1. Introduction

Municipal administrations are facing new challenges like cost reduction, decreasing tax revenues, more administrative tasks delegated from federal and state governments, and an increased service level demand of citizens and companies [14]. Therefore they have to rethink their resource allocation to reduce costs and to improve their workflows [2, 4]. This situation moves business process management into the focus of public decision makers.

So far process modeling in public administrations has mainly been performed with generic (general-purpose) languages. These modeling languages, such as Activity Diagrams (AD) [8], Business Process Modeling Notation (BPMN) [7], or Event Driven Process Chains (EPC) [11], are flexible instruments to describe diverse processes in many different domains. However, they do not particularly consider questions specific to public administration and reorganization [3, 12] like: (1) how can a very large number of processes be acquired efficiently, (2) what changes have what impact on the process efficiency, (3) what processes, activities, or products depend on legal regulations, or (4) how can required information for decision-making be extracted from the process landscape?

In this paper we present the process modeling language PICTURE that has been developed to address the specific conditions of reorganization projects in public administrations. PICTURE allows for an efficient modeling of the entire process landscape of an organization. Based on PICTURE not only isolated processes can be analyzed but a complete overview of the practices of an organization can be accomplished. Thereby, arbitrary information, which is relevant for a reorganization project, can be collected and accessed in an aggregated way. This overall view allows for the identification of technical and organizational measures to improve the efficiency of the process landscape based on the
consideration of structural analogies, potential synergy effects and economies of scale.

The remainder of this paper proceeds as follows. In the next chapter the PICTURE modeling language is described and its main concepts are introduced. The PICTURE language aims at enabling an efficient capture and transparent presentation of whole process landscapes in public administrations. Afterwards, we discuss our approach trying to point out its main strengths and weaknesses. Finally we give a conclusion with a summary of our achievements and an outlook to future research.

The research method being used for developing the PICTURE-language is based on the work from Takeda et al. [13], Walls et al. [15], and Markus et al. [6]. As the objective of this paper is the creation of an artifact in form of a method, the work belongs to the design-science oriented research [5].

2. The PICTURE Modeling Language

The PICTURE-language focuses on a strong involvement of the officials of an administration in the modeling project. There are certain questions for example about the execution of processes and the frequency of certain tasks that can only be answered by a responsible official or his supervisor. In order to represent the entire process landscape many officials must participate. Using traditional general-purpose modeling languages often requires conducting a large number of interviews. This is caused by the fact that such modeling techniques are often too complicated for officials in order to model by themselves. Capturing the whole process landscape is therefore a very time-consuming task.

PICTURE has been designed as a simple and intuitive modeling language focusing on officials in public administrations. It is a main contribution of the PICTURE-language to enable modeling in a distributed manner. Furthermore, the collection of the process models is performed in a coarse granular form to reduce time and efforts for modeling. The mechanisms of the PICTURE-language allow for distributed and local modeling activities and avoid cost- and time-consuming training courses.

The main constructs of the PICTURE modeling language are described in its metamodel (c.f. Figure 1). The underlying technique used are Class Diagrams [8]. White rectangles represent abstract constructs which are not instantiated in PICTURE-models. They are further specialized into concrete constructs (shown as gray rectangles) which can be applied for modeling with the developed technique.
Most concrete Model Elements of the PICTURE-language are either specializations of Process Kind or Link Kind. If one treated a PICTURE-model as a graph, the first would represent its nodes while the second would stand for the edges connecting the nodes. Processes, Sub-Processes and concrete Process Building Blocks belong to the Process Kind. Furthermore, there are two concrete types of links: Anchor Links and Building Block Links. Additional constructs are concrete Attributes and Domains. They play a subordinated role to the Process Kind elements conveying detailed information. All these concepts will be explained in the following.

![Diagram of the PICTURE modeling language metamodel](image)

Figure 1. The PICTURE modeling language metamodel

**Process Building Blocks:** The basic constructs of the PICTURE modeling language are process building blocks (cf. Table 1). A process building block represents a set of activities within an administrative
process [10]. Examples for concrete building blocks are “Incoming Document” (c.f. Figure 2) or “Enter Data into IT”.

Table 1. Examples for process building blocks.

<table>
<thead>
<tr>
<th>Process Building Block</th>
<th>Definition of the Process Building Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incoming Document</td>
<td>A document which arrives from an internal or external source.</td>
</tr>
<tr>
<td>Forward Document</td>
<td>A document is internally forwarded.</td>
</tr>
<tr>
<td>Create Document</td>
<td>A new document is generated.</td>
</tr>
<tr>
<td>Print Document</td>
<td>Information is printed on paper.</td>
</tr>
<tr>
<td>Consultation</td>
<td>A citizen is consulted by an official.</td>
</tr>
<tr>
<td>Enter Data into IT</td>
<td>Facts or documents are manually entered into an IT system.</td>
</tr>
<tr>
<td>Formal Assessment</td>
<td>A document is validated against formal requirements.</td>
</tr>
</tbody>
</table>

Figure 2. The process building block “Incoming Document”.

Concrete process building blocks have been specifically developed for public administrations and apply the vocabulary of this domain. As they are domain specific, the meaning of a process building block is characterized by a corresponding domain statement. Thus, the process building blocks dispose of a fixed, informally defined, domain specific semantics.

In PICTURE concrete building blocks are applied to describe processes. So far, 24 such blocks have been identified and integrated into the language. Processes are represented as (mainly) sequential flow of building blocks. The use of process building blocks restricts the degrees of freedom of the modeler and simultaneously promotes the construction of structurally comparable models. Since, only the given process building blocks can be used, the type and role of each model element is not just syntactically but also semantically fixed. Problems like naming conflicts in a model comparison are avoided, because the name of a process building block is specified by the language designer rather than the modeler.

Building Block Links: Subsequent blocks are connected with building block links. A block may have at most one successor (or none if it is the last one in a sub-process) and at most one predecessor (or none if it starts a sub-process). This complies with the strict sequential character of the activities within one sub-process.
Attributes: With building blocks the sequential order within administrative processes can be specified. Additional facts about the processes can be collected with the help of attributes assigned to the process building blocks. These attributes specify the properties of the corresponding building blocks in detail. For example possible attributes for the process building block “Enter Data into IT” are “Sending Organizational Unit”, “Channel” or “Processing Time” (cf. Table 2). Altogether, PICTURE contains nearly 50 different attributes. Attributes provide the core information for a subsequent process analysis, in which, according to the predetermined goals, corresponding weaknesses and potentials are detected.

Table 2. Examples for attributes including their definitions.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Definition of the Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel</td>
<td>The medium in which a document or information arrives. For example telephone, fax, mail or e-mail.</td>
</tr>
<tr>
<td>Document</td>
<td>The name of the document which is moved or processed. For example an application form or an official notification.</td>
</tr>
<tr>
<td>Sending Organizational Unit</td>
<td>Source of a document or information, e.g. a person, organizational unit or organization.</td>
</tr>
<tr>
<td>Software System</td>
<td>The name of the software system which is involved in this activity.</td>
</tr>
<tr>
<td>Processing Time</td>
<td>Time in minutes it takes to complete a certain activity.</td>
</tr>
</tbody>
</table>

Sub-Processes: In PICTURE a process can consist of several sub-processes (cf. Figure 3a)). A sub-process is a process section being carried out by exactly one responsible official within a single organizational unit. The majority of the modeling activities take place on the sub-process level. As processes can span over multiple organizational units, the differentiation between processes and sub-processes makes it possible to delegate modeling tasks to the responsible official who enacts the activities. Within the scope of the sub-process the responsible official can collect all relevant information and represent them in the form of process building blocks and attributes. However, some processes may contain only one sub-process (cf. Figure 3b)).
Anchor Links: To model existing workflow dependencies between (sub-) processes the concept of an anchor link is introduced (c.f. Figure 1). A link of this kind is always directed and may connect a process building block with another block(s) in (a) different sub-process(es). This offers the possibility to connect sub-processes within one process in a structure representing the real workflow dependencies. Furthermore, activities conducted concurrently from the organization’s global point of view can be modeled this way. Officials in public administration often forward documents to another person. This builds the input of a block in a different sub-process within the same or even another process. As officials model only their own activities, they often do not know the specific process building block, the document is forwarded to. For example they may be only familiar with the destination process’s name, which can be a link’s destination accordingly. During modeling it is also possible to create a link which temporarily lacks destination, as it may not (yet) have been modeled by its responsible official.

Sub-Process Variants: PICTURE offers two other possibilities to describe technically important forks in the process model: On the one hand attributes can be used to specify different cases with percentage values. For example an incoming document can arrive in 50% of the cases through the communication medium mail, in 30% per email, and in 20% per fax. This fully complies with PICTURE’s goal of capturing an organization’s whole process landscape for further analysis rather than strictly mapping
all process flows in detail. On the other hand it is possible to specify process variants (Figure 3c)). A process variant defines an alternative sequence within a sub-process. Process variants contain in comparison with the original sub-process many common process building blocks. However, some of the process building blocks have been modified, new ones have been added and some have been removed. The frequency of a process variant can be described by percentage values.

3. Discussion of the PICTURE-Approach

The PICTURE modeling language presented in this paper has been developed to allow for an efficient capturing of an entire process landscape. Thus, it seems to fit closely to the requirements of public administrations. In the following we will critically discuss the main features of the PICTURE language.

1. Simple representation of the process landscape. The abstraction level of the process building blocks is defined by the PICTURE language. Due to their encapsulated easily understandable semantics, the officials are able to formulate their workflows with the aid of the predefined process building blocks. Furthermore, a better comprehensibility of the models compared with other previously used modeling languages is a clear achievement. Especially processes that are well structured and form-driven can be adequately described. Also the lack of explicit process fork modeling can be considered a meaningful simplification.

2. Creation of maintainable process models. The PICTURE-approach supports the creation of maintainable models. Through modeling with the help of concrete process building blocks, structural variations are less frequent compared to classic process modeling techniques. Nevertheless, necessary changes to the models can be carried out by those responsible for a process. This lower maintenance expense, associated with the maintainable process models, strongly motivates users to keep models up-to-date, unlike the classic approaches.

3. Efficient modeling. The process building blocks of the PICTURE-method are easy to understand, since they use the vocabulary of the public administration domain. Furthermore, the building blocks fix the models’ abstraction level. This way it is possible to model a lot faster than with the classic approaches and also to capture more processes with the same amount of resources. We anticipate that the PICTURE-approach may shrink the time to acquire a single process up to a third compared to projects using the EPC as modeling language [1].
4. Creation of comparable process models. Through the use of the same predefined process building blocks in different process models, the comparability of the models is clearly promoted. The blocks limit the degrees of freedom during modeling. They ensure also that the meaning of a model element is entirely determined by the modeling language. Consequently, problems such as name or type conflicts within a model comparison are avoided [9]. Structural similarities in administrative processes can be easily identified in such a way.

5. Creation of analyzable process models. The achieved good comparison opportunities already represent a possibility of evaluation. For example, through the comparison of process models one can form groups of processes that contain a similar combination of building blocks (e.g. a grouping of all processes, which contain a consulting discussion or a payment). Not only the process building blocks but also the attributes are predefined and represent well-known semantics. This combination of predefined model elements creates additional aggregation opportunities and enables multi-level analysis.

There are also a couple of issues which are explicitly not addressed by the PICTURE-approach. For example it is not suited for a detailed analysis of single processes. The language was designed with the goal of enabling the complete description of process landscapes. Therefore, the domain is described on a correspondingly high abstraction level. The purpose of our approach is not to extensively model control flows or to describe processes in such detail that they, for example, could be implemented in a workflow management system. If necessary, a higher degree of detail can be achieved by the use of additional attributes. Furthermore, the PICTURE-language is not suitable for representing highly unstructured or only uniquely occurring processes, for example the planning processes or the activities in a project. Because of the fixed abstraction level of the process building blocks, such processes can be only insufficiently or not at all described with PICTURE.

4. Conclusion and Outlook

Public administrations are facing an intense reorganization pressure. Achieving transparency about the process landscape is an important first step in the reorganization process. It can serve as foundation of the process analysis, is the basis for subsequent reorganization measures. The PICTURE-language has been developed as an approach to capture and further analyze the entire process landscape of a public administration and
to aggregate the process knowledge in order to reach decision-relevant figures.

A number of objectives for further research work could be identified. Beneath the presentation of performance indicators about the current process landscape especially the intended changes are subject of research. Based on the PICTURE process models the reorganization potential of technological and organizational measures can be estimated. Particularly interesting is the identification of monetary effects of concrete reorganization measures and to derive these effects from the process landscape (e.g. the monetary effect of merging to departments or introducing a workflow management system). Furthermore, also qualitative aspects should be included into the analysis framework of PICTURE like quality effects or effects on the customer satisfaction of technical or organizational measures. Above all it should be possible to define new figures and make calculations with the existing figures.
5. References


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7. Abstract

Public administrations are facing an increased service level demand from citizens and companies which comes along with reduced financial scope. Higher process efficiency as well as time and cost savings are required to cope with this challenge. To achieve this, transparency about the existing process landscape is required to identify reorganization potential. In this paper the PICTURE-approach for analyzing process models in public administrations is presented. PICTURE is a domain-specific modeling language with embedded semantics. It allows for coarse granular modeling and analyses of the whole process landscape in public administrations.