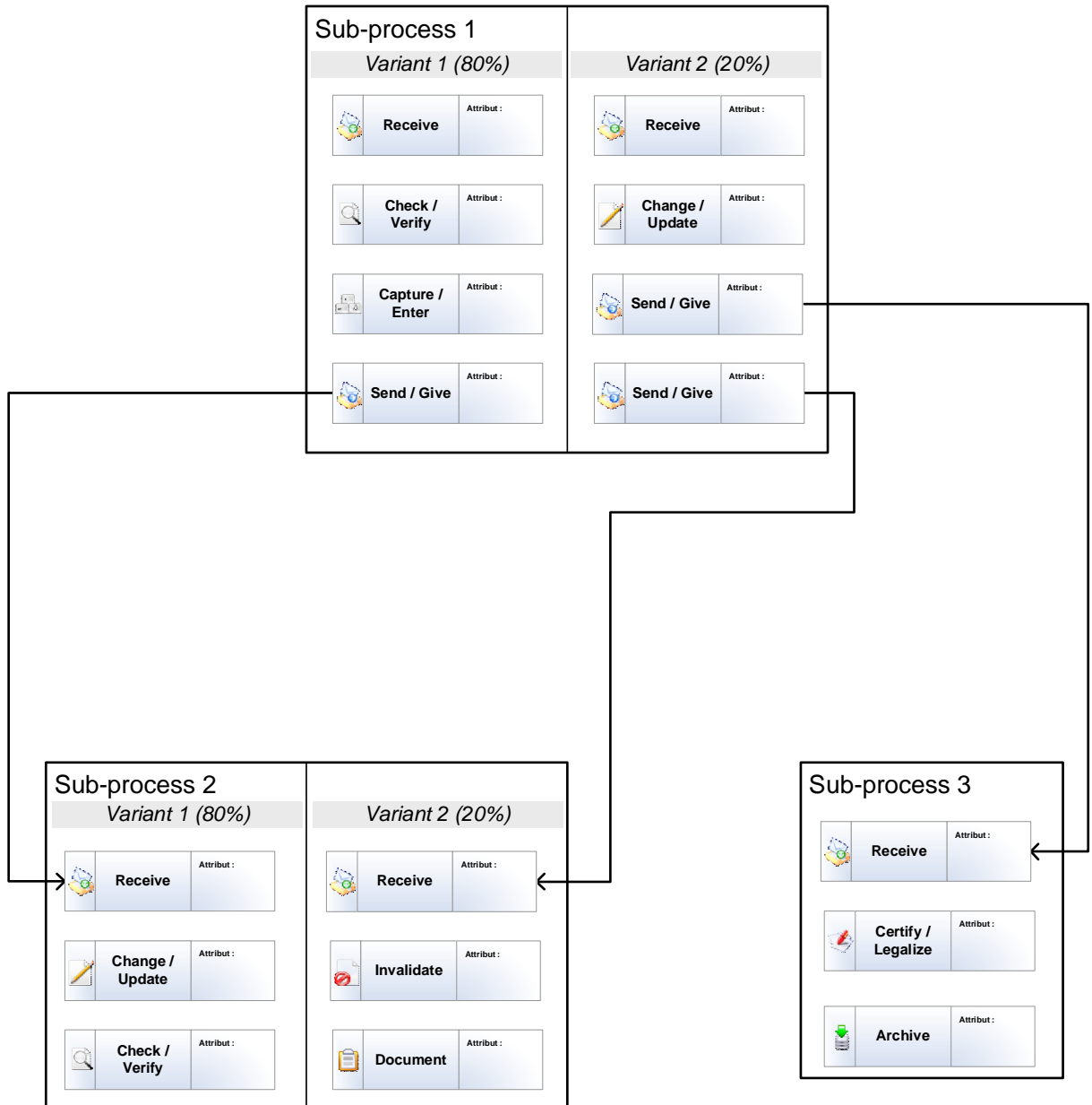


Figure 6: Process visualisation using sub-processes, variants and PBBs

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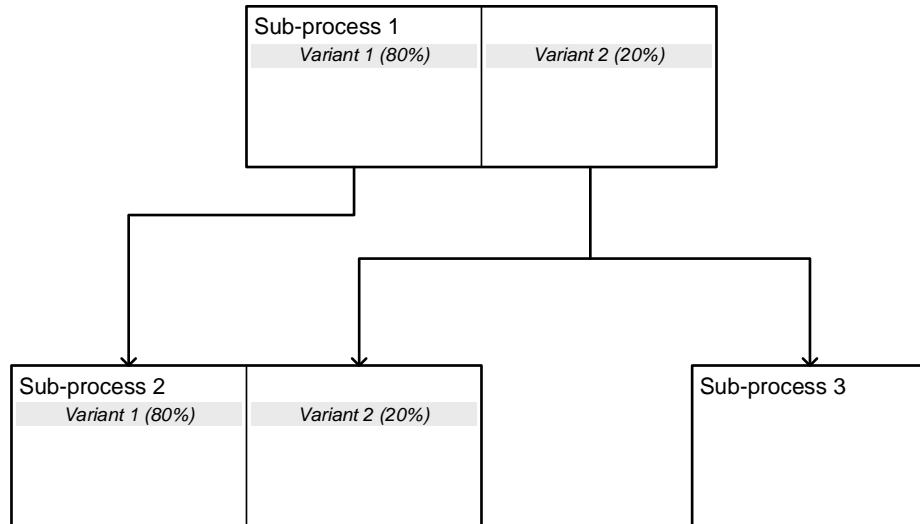


Figure 7: Process visualisation using sub-processes and variants

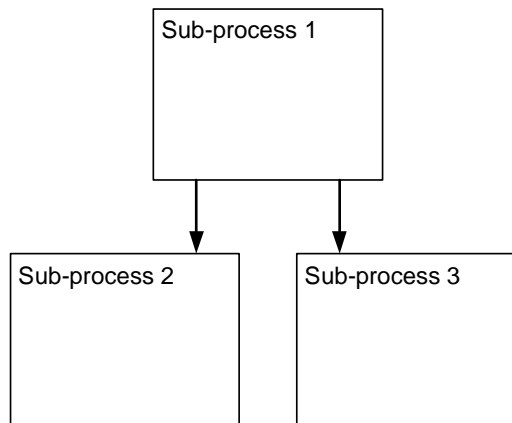


Figure 8: Process visualisation using only sub-processes

Additionally some guiding questions were provided to lead the interview:

- Is the language construct “sub-process” easy to understand and is the given information exhaustive?
- Which visualisation do domain experts prefer and what are the positive and negative aspects of each visualisation?
- Which abstraction level and which information is needed to get a process overview?

4.2 Questionnaire Results

The questionnaires were used in Workshops with the partners CoL and CoM as well as with the City of Osnabrück, City of Essen and City of Reede (all Germany). The inclusion of the last three public administrations allows verifying if the developed constructs are also understandable to members of public administrations which were not familiar with the PICTURE approach due to previous work shops. The detailed results from the workshops can be found in Appendix A. The following summarises the results of those workshops.

Section I: Terminology

In most of interviewed Public Administrations there is a rough understanding of a process as

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some kind of work flow. But there are problems when defining exactly the limits of one process in contrast to other processes. Mostly only the own organisational unit is taken into account when defining a process.

Another aspect was that members of CoL had a totally different understanding of the term “process” (or its polish translation) than the interviewed German Public Administrations. For them the term process means the same as “instruction” or “task”.

From these results the following requirements were deducted for the Process Landscaping Methodology:

- *Support for identification of processes:* The Process Landscaping Methodology must support the domain experts in identifying what belongs to a process, especially for processes across different organisational units.
- *Careful localisation:* It must be guaranteed that all localisations of the Process Landscaping Methodology confer the same meaning to the respective domain experts. This can be achieved by exactly defining the meanings of the used terms and by using these definitions as starting point to find an adequate translation into the different languages.

Section II: Symbols

Assessment of the proposed symbols:



















Process Building Block I	Symbol I	Symbol II	Process Building Block II
Sign			Certify
Assign			Take From
Check/Verify			Examine / Analyse
Pay			Encash
Send/Give			Receive
Consult			Coordinate
Discuss			
Change/Update			Register
Document			

Table 1: Symbols which are too similar to each other

From these results the following requirements were deducted for the Process Landscaping Methodology:

- Symbols depicting persons were found to be too similar to each other → We have to refine it.
- It was found that the symbols for “Pay” and “Encash” point in the wrong direction and that the symbols should therefore be swapped. → We have to think about it.

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Process Building Block	Symbol
Produce/Create/Generate	
Capture/Enter	
Take Notice/To be informed	
Retrieve/Gather/Enquire	
Close (green check implies approval)	
Decide (Question mark irritating)	
Sign	
Certify	
Examine / Analyse (Plus sign implies zooming in)	

Table 2: Symbols which were found inadequate or incomprehensible

Furthermore the following recommendations were given to improve the symbols:

- *Copy:* Two Documents with identical content
- *Wait Until:* – Hour Glass
- *Sign:* Signature at bottom of a page
- *Certify:* A seal or a stamp
- *Archive:* folder or filing cabinet
- *Decide:* Check instead of Question mark

Section III: Visualisation of alternative process flows

The result which visualisation for alternative process flows was preferred varied strongly. Some public administration preferred the first opportunity especially if they had experience with EPC, as it was found to offer the greatest amount of detail especially for modelling experts. Other found this visualisation to complex and therefore not suitable for domain experts not familiar with modelling.

Vice versa the second and third suggestions were found to oversimplify the process by some public administrations. They argued that the complexity of the process is not reflected in those models mainly because forks after decisions are not displayed. Others found those suggestions easy to understand particularly for those domain experts with no or few experience with process modelling. Some feared that identical PBBs in different variants have to be modelled twice and thereby cause too much modelling effort.

Furthermore a target view which shows the process after the introduction of ICT was suggested. In any case the modelling effort should be kept as small as possible and no process step should be modelled twice.

From these results the following requirements were deduced for the Process Landscaping

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Methodology:

- We have to think about the actual proposal for the visualisation of alternative process flows.
- The point where a process splits into alternative process flows should be easy to recognise while the process model should still be understandable and not too complex.
- Redundancies in the process models should be avoided.

This could be achieved by dividing a sub-process into different sections. Sections that are common to all variants are just modelled sequentially as suggested before. For the sections that differ, multiple parallel sequences could be used, one for each variant. Different colours could be used to mark the different sections and to therefore facilitate an easier understanding.

Section IV: Visualisation of Sub-Processes

Similar to Section III no visualisation was preferred to the others by all Public Administrations. It was found that the varying levels of detail in the different visualisations can be useful in different situations. The third visualisation allows a quick overview over the process whereas the first one is suitable for a more detailed analysis. One public administration also proposed the introduction of swim lanes to visualise which sub-process is executed by which organisational unit.

From these results the following requirements were deducted for the Process Landscaping Methodology:

- Different levels of details to visualise the relationships between sub-processes should be included.
- A mechanism should be implemented which starts with the third visualisation and gradually presents more details to users by providing the possibility to “expand” the sub-process to the levels of detail presented in the first and second visualisation.

The questionnaires filled while interviewing the Public Administrations are provided in the annex.

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5 Conclusions and future work

This document contains the requirements the PICTURE Process Landscaping Methodology has to meet from a scientific and user-oriented perspective.

The results of the former work packages lead us to the conclusions, that existing modelling languages have several weaknesses which distract us from adopting these approaches. In general all these notations have the disadvantage of generality and unfixed level of detail. The demands we make for PICTURE follow up to the Process Building Blocks to determine the level of abstractions and in the same manner follow up to a domain-specific approach with as less modelling constructs beside the PBB as possible. Furthermore we claim for a hardware and software (operating system, browser technology etc) independent implementation which easily can be distributed all over the organisation.

The analysis of the former work packages and the results of literature review influenced the design of the questionnaire presented in chapter 4 with several alternatives of how to *model* and how to *present* the process models with PICTURE. We arranged several interviews and evaluated or proposal with different results.

The main work to do in work package 4 is to develop the Process Landscaping Methodology based on the requirements and the results of the questionnaire. We have to refine the requirements and have to match them with our proposed modelling elements. In several evaluation steps – in combination with WP5, the development of the PICTURE-tool – we have to find out how we can fit especially the user-requirements in the best way to build a really user-oriented Modelling Methodology.

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6 Literature

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7 Annex

7.1 Questionnaire Results CoL

At 27.04.2007 ZIE with cooperation with COL have organized a workshop, which main goals were to:

- Familiarize representatives of PA with used in PBB terminology
- Evaluate the understanding of used terminology
- Evaluate the understanding of used methods of visualization of Process Flows
- Evaluate the visualization of PBB

Workshop participants:

- ZIE
- COL
- Experts from PA
- Students from University of Lodz

Section I – terminology and visualization of Process Flows

I Terminology

During the workshop was taken a discussion about understanding of used terminology. The main problems and misunderstandings were with the “process” and the “process flow” definitions. These terms were used by representatives of PA in convertible way.

Experts meant by “process” something similar to:

- “instruction”
- “a task to do”

Term “Process Flow” was described as:

- “a set of instructions”
- “algorithm”

There were also problems with understanding of term “sub-process”. Experts haven’t seen the difference between that term and the term “process”.

II Visualization of Process Flows

In case of visualization of Process Flows, listening to experts opinions, we came to following:

- Visualization with branches
 - Too difficult
 - Problems with understanding the “exclusive or” (XOR) operand
 - It’s easy to lost control over diagram
- Visualization with variants and small branches
 - Clear and easy to read
 - Intuitive
 - Easy to work in groups
- Visualization only with variants
 - Easiest
 - Definitely too much labor consuming

In opinion of experts, the best was visualization with variants and small branches.

Section II – Visualization of PBB’s

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I. Objectives and Methods of Evaluation.

The main objective of evaluation activities was to check the visualization of PBBs in general and proposed symbols of PBBs.

Evaluation consisted of two kinds of activities:

- Questionnaire was submitted to thirty representative COL's officials (the first group of persons involved in the evaluation process). Questionnaire included proposed symbols and several kinds of questions connected with symbols. First of all officials were asked to define what do the showed symbols mean. They were also asked to couple the symbols and definitions of PBBs.
- During the PICTURE Workshop ZIE and COL's experts and students (second group of persons involved in evaluation process) were asked to model Public Procurement Process with provided PBBs symbols and after that they were asked following questions:
 - Are the symbols suitable for the PBBs?
 - Are there symbols which are too similar and mixed up?
 - Do You see the differences between mixed up symbols?
 - Do You think that the symbols will help to pick up the right PBB faster?
 - Is it PBBs layout correct?
 - What are Your experiences, findings and suggestions after the modeling ?

II. Questionnaire figures.

Analysis of the first part of questionnaires (section connected with PBBs definition) shows that there are two categories of PBBs symbols:

- There are symbols which are definitely suitable, and the 100% of respondents haven't got any problem to define them e.g.: Print, Scan, Publish, Calculate, Forward, Delegate, Onsite visit, Wait until and Pay.
- There are symbols which are inadequate to the real PBBs definition. 100% of respondents didn't know what the "Capture/Enter", "Reconfirm" "Archive" and "Sign" symbols mean.

Analysis of second section of questionnaire (couples the symbols and definitions) shows that some symbols are too similar to each other e.g.:

1. Certify/Legalize – Change/Update – Registrate – Sign – Reserve/Book
2. Check/Verify – Examine/Analyze

III. Workshop figures.

After the process modeling, during the discussion experts divided PBBs symbols into four categories:

1. Symbols which don't need to be modified because they are suitable e.g.:
Print, Copy, Wait until, Scan, Onsite visit, Publish, Calculate, Dispose.
2. Symbols which need to be modified because are too similar to each other e.g.:

Sign – Certify
Assign – Take from
Change/Update - Register – Document
Check/Verify – Examine/Analyze
Consult – Coordinate –Discuss
Pay – Encash
Send/Give – Receive

3. Symbols which need to be modified because are inadequate or incomprehensible e.g.:

Produce/Create/Generate
Capture/Enter
Take notice/To be informed
Retrieve/Gather/Enquire

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Close
Decide
Sign

4. Symbols which can be swapped with each other.

Encash → Pay

IV. Summary and suggestions.

Experts involved in evaluation activities agreed that PBBs symbols are indispensable and they help to pick up the proper PBB. They also agreed unanimously that overall PBBs layout of correct – symbol on the left, name, attributes on the right. They also noticed that some of symbols need to be modify.

Expert had also suggestions connected with graphical illustration of several PBBs e.g.:

PBB “Copy” – symbol can illustrate two documents with exactly the same content.

PBB “Wait until” – symbol with hourglass.

PBB “Sign” – can be illustrate by signature on the bottom of the page.

PBB “Certify” – can be illustrate by page with the seal.

There should be notice that PBB “Demand sth./To follow up” should also have symbol.

7.2 Questionnaire Results CoM

Section I: Terminology and Understanding of Processes

How familiar are the experts with the term/concept „process“?	Very good; Uses intensively data models, structural models and process models;
How good is the understanding of the concept „process“ within the administration in general?	Rough process idea exists; Problems to define the beginning and the end of a process; Process is everything with a structural flow; A consulting process for example in a social welfare office is not distinguished as a business process; “Semi-structured workflows are no processes”;
How would the experts organise processes? Which criteria would they use?	Organization, individual aspects; They use a process flow, data and organizational view;
Was the process landscape already captured in the administration? In which way?	Yes with the use of event Driven Process Chain; ARIS – Toolset;
Does a book of products or something similar exist, in which processes are structured?	Processes are structured by function groups;

Section II: Visualisation of PBBs, Constraints for PBBs

Which method was used to check the visualisation?	--
Is a visualisation through symbols helpful in general?	Yes, because you get a quick idea of what happens;
Is the overall layout of the PBBs okay?	Graphics in the PBBs suitable in most cases;
Are the symbols suitable for the PBBs?	--
Were there problems with assigning symbols to PBBs? Which symbols were problematic?	„Decide“ – ambiguous „Certify“ - symbol not adequate, something like an official seal better;
Were there any suggestions for improvement?	See above;
Are there sequences of PBBs which occur often?	--
Do the experts think that a PBB can only be followed by a certain subset of PBBs?	--

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Are their PBBs which have to be used if another PBB was used before?	--
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Section III: Visualisation of (alternative) Process Flows

1. Visualisation with branches	
Are domain experts able to understand the visualisation?	Good, after a short introduction;
Were there any suggestions for improvement?	Easy to understand, because interview partner has experiences with EPC;
Which positive aspects were underlined?	Decision forks can easily be detected; Good that there is no closing XOR; Thus, syntax is easier than EPC syntax;
Is the visualisation useful? For which purpose / in which area?	Very useful for all purposes. Every person can understand this type of process modeling language intuitively; (Interview partner has a strong EPC background);
2. Visualisation with variants and small branches	
Are domain experts able to understand the visualisation?	Good, but no use for this kind of variants;
Were there any suggestions for improvement?	You can not see the complexity of a process; It's oversimplifying the business process;
Which positive aspects were underlined?	Usable for estimating the effort; The workflow is noticeable; Usable for showing processes to administration directors;
Is the visualisation useful? For which purpose / in which area?	See above;
3. Visualisation only with variants	
Are domain experts able to understand the visualisation?	Good, after a short introduction;
Were there any suggestions for improvement?	Not usable for process modeling; This way of process representation makes no sense for interview partner, because it's not possible to catch the complexity of a process; And problems in reading the control flow; "After a Decide there have to be fork";
Which positive aspects were underlined?	Only that it is easy to read, because it is strict liner;
Is the visualisation useful? For which purpose / in which area?	No for process analysis by a modeling expert;
General questions about the visualisations	
Which visualisation do domain experts prefer?	Definitely the first one. The interviewee prefers a representation with folks; No new insights by Level II and III; Level I is easy enough to understand; In a sub-process you need information from which sub-process you come from and to which process you can go; Interviewee want to have the possibility to highlight specific process building blocks and to see the future process with information technology support;
How relevant are small process branches in public administrations?	Small branches are very important, because in nearly every process you have to decide something and then act in a different way;
Are small branches only necessary after specific PBBs?	--

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Section IV: Visualisation of Sub-Processes

1. Detail Level I	
Are domain experts able to understand the visualisation?	Good, after a short introduction;
Were there any suggestions for improvement?	Possibility to annotate information to the edges. Possibility to jump into the processes;
Which positive aspects were underlined?	Easy to understand and gives a complete overview; Necessary for a deep process analysis and identification of technology measurers.
Is the visualisation useful? For which purpose / in which area?	To get a complete and detailed overview of the process flow;
2. Detail Level II	
Are domain experts able to understand the visualisation?	Good after a short introduction;
Were there any suggestions for improvement?	Attributes let the model „explode“; There are too many information visualized in the attributes;
Which positive aspects were underlined?	You can see how processes are linked together;
Is the visualisation useful? For which purpose / in which area?	Not more helpful than Level of Detail III
3. Detail Level III	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	Attributes let the model „explode“
Which positive aspects were underlined?	Good overview;
Is the visualisation useful? For which purpose / in which area?	Overview and navigation through a process;
General questions about the visualisations	
Which visualisation do domain experts prefer?	Third one for Navigation an modeling the rough structure; First one for a deeper view to a process;
Which abstract level and which information is needed to get a process overview?	

7.3 Questionnaire Results City of Rhede

Section I: Terminology and Understanding of Processes

How familiar are the experts with the term/concept „process“?	Good (scholar knowledge from studies)
How good ist he understanding of the concept „process“ within the administration in general?	Little general knowledge
How would the experts organise processes? Which criteria would they use?	Core / support processes Organisational structure Important attributes : possibilities for IT-support of processes
Was the process landscape already captured in the administration? In which way?	Until mid-90's process recording through KGSt-sheets; no process recording afterwards
Does a book of products or something similar exists, in which processes are structured?	Complete book of products exists since 1998; processes not modelled
Further comments	
Process recording in the administration was not successful so far; detailed analysis not considered	

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necessary
 An affordable software tool is essential for process modelling in public administrations;
 Process modelling should be easy and intuitive, so that people with no experience in the field can understand the models (visualisation through symbols useful)
 Process modelling should not take much time; external support could be helpful (although the experiences so far were not good)
 A software tool for process modelling should provide a good usability
 Process modelling should be conducted by organisation designers, not administration workers itself;
 PA workers can optimise their processes (after modelling)

Section II: Visualisation of PBBs, Constraints for PBBs

Which method was used to check the visualisation?	Present symbols and names of process building blocks, discussion
Is a visualisation through symbols helpful in general?	Visualisation is considered very helpful, depending on user's preferences
Is the overall layout of the PBBs okay?	--
Are the symbols suitable for the PBBs?	Symbols fit quite well
Were there problems with assigning symbols to PBBs? Which symbols were problematic?	Symbols with persons are problematic and hard to distinguish (e.g. PBBs „consult“ and „discuss“) PBB „registrate“ can be easily mixed up with PBB „archive“ (name, not symbol) PBB “check/verify”: symbol can be mixed up with “page view”-symbol in MS Word PBB “decide”: the question mark is irritating
Were there any suggestions for improvement?	Some symbols are too similar to others; they should be more distinguishable PBB “decide”: check better than question mark
Are there sequences of PBBs which occur often?	--
Do the experts think that a PBB can only be followed by a certain subset of PBBs?	--
Are there PBBs which have to be used if another PBB was used before?	--
Further comments	
PBBs are too atomic overall; process recording at this detail level questionable	

Section III: Visualisation of (alternative) Process Flows

1. Visualisation with branches	
Are domain experts able to understand the visualisation?	Quite good understanding (experience with EPC)
Were there any suggestions for improvement?	May become difficult with big, complex processes
Which positive aspects were underlined?	Control flow is easy to capture Similar to well-known methods (EPC)
Is the visualisation useful? For which purpose / in which area?	Helpful for process optimisation / reengineering Good for modelling experts
2. Visualisation with variants and small branches	
Are domain experts able to understand the visualisation?	Not very good (big need for explanation)
Were there any suggestions for improvement?	Small branches are not useful Some PBBs need to be recorded twice Too general visualisation
Which positive aspects were underlined?	--
Is the visualisation useful? For which purpose / in	Variants are useful for different customer groups

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which area?	Variants only useful, when they are very different
3. Visualisation only with variants	
Are domain experts able to understand the visualisation?	Middle (some need for explanation)
Were there any suggestions for improvement?	Control flow is not clear This visualisation is hard to understand in general
Which positive aspects were underlined?	--
Is the visualisation useful? For which purpose / in which area?	Not useful at all
General questions about the visualisations	
Which visualisation do domain experts prefer?	Alternative 1 was preferred
How relevant are small process branches in public administrations?	Not very relevant
Are small branches only necessary after specific PBBs?	--
Further comments	

Section IV: Visualisation of Sub-Processes

1. Detail Level I	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	The visualisation is too generic Too little information
Which positive aspects were underlined?	--
Is the visualisation useful? For which purpose / in which area?	Only useful as a starting point for navigation
2. Detail Level II	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	More details needed
Which positive aspects were underlined?	Some information about the control flow included (percentages)
Is the visualisation useful? For which purpose / in which area?	Good as an overall overview
3. Detail Level III	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	May be too complex with big, complex processes
Which positive aspects were underlined?	Provides good overview
Is the visualisation useful? For which purpose / in which area?	Good for understanding sub-process connections
General questions about the visualisations	
Which visualisation do domain experts prefer?	Alternative 3
Which abstract level and which information is needed to get a process overview?	At least information about controll flow
Further comments	
Different detail levels should be available	

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7.4 Questionnaire Results City of Essen

Section I: Terminology and Understanding of Processes

How familiar are the experts with the term/concept „process“?	Good
How good is the understanding of the concept „process“ within the administration in general?	Good/satisfactory
How would the experts organise processes? Which criteria would they use?	Structured by organisation
Was the process landscape already captured in the administration? In which way?	Yes, but there are several modelling languages existing
Does a book of products or something similar exist, in which processes are structured?	

Section II: Visualisation of PBBs, Constraints for PBBs

Which method was used to check the visualisation?	
Is a visualisation through symbols helpful in general?	Yes, especially for the clerks
Is the overall layout of the PBBs okay?	good
Are the symbols suitable for the PBBs?	good
Were there problems with assigning symbols to PBBs? Which symbols were problematic?	„coordinate“ – for the interviewee this is something like a title for a whole process
Were there any suggestions for improvement?	
Are there sequences of PBBs which occur often?	Nein
Do the experts think that a PBB can only be followed by a certain subset of PBBs?	
Are their PBBs which have to be used if another PBB was used before?	

Section III: Visualisation of (alternative) Process Flows

1. Visualisation with branches	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	
Which positive aspects were underlined?	Loops can easily be detected. Problems are more obviously
Is the visualisation useful? For which purpose / in which area?	Yes, for the manager of the process modelling.
2. Visualisation with variants and small branches	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	
Which positive aspects were underlined?	You can also see, that there are decisions or something necessary
Is the visualisation useful? For which purpose / in which area?	Adequate for presenting processes to men who stands further upstairs in the hierarchy
3. Visualisation only with variants	
Are domain experts able to understand the visualisation?	good
Were there any suggestions for improvement?	Hard to identify decision knots. Hard to identify process inefficiencies.
Which positive aspects were underlined?	

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Is the visualisation useful? For which purpose / in which area?	Maybe adequate for the clerk with less process knowledge
General questions about the visualisations	
Which visualisation do domain experts prefer?	Definitely the first one
How relevant are small process branches in public administrations?	
Are small branches only necessary after specific PBBs?	Mostly after decide knots
Further comments	
<ul style="list-style-type: none"> - a target view which shows the process after the introduction of ICT would useful - Involvement of the citizens interesting (were are they involved or notified) 	

Section IV: Visualisation of Sub-Processes

1. Detail Level I	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	
Which positive aspects were underlined?	Easy when you just want to see who is responsible for what.
Is the visualisation useful? For which purpose / in which area?	
2. Detail Level II	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	
Which positive aspects were underlined?	You can see that where some variant stake place in the organisation. Sometimes this is helpful.
Is the visualisation useful? For which purpose / in which area?	
3. Detail Level III	
Are domain experts able to understand the visualisation?	Good
Were there any suggestions for improvement?	When there are complex process modelst he visualisation gets vastly big and unclear.
Which positive aspects were underlined?	Often it's important to see the coarse processes too.
Is the visualisation useful? For which purpose / in which area?	
General questions about the visualisations	
Which visualisation do domain experts prefer?	The first one if you want to see who has to do which subprocess. The third one when you have to know something about the processes too.
Which abstract level and which information is needed to get a process overview?	

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7.5 Questionnaire Results City of Osnabrueck

Section I: Terminology and Understanding of Processes

How familiar are the experts with the term/concept „process“?	Good overall understanding of the concept “process”; strong focus on organisational units, organisation unit change etc.; not familiar with concept of views
How good is the understanding of the concept „process“ within the administration in general?	Not very good; particularly small understanding of trans-sectoral processes
How would the experts organise processes? Which criteria would they use?	Mainly by organisational units
Was the process landscape already captured in the administration? In which way?	Process modelling in subareas using <i>viFlow</i>
Does a book of products or something similar exist, in which processes are structured?	Processes were only filed in data files so far; an easier locating of processes is desirable; particularly process navigation (navigation between processes)
Further comments	
<p>The software tool used to capture processes so far supported a swimlane representation, thus there is a strong focus on organisational units</p> <p>Organisational units involved are of big relevance and should be apparent</p> <p>It is desirable to index processes and to present them in an easily accessible way</p> <p>A complete capturing and maintenance of processes is laborious and cannot be conducted centrally; thus, distributed modelling would be advantageous (with a central coordination point and control mechanisms)</p> <p>Process maintenance should be possible locally, not centrally</p>	

Section II: Visualisation of PBBs, Constraints for PBBs

Which method was used to check the visualisation?	Present symbols and names of process building blocks, discussion
Is a visualisation through symbols helpful in general?	Yes. visualisation through symbols was well received; visualisation makes the intuitive understanding of PBBs easier (with focus on distributed modelling by inexperienced PA workers)
Is the overall layout of the PBBs okay?	--
Are the symbols suitable for the PBBs?	Good in general; a great part of the symbols was easily understood instantly or after short discussion
Were there problems with assigning symbols to PBBs? Which symbols were problematic?	<p>PBB Close: symbol implies permission (green check)</p> <p>PBB Pay and PBB Encash: The arrows are wrong from the point of view of PA workers</p> <p>PBB Examine/Analyse: plus symbol implies a “zoom function”; the name is inappropriate in general</p> <p>PBB Consult (external): be consulted by an external person or provide external consultation?</p>
Were there any suggestions for improvement?	<p>In general, PBBs should be customisable despite a standardised depiction (e.g. “building application” instead of “document”)</p> <p>PBB Certify/Legalise: a stamp or seal symbol would be better</p>

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	PBB Archive: a filing cabinet or a folder would be better as a symbol PBB Discuss (internal): Would better be called Conference or Meeting There should be a PBB Remind (during a processing break that takes too long the editing status can be enquired and the process can be reminded of, respectively)
Are there sequences of PBBs which occur often?	--
Do the experts think that a PBB can only be followed by a certain subset of PBBs?	--
Are their PBBs which have to be used if another PBB was used before?	--
Further comments	

Section III: Visualisation of (alternative) Process Flows

1. Visualisation with branches	
Are domain experts able to understand the visualisation?	Quite good; similarities to the previously used tool alleviates the intuitive understanding; connector symbols (XOR) were not familiar, but easily understood after short explanation
Were there any suggestions for improvement?	The visualisation is partly <i>too</i> detailed (for certain processes); clearness could become a problem
Which positive aspects were underlined?	Good depiction of the control flow; intuitively understandable and easily readable Economy of process steps through optimisation easily recognisable for method experts
Is the visualisation useful? For which purpose / in which area?	Useful with complex control flows and complicated processes; sensible for analyses by method experts
2. Visualisation with variants and small branches	
Are domain experts able to understand the visualisation?	Quite bad; not much better after explanation
Were there any suggestions for improvement?	Complex correlations are not recognised as complicated, because there are almost only linear correlations
Which positive aspects were underlined?	Easy to understand for PA workers
Is the visualisation useful? For which purpose / in which area?	Sufficient for a first general overview
3. Visualisation only with variants	
Are domain experts able to understand the visualisation?	Bad to medium; extensive explanation necessary
Were there any suggestions for improvement?	The question came up, why the PBB Check is repeated in both variants, although the result is clear in advance
Which positive aspects were underlined?	Allows for a quick overview
Is the visualisation useful? For which purpose / in which area?	Sufficient for easy, standardised processes; especially sensible for modelling laypersons
General questions about the visualisations	
Which visualisation do domain experts prefer?	Visualisation 1 was preferred; there were resistances against the simplifications in visualisations 2 and 3, "The alternatives should be visible after forks"
How relevant are small process branches in public administrations?	Forks play an important role, because improvements can be made in these points

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Are small branches only necessary after specific PBBs?	--
Further comments	
<p>Exceptions were not modelled so far; alternative sequences (variants) were modelled as particular processes In general the concept of variants was not received well Distinguishing variants and small branches was problematic The experts' opinions differed: partly alternative 1 was preferred, partly alternative 3 A target-performance comparison is desirable, e.g. by parallel depiction of actual and target state Graphical accentuation of changes</p>	

Section IV: Visualisation of Sub-Processes

1. Detail Level I	
Are domain experts able to understand the visualisation?	Very good; visualisation easily comprehensible
Were there any suggestions for improvement?	Correlations in complex processes can be unclear; Variants should be hidden on this level
Which positive aspects were underlined?	Correlations are clear; very detailed view is suitable for process analyses
Is the visualisation useful? For which purpose / in which area?	Useful for analyses through method experts; only limited suitability for PA workers
2. Detail Level II	
Are domain experts able to understand the visualisation?	Good understanding
Were there any suggestions for improvement?	Only small value added in comparison to detail level III
Which positive aspects were underlined?	Overview of complex processes is made easy (cp. Detail level II)
Is the visualisation useful? For which purpose / in which area?	Suitable to gain a first access and overview; Adequate for circulation to administration directorate
3. Detail Level III	
Are domain experts able to understand the visualisation?	Good comprehension
Were there any suggestions for improvement?	The organisational units involved are particularly important; sufficient for process overview; variant view as in detail level II is not necessary
Which positive aspects were underlined?	Process overview and correlations can be easily comprehended
Is the visualisation useful? For which purpose / in which area?	Suitable to gain a first access and overview; Adequate for circulation to administration directorate
General questions about the visualisations	
Which visualisation do domain experts prefer?	Detail level II was considered redundant; detail level I and III are necessary
Which abstract level and which information is needed to get a process overview?	Detail level with involved organisational units sufficient for a first overview; more information (variants, PBBs) should be displayed for closer examination
Further comments	
<p>Wish for swimlane representation to visualise organisation unit changes Every detail level is sensible in particular (for different purposes) Zoom functionality is desirable (between different detail levels)</p>	