JeDEM 15(1) 144-168, 2023
ISSN 2075-9517
http://www.jedem.org
Date of submission: 06.05.2023
Date of acceptance: 22.08.2023
Article DOI: 10.29379/jedem.v15i1.736

Application of business process modelling and reengineering to law making process in Poland

Szymon Mamrot

Orcid Nr.: 0000-0002-7307-7004
Łukasiewicz Research Network - Poznań Institute of Technology, ul. Ewarysta Estkowskiego 6, 61-755 Poznań, Poland, szymon.mamrot@pit.lukasiewicz.gov.pl

Abstract: The effectiveness of services provided by the governmental institutions is determined by the quality of established law. The number of the adopted regulations is increasing but their quality is reducing. Improvement of existing legislation is a time-consuming and difficult task. We propose to apply techniques of business process modelling and reengineering to improve the quality of law in the course of law-making. The main contribution of the article is a method based on the application of the Business Process Model and Notation (BPMN) to design processes, introduced by the legal acts. Due to the application of this method, processes regulated by legislations could be failure-free and effective. This method permits one to indicate how proposed amendments affect the regulated processes. The method was practically implemented and validated during the process of law-making in Poland. This case empirically confirmed that the application of our method could enhance the quality of public processes, regulated by legislation.

Keywords: legislative process; law-making process, business process reengineering; business process modelling, BPMN

1. Introduction

Deployment of Information and Communication Technology (ICT) in public administration needs to be accompanied by process reengineering. Otherwise, ineffective processes in governmental institutions, even if supported by ICT, are followed by low quality outcomes, inefficiency and ineffectiveness. The quality of processes in public administration depends directly on the quality of law. Only well-established law, free of deficiencies, inconsistencies and incompleteness may be a basis for effective and efficient processes in public administration.

The number of adopted legal acts is steadily growing. On the one hand, this is due to a dynamic development of different areas which require new regulations for society to function properly. On the other hand, a significant portion of newly adopted regulations require amendments, which is

proof of the poor quality of legislative processes. Therefore, a real challenge lies in the improvement of legislative processes, which would enhance the quality and efficiency of established law. The most efficient and least costly improvements may be achieved at an early stage of the legislative process. In this paper we propose a method of law-making that is based on the application of business process modelling and reengineering techniques, to processes followed from regulations.

The BPMN (Business Process Modelling Notation) is currently a widely used notation, but so far it has not been applied to redesign processes in the course of law-making. The strength of the presented method lies in the elimination of potential process deficiencies in the course of law-making, before these processes are implemented and deployed. Moreover, due to the application of process simulation, the most effective variants of processes can be selected before regulations are adopted. Application of the presented method permits an increased awareness for legislators on law influence on regulated processes. This should lead to an enhancement of the quality of established law. Application of this method would significantly reduce the need for law amendments.

Currently, business process modelling is a prerequisite for implementing any electronic services in governmental institutions. Through application of BPMN to law-making, processes defined by legal acts would be more advanced, ready for implementation in electronic systems.

The practical value of the presented method was confirmed in Poland during the analysis of the registration of a civil law partnership. The method is, however, universal and may be applied in any country, to any law-making process.

In this paper the following research methods have been used. The literature related to the Business Process Management and Legal Informatics has been reviewed. Desk research and conversation with the relevant entities have been used to develop the initial version of the method. Then, the method was evaluated using the case study method (Yin, 2009).

The field of legal informatics provides certain tools to facilitate the law-making process (Biasiotti, 2008), (Sharma, 2021), but these tools do not rely on business process modelling and simulation. This paper takes a step towards filling this gap by presenting a new method that allows for the evaluation of the efficiency of legal regulations during the course of the law-making process, through the application of Business Process Management techniques. Moreover, the presented method has an interdisciplinary character, as it is the result of research conducted at the intersection of three fields: economics, law, and computer science.

The paper is organized as follows. In Section 2, we explain the notions of business process management, business process modelling and BPMN. In Section 3, we describe the application of ICT to legislative processes. In Section 4, our method is presented. Section 5 discusses a case study of the method application. Finally, Section 6 concludes the paper.

2. Business process management

2.1. Business process management – history, definition

There are many definitions of a "process". Most of them treat a process as a relationship between inputs and outputs, where inputs are transformed into outputs using a series of activities which add value to the inputs (Aguilar-Savén, 2004). Initially, business processes were related only to enterprises. Currently, the term "business process" applies to public administration too. The history of Business Process Management (BPM) is quite long. The roots of this concept can be found in Adam Smith's concept of managing labour in the manufacturing industry. He pointed out that a process should be divided into several sub-parts to make it more efficient. Frederick Taylor proposed a management method known as "time and motion" to document and analyse the work involved in business processes, reducing the time and the number of functions involved in any process.

In the 1960s, the term BPM was first used in the field of system engineering as a way to increase efficiency of business processes. In the 1970s, researchers introduced the concept of managing business processes automatically. In the early 1980s, the Total Quality Management (TQM) concept was proposed, to produce higher quality products for a lower cost in less time. Business Process Reengineering (BPR) was introduced in the 1990s as a method to analyse and redesign business processes (Alotaibi, 2014).

Business Process Management includes concepts, methods and techniques to support the design, administration, configuration, enactment and analysis of business processes (Hammer and Champy, 1993). BPM is the discipline that combines knowledge from information technology and knowledge from management sciences and applies this to operational business processes (Van der Aalst, 2013).

Application of BPM in public administration is related to the concept of shifting governmental entities towards becoming quasi-markets. This is especially connected with the idea of New Public Management (NPM). According to NPM, the public sector should enhance cost efficiency and competitiveness between public bodies (Niehaves, B., Plattfaut, R, 2010). At the same time, the idea of Business Process Reengineering (BPR) was presented (Ciaghi & Villafiorita, 2011). BPR can be defined as undertaking a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical measures of performance, such as cost, quality and speed (Abijith, Wamba, Samuel, & Gnanzou, 2013). In the public sector, BPR mostly means standardisation of business processes, automation of some activities and elimination of some unnecessary ones. As BPR in the public sector is strongly regulated, i.e., constrained by law and therefore, dependent on changes of legal acts, it is particularly important to enhance the quality of legislative processes (Indihar Stemberger & Jaklic, 2007).

BPM and BPR are considered as complimentary to each other, rather than, as a substitute. Both have the same goal of optimizing organizational effectiveness and efficiency. BPM focuses on the continuous improvement, whereas BPR studies the organization processes and strives to create the perfect process from scratch. The main differences between BPM and BPR are presented in Table 1 (Annand, 2011).

Table 1: Differences between BPM and BPR

Business Process Management	**Business Process Reengineering**
Automates and reuses the existing processes	Recreates processes from scratch
Risk is low	Risk is high
Improvement is continuous	One big and radical change is done
Time taken for implementation is comparatively less	It takes lot of time to be implemented
One or more process can be simultaneously taken and worked upon	One major process is taken and worked upon at a time
Does not have any effect on the culture of the organization	During implementation cultural issues become a major concern
Outcome is continuous and incremental	Outcome is drastic
Less expensive	More expensive

2.2. Business process modelling

Business process modelling is a management discipline that provides support to business processes using different methods, techniques and software tools to control and analyse organizational processes and activities, which include people, organizations, applications, documents and other related information (Alotaibi, 2014).

1) Business process modelling assists with three goals:
2) Describing business processes in a graphical way.
3) Analysing business processes by using either qualitative or quantitative methods.
4) Enacting business processes for the purpose of simulation or to support their execution.

The ongoing and strengthened interest in business process modelling has given rise to a wide range of modelling techniques[1], from simple flowcharting techniques, to techniques initially used as parts of software design, such as UML, through dedicated business-oriented modelling approaches, such as Event-driven Process Chains, up to formalised and academically studied techniques, such as Petri nets (Recker, Rosemann, Indulska, & Green, 2009).

2.3. Business Process Model and Notation as a leader of business process modelling techniques

The Business Process Model and Notation (BPMN) is a graphical notation used to model business processes. The primary goal of the BPMN was to provide a notation which would be readily understandable by all business users, from the business analysts that create the initial drafts of processes, through the technical developers responsible for implementing a technology that performs those processes, then finally, to the business people who will manage and monitor those processes (Recker, 2012). It appears that this goal was achieved, which is confirmed by a huge number of BPMN users.

[1] These techniques can be divided into two main groups: first, techniques which were initially created for analysing and developing information systems and then adopted to business process modelling; second, techniques which were developed from scratch for business process modelling.

The BPMN is made up of a set of graphical elements that enable the easy development of process models (White, 2004). There are four basic categories of these elements:

- Flow Objects,
- Connecting Objects,
- Swim-lanes
- Artefacts.

Flow objects contain events, activities, and gateways. An event is represented by a circle and affects the flow of the process. Events usually have a cause (trigger) or an impact (result). An activity is represented by a rounded-corner rectangle and is a generic term for work that organisations perform. Gateways are represented by the familiar diamond shape and are used to control the divergence and convergence of sequence flow.

Connecting objects are used for connecting the flow objects. Sequence flow defines the execution order of the activities within a process, while message flow is used to show the flow of messages between two separate process participants. Association flow is used to associate both text and graphical non-flow objects with flow objects.

Swim-lanes are used to denote a participant in a process and acts as a graphical container for a set of activities taken on by that participant. There are two types of the swim-lane constructs: pools and lanes. Pool represents a participant in a process, while lanes are used to organize and categorize activities.

Artefacts are data objects, groups, and annotations. The goal of data objects is to show how data is required or produced by activities. The Group construct is a visual aid used for documentation or analysis purposes. Annotations are a mechanism for a modeller to provide additional text information for the reader of a BPMN diagram.

A summary of most BPMN elements is shown in Figure 1 (Chinosi & Trombetta, 2012).

Figure 1: The BPMN elements

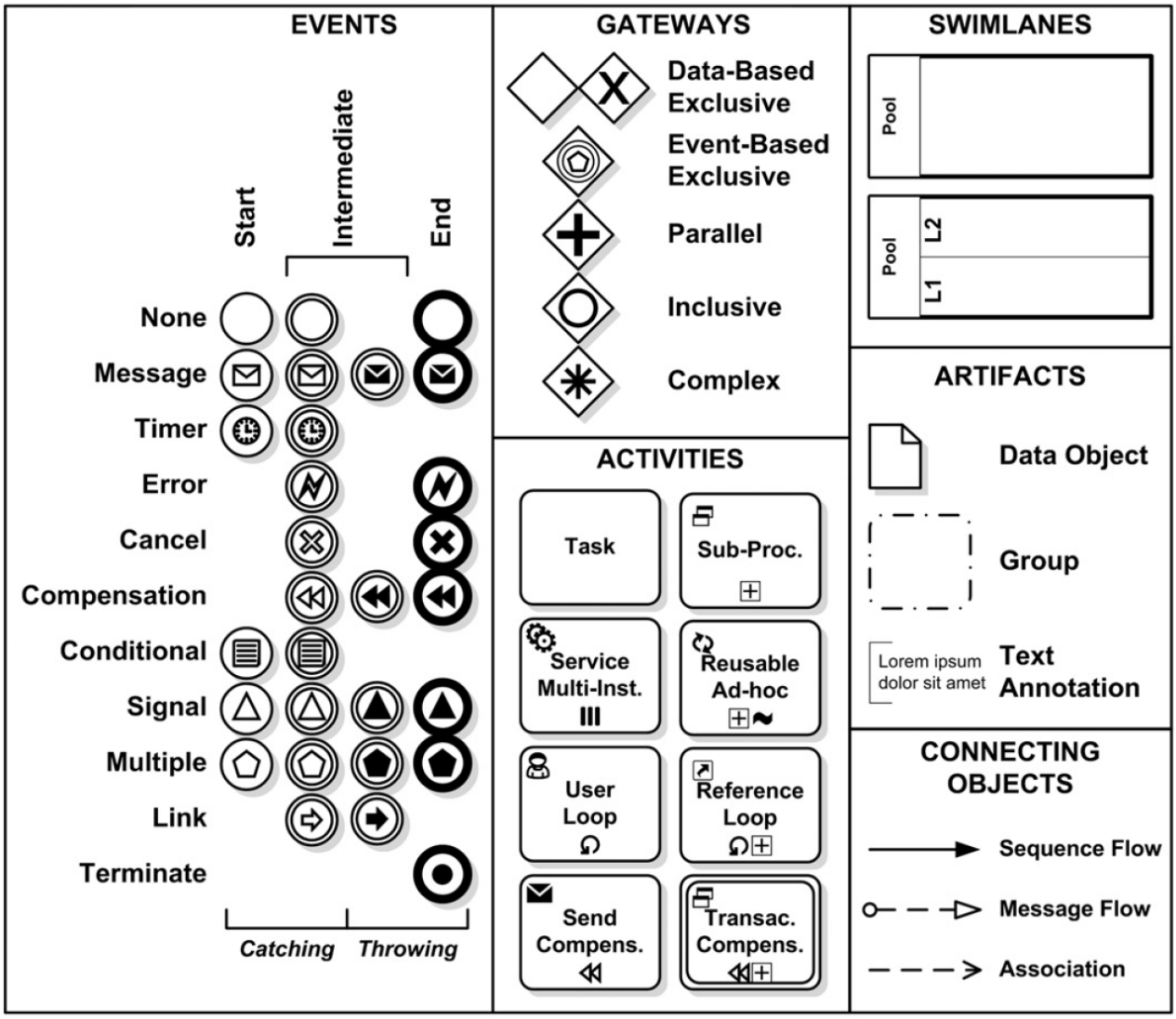
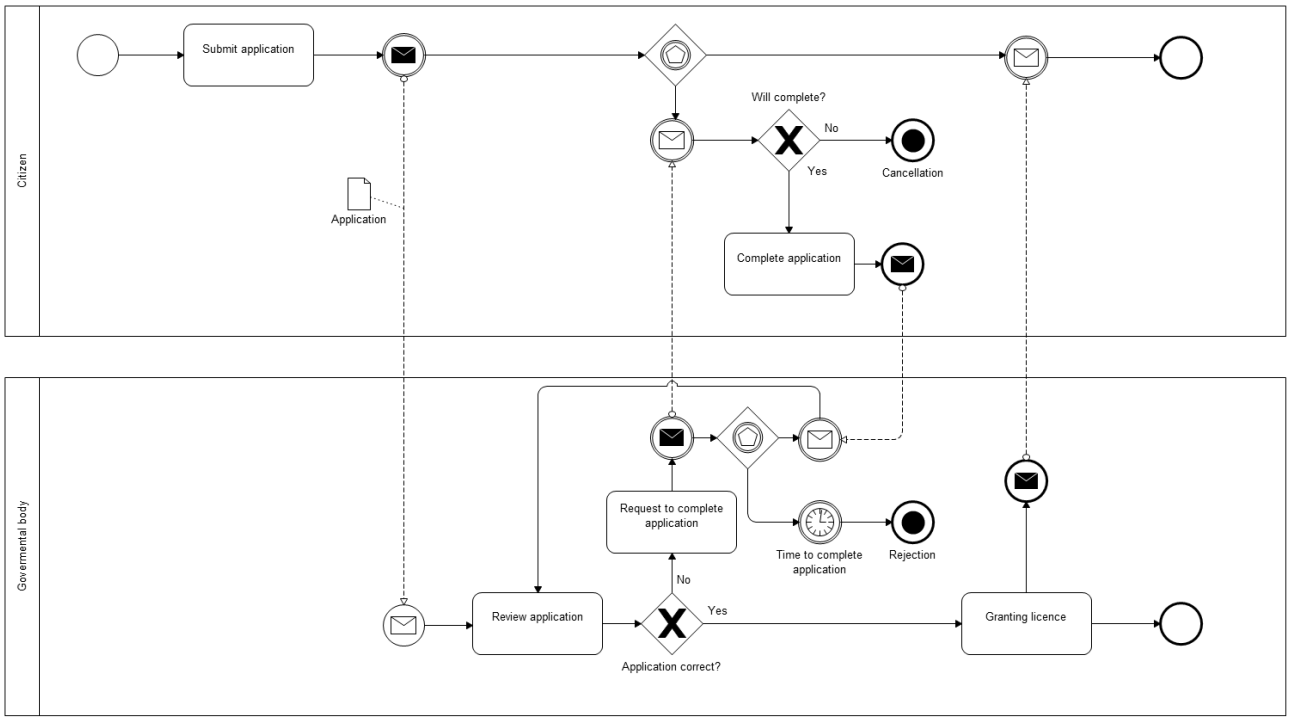


Figure 2 shows a simple example of the BPMN diagram, concerning the process of a citizen's application for a licence. The process flow is the following. A citizen sends an application for a licence to a governmental body. The governmental body reviews the received application and either grants the licence or requests for completing the application. The governmental body sets a deadline for the citizen to complete the application. The citizen can either complete the application or cancel the application. If the citizen decides to provide the completed application, the governmental body reviews it again and the process flow continues.

Figure 2: Example of the BPMN diagram



In comparison with other notation, the BPMN has many benefits. The most important are the following:

- BPMN is a stable notation (current version 2.0), permitting the illustration of not only particular steps in business processes, but also, a flow of a process and a flow of information between different processes, allows one to model processes, to analyse them for possible issues and time or cost reductions (Indulska, 2009);
- BPMN supports business process modelling, for both technical and business users, facilitates communication of business processes across different stakeholder groups -business analysts who models and analyse the business processes, IT developers who implement the designed processes, and business managers who monitor and manage the processes;
- BPMN is a product-neutral notation language, which means that is not controlled by one vendor and is widely deployable;
- BPMN is free and accepted by the most important business stakeholders, (Indulska, 2009);
- BPMN diagrams can be easily transformed into other standards (BPEL, XPDL) and directly applied to a BPM engine, instead of going through human interpretations and translations into other languages (White, 2000);
- BPMN diagrams facilitate process automation by using Web Services – Business Process Execution Language (WS-BPEL), (Indulska, 2009);
- BPMN provides an opportunity to use simulations to evaluate the effectiveness of modelled processes and enables us to see how AS-IS nad TO-BE processes might operate, (Indulska, 2009).

In his paper, Moody (2007), describes a set of principles[2] for preparing effective diagrams. Johannson, Magnus, and Carlsson (2012), chose four major business process modelling techniques, including BPMN, to evaluate using Moody's quality criteria. Apart from the BPMN, they assessed Flowchart, UML and EPC. The BPMN is the only technique which reached an acceptable level within Moody's quality criteria. Due to the above mentioned benefits of the BPMN, this method is widely used in the private sector. Recently, the BPMN has become a standard method of process modelling in governmental institutions too.

2.4. Business process simulation

BPMN is widely used for executing simulation, which is a popular technique for analysing business processes. It helps predict the performance of the process, under a number of scenarios determined by the decision maker. Simulation provides quantitative estimates of the impact that a process design is likely to have on process performance (Johansson, 2012). The advantage of simulation is that it is a very flexible technique because it can be used to assess both the current process and the redesigned process performance. Simulation enables the analysis of alternative process scenarios by providing quantitative process parameters, such as cost, duration time and resource utilization. These parameters form the basis for evaluating alternatives and selecting the most promising scenario for implementation (Vergidis, 2008). Changes in business processes are often risky and their outcomes are difficult to correct after implementation. Due to the application of business process simulation, re-engineering effects can be anticipated in a quantitative way. The ability to test their effects before implementation is one of the core strengths of simulation techniques (Hlupic, 2006).

3. Legislative processes

3.1. Better regulation

The global financial crisis showed that good legislation is essential if we want our economies to function efficiently. The problem of better regulation has been raised for many years by the Organisation for Economic Cooperation and Development (OECD) (OECD, 2012). OECD recommends its members maximize the net benefits of the adopted regulations. The economic, social and environmental benefits related to the regulation should always exceed the cost of its implementation. It is also recommended to ensure that regulations remain up to date, cost-justified, cost-effective and consistent, to deliver the intended policy objectives.

The European Union also deals with the issue of better regulation. In the EU, better regulation is understood as EU policies and laws are designed so that objectives are achieved at minimum cost. According to the European Commission document; Better Governance for the Single Market, rules at the EU level should fulfil at least the following requirements:

[2] According to these principles, diagrams should fulfil the following criteria: discriminability, manageable complexity, emphasis, cognitive integration, perceptual directness, structure, identification, visual expressiveness, graphic simplicity.

- Rules must be clear, easy to understand and unambiguous;
- Rules must achieve their intended effect without causing unnecessary burdens on businesses, citizens or administrations;
- Where businesses and citizens need to comply with procedures, they should be able to do so swiftly and via electronic means;
- Rules should guarantee that businesses and citizens find information and help and have access to fast and effective redress where needed.

The application of BPMN to legislative processes will facilitate the first three of the above mentioned requirements. Thus, processes defined by the legal acts will be clear, easy to understand and will not cause unnecessary burdens on businesses and citizens. The processes will be ready to implement by public administrations as electronic services.

3.2. Application of IT to legislative processes

Legal informatics is a multidisciplinary field that combines law, computer science and information technology to create, study and apply the law (Biasiotti, 2008). It focuses on the application of ICT solutions to enhance legislation processes, improve access to legal information and support legal decision-making (Seipel, 2004). Legal informatics explores how technology can be applied to automate routine legal tasks, streamline legal workflows and improve the efficiency and effectiveness of legal professionals. Legal informatics also provides IT solutions that support legislative processes. These solutions provide information to all actors involved in the legislative process, enable cooperation among such actors, ensure efficiency, transparency and the quality of the legislative outputs (Biasiotti, 2008). Currently, legal informatics focuses on exploring how new technologies like Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), and Blockchain can be applied to develop modern IT solutions for the legal domain (Sharma, 2021).

IT has been supporting legislative processes since the 1980s. There are basically four classes of IT applications which support legislative processes (Voermans, Fokkema, & Van Wijk, 2012). The first class involves simple office applications, which facilitate the process of creating legal documents[3]. The second class consists of dedicated database applications commonly used for storing, processing and accessing legislative documents or documents pertaining to legislation. The third class of IT applications includes legislative calendars and legislative progress monitors. Electronic legislative calendars typically contain the legislative programme for one year and usually provide information on upcoming events and debates on legislation. The goal of the legislative progress monitors is to inform about the current status of a legislative document, the state of affairs or the progress of the passage of a bill[4]. Many countries use both calendars and progress monitors to increase the transparency of the legislative processes. The fourth and final class of IT applications covers systems dedicated to support the process of drafting legal acts. These systems usually contain tool boxes for legislators, which include a set of rules, best practices, models and illustrations on methods and

[3] LegisWrite is an example of such a simple application. This is a Word add-in used to create EC legislative documents.

[4] The UK progress monitor is a good example – http://www.parliament.uk/about/how/laws/passage-bill/ .

techniques for legislative drafting. They usually facilitate the process of amendments of legal acts by implementing tracked changes[5].

Currently, an application of business process modelling to the legislative processes is limited to only the legislative process itself. Some countries, like the Netherlands, are aware that legislative processes are very complex and they use the BPMN to model and simplify these processes (Voermans, Fokkema, & Van Wijk, 2012). They are working on improvement of the legislative process itself, but they don't deal with processes defined by the legal acts. In this paper, we propose a new application of the BPMN which permits it to model and redesign processes following from these legal acts.

4. Application of BPMN to legislative processes

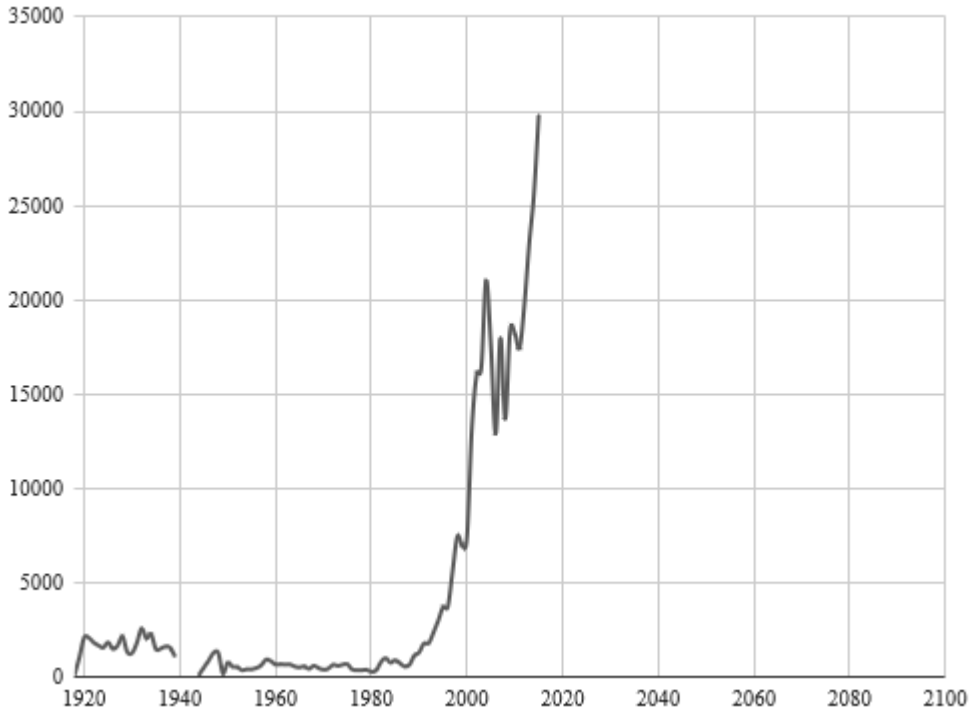
The process of law-making is complex and multistage. Usually, the content of a legal act is amended many times at different stages of the legislative process. It is especially difficult for legislators to regulate complex processes defined by legal acts.

According to Grant Thornton research, in 2014 in Poland 1,995 new legal acts were adopted. These legal acts included over 25,000 pages. In the same time, in France, the new legal acts included over 22,000 pages and in Italy over 15,000. From year to year, the number of adopted legal acts is rapidly growing (Fig. 3)[6].

[5]Examples of such a system are Dutch system LEDA or Australian system ENACT.

[6] http://barometrprawa.pl/

Figure 3: The number of legal acts adopted in particular years in Poland



The average number of words in legal acts is growing as well. In order to be up to date with new legislation, business people in Poland should read, daily, 103 pages of new legal acts.

Moreover, the number of law amendments is increasing, which indicates the poor quality of law-making processes. In Poland in 2011-2015, Parliament adopted 752 enactments, but over 75% of these legal acts concerned the amendments. According to the research conducted in New Zealand (Sherwin, 2014), more than half of all bills reviewed by the Law Commission in 2013 had significant problems.

There are three classes of the rules that can be contained in legal documents (Ciaghi & Villafiorita, 2012):

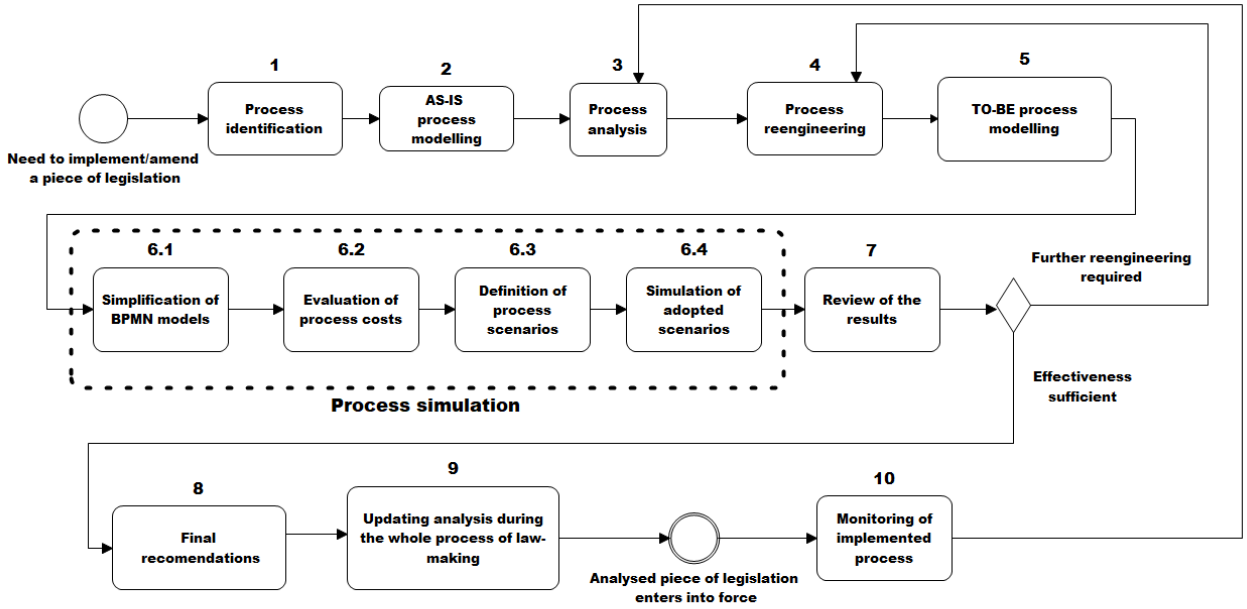
1) Constitutive rules that define abstract and concrete entities, such as concepts, actors, institutions, roles, competences, attributes, etc.
2) Instructional rules giving prescriptions that fix duties with respect to given goals, e.g. prohibitions.
3) Procedural rules that define formal obligations and model formal actions. These rules explain institutional procedures that follow the directives given by instructional laws.

4.1. The concept of the method

The procedural rules can be visualised and modelled like other governmental processes. To facilitate the task of law-making, particularly in terms of the procedural rules, in this paper we propose application of business process modelling and reengineering techniques to legislative processes. Our

method can be applied both to the introduction and amendment of legislation that regulates processes. Figure 4 shows the major steps of the method.

Figure 4: The presented method.



Process identification

During the first step, processes, for whichever legislation is to be introduced or amended, are identified. Due to the complexity of legal acts, it is not a trivial issue to identify process. Processes are usually regulated by more than one single legal act; indeed, they are affected by many different regulations. Within this step, all these legal acts should be analysed. Understanding laws can be extremely difficult, mainly due to the formalisms used in legal language and the intricate network of dependencies that needs to be identified in order to fully understand the rules contained in a law and their applicability to a given process (Ciaghi & Villafiorita, 2012).

Currently some countries[7] adopted XML-based formats to manage legislative documents. The use of XML opens up a possibility of process identification, based on semantic analysis of legal documents. XML format is enriched with markup tags that identify business process participants, activities, artefacts and events.

Process modelling

[7] XML as a format for the representations of legal information is used in Denmark, Italy, Austria and Switzerland.

During the second step, a model (AS-IS) of the process is prepared. The goal of this step is to comprehend the true realization of processes and to describe them as they are executed in practice. Since implementation of the processes is greatly affected by its use in practice, it is impossible to know the real effect of processes without consulting about them with key stakeholders. There are several methods to obtain the information necessary to model current AS-IS processes. These methods can be divided into two main types. The first type is based on document analysis, while the other is founded on receiving feedback from process stakeholders. Both methods are required to illustrate real processes. Document analysis should concern not only legal acts but also materials prepared on the regional and local levels, such as local regulations and instructions and resolutions. Interviews, questionnaires and workshops are the most common ways to consult with key stakeholders over the modelled BPMN diagrams.

It's worth noting that there are some tools[8] that enable one to synchronize business process models and legal regulations in XML format. These tools link the process to the paragraphs of the law in which they are defined. This facilitates maintaining traceability between the text of a law and a process model.

Process analysis

In the third step, processes are thoroughly analysed in terms of their legal, organizational and technical characteristics. Modelled AS-IS processes are also compared with their description in legislation.

Process analysis is subdivided into two major stages:
1) Process quality analysis.
2) Process efficiency analysis.

Within the first stage, process deficiencies are identified. Business process maps themselves can frequently show many problems that have not previously been observed.

One of the most commonly identified problems is process inconsistency. This is due to the fact that legislators drafting legal acts are very often not aware of how processes are executed in practice, in particular processes executed at local or regional levels. Another problem is complexity. Processes are often very complicated, so legal acts are full of details. Legislators are not able to control how changes introduced in one legal act affect other ones. Such process failures can be precisely identified during analysis of modelled processes.

The second stage – efficiency improvement – is more challenging. At the beginning, it is useful to look at processes from a wider perspective. It is recommended to prepare a map of related processes, which will permit the identification of interaction between different processes.

One of the commonly used techniques is reducing the duration of activities on the critical path. The other one is elimination of bottlenecks in processes. Public administration processes usually

[8] Visual Law and Process Modeller (VLPM) is an example of a tool that enables to automate the extraction of some information, analysis and law traceability (Ciaghi, Villafiorita & Mattioli, 2010).

suffer from redundancy. Citizens are obliged to provide information, which public administration either already possesses, or does not need in order to execute processes. BPMN analysis permits the identification of all documents, which are exchanged within the process itself or with other processes. Due to process analysis, it is possible to identify redundant documents and remove them.

Process reengineering

The goal of business process reengineering is to improve process performance in ways, such as maximizing quality and minimizing duration, cost and used resources. These parameters are interconnected, so it is difficult to optimise all of them simultaneously. As a result of process reengineering, TO-BE BPMN diagrams are designed.

There are some rules that can be used for process redesign and treated as best practices. The presented below rules are universal, in the sense that they are applicable within the context of any business process, followed from the procedural regulation.

1) Eliminate unnecessary tasks.
2) Move tasks to a more appropriate place.
3) Consider whether tasks may be executed in parallel.
4) Decrease work in progress by removing bottlenecks and making work flow smoothly.
5) Combine smaller tasks and divide larger tasks.
6) Eliminate physical constraints by applying ICT.

Process simulation

BPMN simulation is a very useful tool to compare different process variants in terms of the parameters mentioned above. The key goal of simulation is to compare AS-IS BPMN diagrams with TO-BE BPMN diagrams. BPMN simulation can be subdivided into four main stages:

1) Adapting BPMN diagrams to simulation needs.
2) Evaluation of process costs.
3) Definition of simulation scenarios.
4) Executing a simulation according to different scenarios.

First, for simulation purposes, simpler versions of the BPMN diagrams are designed. Simplified BPMN diagrams include only those process elements that are different in analysed variants of processes; to simplify the simulation activities which are the same in compared processes are not included in the BPMN diagrams. Moreover, it is important to decide about the points of a process where the flow of process splits up into different paths. In BPMN diagrams, such points are illustrated as gateways. To simulate processes, it is necessary to understand the parameters of the behaviour of such gateways. All information gathered for a simulation needs to be statistically significant.

In the second stage process costs are determined. To this end, the costs of each activity of the process are determined using the standard cost model, SCM (International SCM Network, 2005). In this model, the costs are calculated using the following formula:

SCM $=\sum_{i=1}^{n} C_i \, xP_i$, where:

i means the subsequent activity in the process;

n means the number of activities in the process;

Ci means the costs incurred in i-th activity in the process;

Pi means the multiple times of performing the i-th activity in the process during the year.

Ci is calculated using the formula:

Ci = (Hi x Si) + Ai, where:

Hi means the time of performing the i-th activity in the process, measured in hours;

Si means rate per hour for performing the i-th activity;

Ai means additional costs related to performing the i-th activity.

Pi is calculated using the formula:

Ni x Fi, where:

Ni means the number of enterprises performing the i-th activity;

Fi means the frequency of performing the i-th activity by a single enterprise.

Third, different simulation scenarios are established. Scenarios describe the simulation environment for processes. Within a scenario, the following parameters are set:

- simulation time (start, end, duration, time units, calendar),
- transactions[9] (number, timetable),
- resources (quantity, schedule).

The last stage is executing the simulation according to set scenarios. BPMN provides many different simulation reports. Statistics are gathered about process times, costs, resources and queues.

The most important value of the simulation is the possibility to assess alternative process variants as early as at the law-making activities. It is very important, because any change of the law is time-consuming and difficult to implement.

Review of the results

During this step, results of process simulation are analysed in order to evaluate whether the achieved effectiveness is sufficient. The effectiveness is measured, based on the level of Key Performance Indicators (KPI). These KPIs are time of processes, cost of processes and the use of resources. If the level of KPIs is not satisfied, the further reengineering is required.

Final recommendations

[9] Transaction is an event initiating process running.

If the KPIs achieved a satisfactory level, the final recommendation is submitted to legislators. The final report summarizes the results of all conducted analyses and presents different process variants, together with the pros and cons.

Updating information during the whole process of law-making

The presented method needs to be applied from the earliest stage of law-making, when the assumptions for the legal act are prepared. Due to the fact that the legislative process is multistage and the initial draft of a legal act is amended many times, it is necessary to apply this method at each stage of the law-making process. Application of this method permits the indication of consequences of the proposed amendments of analysed regulations. It is especially crucial to clearly show the results of the proposals made by politicians during the process of law-making.

Monitoring of implemented process

When the analysed piece of legislation enters into force, it does not mean the end of action. Reengineering of processes requires on-going activities. Monitoring and ex-post evaluation are the key parts of these activities. Analysis, based on the real data concerning executed processes, permit further process improvement.

4.2. The implementation of the presented method

One of the values of the presented method is its applicability in practice. However some steps need to be taken to implement this method within the law-making activities. Firstly, the business process analysts need to be involved in the legislative process. BPMN specialists should participate at any stage of the law-making process. During the legislative activities they would be responsible, not only for developing the BPMN diagrams from scratch but also, for modifying them according to the amendments introduced to the proposals of legal acts.

Secondly, lawyers and policy makers, who are currently the main actors of law-making process, should be familiarised with the basics of business process modelling. They should be able to understand the BPMN diagrams, which should not be very challenging, as the BPMN was developed to be understandable by all business users.

Apart from improving the qualifications, it would be necessary to use special software that would facilitate the business process modelling and simulation. One of the possible tools is a server software solution - iGrafx Enterprise Central. This software enables not only modelling and simulation of business processes, but also includes a process central repository. This repository enables team collaboration and provides functionality that enables individuals to publish, review and manage processes. It would be also very beneficial to have a tool similar to the mentioned Italian software – VLPM. This tool would help to keep traceability between processes and laws.

Implementing the presented method would require the amendments of law that regulates the legislative process. These regulations could be amended by application of the presented method.

Table 2 presents the roles of the participants of legislative process within the particular stages of the presented method. The tools that could support the work are indicated as well.

Table 2: The roles of the participants of legislative process within the particular stages of the presented method.

Stage of the presented method	**Leading role**	**Supportive role**	**Tools**
Process identification	Business process analysts Institutions responsible for drafting regulation	Participants of the process (citizens, businesses, governmental bodies, etc.)	IT tool to keep traceability between processes and laws
AS-IS process modelling	Business process analysts	Institutions responsible for drafting regulation Participants of the process (citizens, businesses, governmental bodies, etc.)	IT tool to model business processes.
Process analysis	Business process analysts	Institutions responsible for drafting regulation Participants of the process (citizens, businesses, governmental bodies, etc.)	IT tool to model business processes
Process reengineering	Business process analysts	Institutions responsible for drafting regulation Participants of the process (citizens, businesses, governmental bodies, etc.)	IT tool to model business processes
TO-BE process modelling	Business process analysts	Institutions responsible for drafting regulation	IT tool to model business processes
Process simulation	Business process analysts	-	IT tool to simulate business processes
Review of the results	Institutions responsible for drafting regulation	Business process analysts	-
Final recommendations	Institutions responsible for drafting regulation	Business process analysts	-

Updating analysis	Business process analysts Institutions responsible for drafting regulation	-	IT tool to model and simulate business processes
Monitoring of implemented process	Institutions responsible for regulation	-	IT tool to keep traceability between processes and laws

5. Case study

As a case study of application of the method proposed in Section 4, in this section we consider a process of registration of a civil law partnership in Poland. Civil law partnership is quite a popular legal form of business activity in Poland. It is often used for the business activity of such professionals as doctors, architects, or accountants. iGrafx Process Central 2011 was used as a tool for business process modelling and simulation. This tool is designed for experts and non-experts alike. It provides simulation, advanced visualization, analysis, modelling, and reporting.

Process identification.

In the first step, the process of registration of a civil law partnership in Poland was identified. It was not an easy task, because according to the Polish legislation, this process is set out in a number of acts of law and relevant implementing regulations. Moreover, on the part of public administration, three independent entities participate in the process: municipality offices, tax offices and branches of the Central Statistical Office. The regulations regarding the registration of a civil law partnership are supervised by various ministries, such as the Ministry of Economic Development, Ministry of Finance and others.

Process modelling

Within the second step the process has been modelled as AS-IS BPMN diagram (Fig. 5). During the analysis, the duration of individual activities was measured. In addition, in interviews with individuals involved in process implementation, information on the process has been gathered.

Originally, the civil law partnership registration process is comprised of four steps:

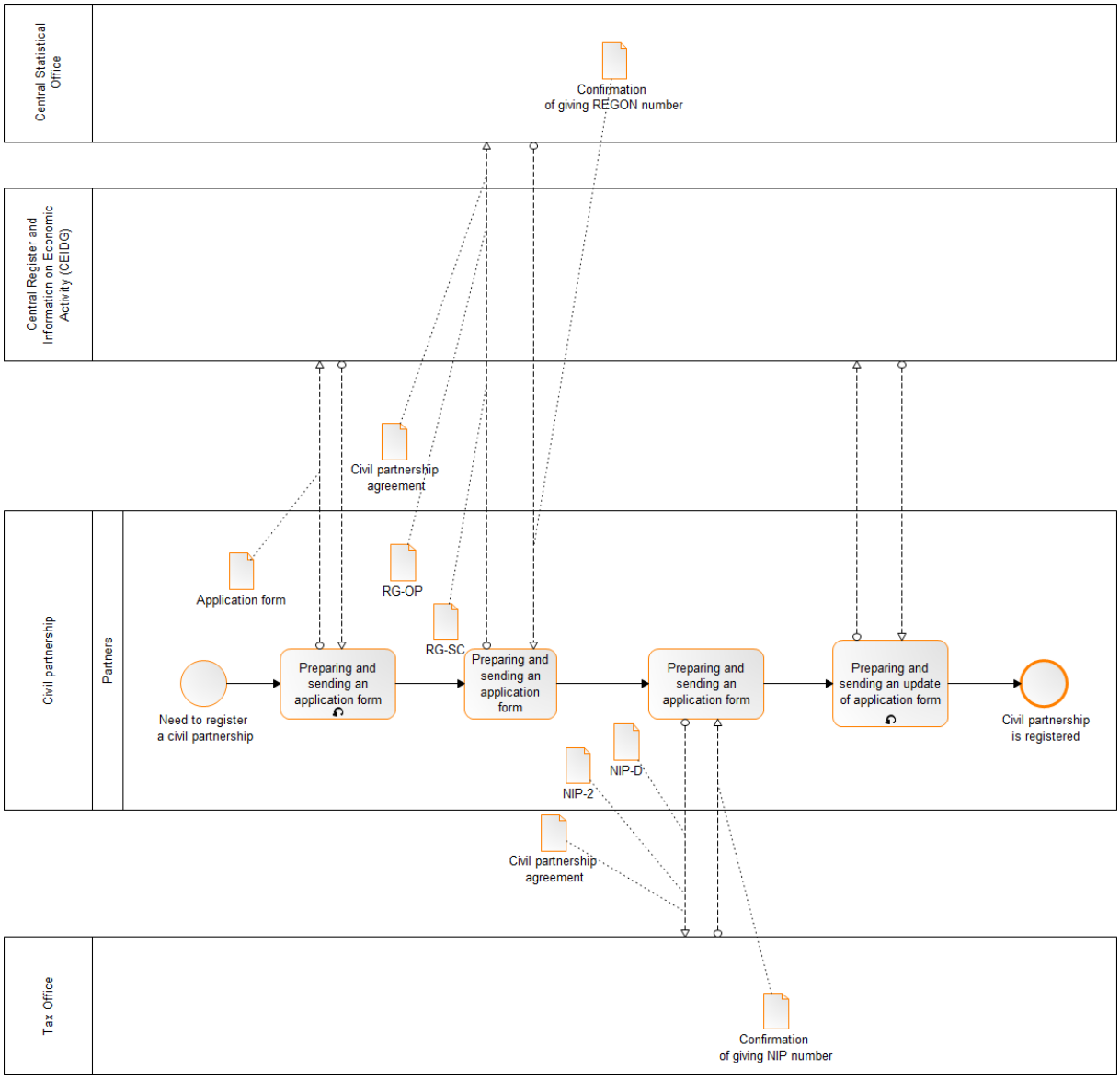
1) Each partner in a civil law partnership registers as sole proprietor. There are two registration methods available: electronically via the CEIDG[10] system or in municipality office.
2) On behalf of the entire partnership, one of the partners requests that the Central Statistical Office branch assign the REGON[11] (Statistical Identification Number) to the partnership. This activity requires a visit to the office.

[10] The Central Registration and Information on Economic Activity (abbreviated to CEIDG) is a register of enterprises operated by natural persons in the territory of Poland.

[11] The REGON number is required for statistical purposes.

3) On behalf of the entire partnership, one of the partners requests the Tax Office to assign the NIP[12] (Tax Identification Number) to the partnership. This activity requires a visit to the office.
4) The partners in the civil law partnership update their respective entries in the CEIDG system by entering the REGON and NIP numbers in the civil law partnership he or she is a partner in. There are two CEIDG system entry update methods available: electronically or in the municipality office.

Figure 5: AS-IS BPMN diagram



Process analysis

Process model in the form of BPMN permitted to identify the following problems:

[12] The NIP number is required for fiscal purposes.

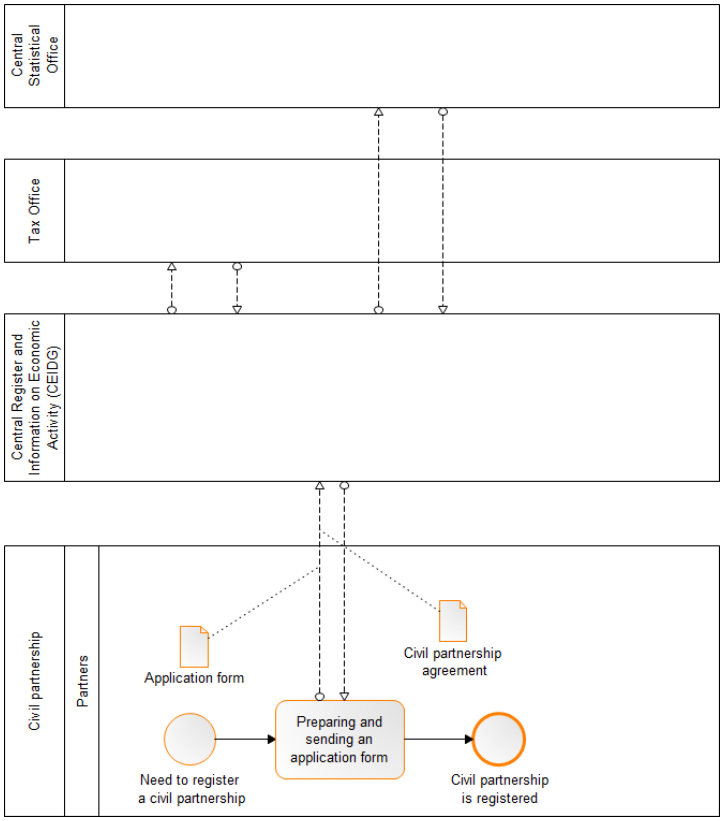
- the process is not effective from the point of view of entrepreneurs registering a civil law partnership,
- during process execution, public authorities do not exchange information,
- the analysis of documents exchanged in the process shows that the entrepreneurs must submit the same data to the public administration several times.

Process reengineering

Based on the results of analysis conducted in the previous step, the To-BE BPMN diagram was modelled (Figure 6). The following changes have been made:

- an entrepreneur submits only one application with all the information necessary to establish civil law partnership,
- the application is submitted electronically via the CEIDG system or in the municipality office,
- public administration exchanges the information between its units, without involving the entrepreneurs.

Figure 6: TO-BE BPMN diagram



Process simulation

The main goal of the simulation was to measure and compare the KPIs for AS-IS and TO-BE process. The most important KPI's were costs and duration time of the process.

Before starting simulation, the BPMN diagrams were simplified by removing these parts of process, which were the same in AS-IS and TO-BE versions of the process. Afterwards, the duration of

each activity was introduced into simulation model. Next, the simulation scenario was set. The scenario defines the simulation environment for the process and is based on the adopted assumptions. It was assumed that the number of cases would be the same both for AS-IS and TO-BE process. The detailed assumptions used for simulation, are presented below:

- cost of 1 hour of the entrepreneur's work amounts to PLN 24.80,
- cost of 1 hour of a public administration employee's work amounts to PLN 27.65,
- The following simulation scenario has been adopted:
- average number of applications to register a civil law partnership in one municipality office: 968,
- each application is submitted by 1 applicant,
- simulation duration, 1 year = 264 working days,
- working time: 8 working hours.

Based on the adopted scenario, the simulation was executed using iGrafx Process Central 2011.

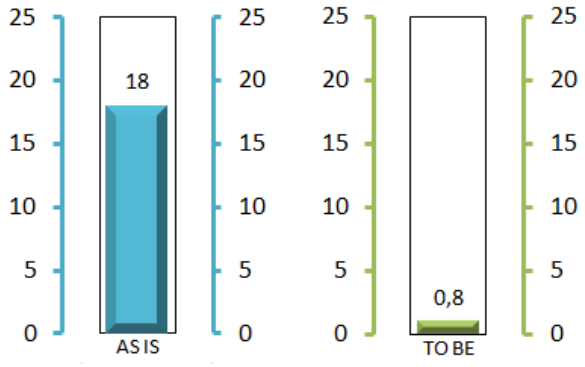
The results of the performed process simulation are presented in Table 1.

Table 3: Simulation results

		AS IS	**TO BE**
Process duration	Min (days)	13.07	0.51
	Average (days)	17.94	0.83
	Max (days)	22.94	1.20
Average cost	Partners	PLN 224.67	PLN 66.77
	CEIDG	PLN 98.37	PLN 61.75
	Central Statistical Office	PLN 63.32	PLN 0.00
	Tax Office	PLN 63.47	0.00
	Total	PLN 435,430.91	PLN 124,402.43

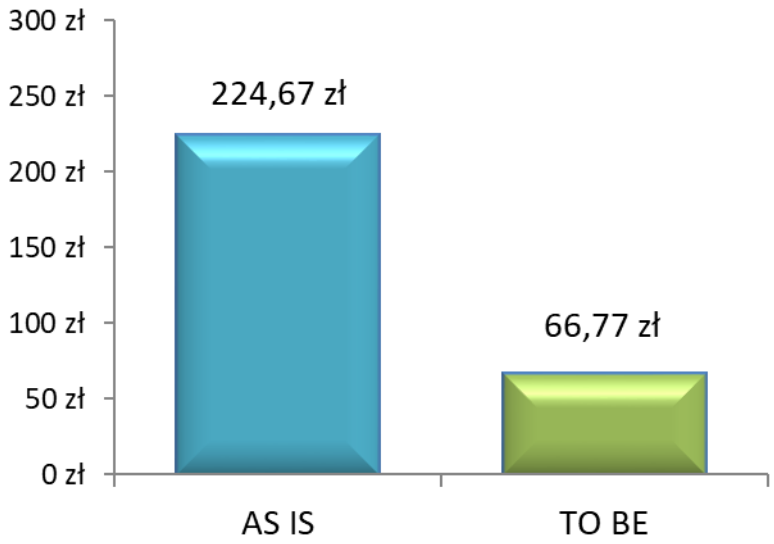
The results of simulation shows that the registration of a civil law partnership would take, on average, one day, after implementation of the proposed changes, instead of 18 days. (Figure 7).

Figure 7: Average duration of civil law partnership registration



The proposed process changes would also reduce costs incurred by entrepreneurs, in relation to the registration of civil law partnership (Figure 8). In the TO-BE version, the registration costs incurred by entrepreneurs are by 70% lower than in the current process variant.

Figure 8: Average costs of registration of a civil law partnership incurred by partners (PLN)



The simulations performed confirmed that the proposed process changes considerably improve the efficiency of the civil law partnership registration process. The improvement of efficiency pertains, not only to the ratios related to the process carried out by enterprises, but will also cause the drop of costs incurred by the public administration.

6. Conclusions

As shown in this paper, application of BPMN to legislative processes could positively affect the quality of law-making. We believe that our method could contribute to solve two important issues of legislation – poor quality and inefficiency. The application of this method could result in a reduction of failures in legislation. This would significantly limit the need for law amendments in the future. This would be especially important at the present time, when the number of legal acts

adopted all over the world is constantly growing. The presented method could also facilitate the process of law amendment. Due to application of BPMN diagrams, it would be easier to maintain consistent law.

Moreover, we have devised a method which could enhance the efficiency of the law. Due to process analysis and reengineering, it is possible to decrease process duration, costs and used resources. The key part of our method is BPMN simulation, which permits legislators to compare different variants of business processes that will follow on from a law and choose the ones that best meet their adopted objectives. Simulation could improve awareness of legislators of the law's influence on regulated business processes. Most processes in public administration are executed at the local or regional levels. Efficient processes without failures could be easily implemented by local and regional public administration. These efficient processes, defined by legal acts, could also facilitate implementation of e-government services.

The method presented should be practised at each stage of legislative processes. Any changes of law, proposed during a legislative process, need to be analysed in terms of their influence on processes. Legislators should be aware of the consequences of their decisions.

Future work could explore how AI, particularly NLP, could automate some steps of the presented method. The identification of processes included in the draft of a legal act and business process modelling could be supported by NLP tools. AI could also facilitate the monitoring of the implemented processes.

Moreover, future studies on this method should be focussed on social benefits and social costs, which both play important roles in implementing public processes. Further studies should also concentrate on application of the presented method for use in implementing business processes in the cloud in the Software as a Service model. One process implementation will then serve a large number of administrative units, so that the problem of law quality, followed by process quality, will be of multiplied importance.

References

Anand, A., Wamba, S. F., & Gnanzou, D. (2013, June). A Literature Review on Business Process Management, Business Process Reengineering, and Business Process Innovation. In Workshop on Enterprise and Organizational Modeling and Simulation (pp. 1-23). Springer Berlin Heidelberg. http://dx.doi.org/10.1007/978-3-642-41638-5_1

Aguilar-Saven, R. S. (2004). Business process modelling: Review and framework. International Journal of production economics, 90(2), 129-149. https://doi.org/10.1016/S0925-5273(03)00102-6

Alotaibi, Y. (2014). Business process modelling challenges and solutions: a literature review. Journal of Intelligent Manufacturing, 1-23. https://doi.org/10.1007/s10845-014-0917-4

Biasiotti, M., Francesconi, E., Palmirani, M., Sartor, G., & Vitali, F. (2008). Legal informatics and management of legislative documents. Global Center for ICT in Parliament Working Paper, 2.

Chinosi, M., & Trombetta, A. (2012). BPMN: An introduction to the standard. Computer Standards & Interfaces, 34(1), 124-134. https://doi.org/10.1016/j.csi.2011.06.002

Ciaghi, A., & Villafiorita, A. (2010, November). Improving Public Administrations via Law Modeling and BPR. In International Conference on e-Infrastructure and e-Services for Developing Countries (pp. 69-78). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-23828-4_7

Ciaghi, A., & Villafiorita, A. (2012). Law Modeling and BPR for Public Administration Improvement. In Handbook of Research on E-Government in Emerging Economies: Adoption, E-Participation, and Legal Frameworks (pp. 391-410). IGI Global. http://dx.doi.org/10.4018/978-1-4666-0324-0.ch019

Ciaghi, A., Mattioli, A., & Villafiorita, A. (2010). A tool supported methodology for BPR in Public Administrations. International Journal of Electronic Governance, 3(2), 148-169. http://dx.doi.org/10.1504/IJEG.2010.034093

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and The Committee Of The Regions. (2012). Better Governance for the Single Market.

Hammer, M., Champy, J. (1993). Reengineering the corporation. A manifesto for business revolution. Harper Business, New York.

Hlupic, V., de Vreede, G., & Orsoni, A. (2006). Modelling and simulation techniques for business process analysis and re-engineering. International Journal of Simulation, 7(4), 1-8.

Indulska, M., Green, P., Recker, J., & Rosemann, M. (2009). Business process modeling: Perceived benefits. In Conceptual Modeling-ER 2009: 28th International Conference on Conceptual Modeling, Gramado, Brazil, November 9-12, 2009. Proceedings 28 (pp. 458-471). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-04840-1_34

International SCM Network, (2005). International Standard Cost Model Manual; Measuring and reducing administrative burdens for businesses.

Jansen-Vullers, M., & Netjes, M. (2006, October). Business process simulation–a tool survey. In Workshop and Tutorial on Practical Use of Coloured Petri Nets and the CPN Tools, Aarhus, Denmark (Vol. 38).

Johansson, L. O., Wärja, M., & Carlsson, S. (2012). An evaluation of business process model techniques, using Moody's quality criterion for a good diagram. In BIR12. CEUR Workshop Proceedings, CEUR-WS. org (Vol. 963).

Moody, D. (2007). What makes a good diagram? improving the cognitive effectiveness of diagrams in is development. In Advances in information systems development (pp. 481-492). Springer US. https://doi.org/10.1007/978-0-387-70802-7_40

Niehaves, B., & Plattfaut, R. (2010, August). From bureaucratic to quasi-market environments: on the co-evolution of public sector business process management. In International Conference on Electronic Government (pp. 387-399). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-14799-9_33

OECD Public Governance and Territorial Development Directorate. (2012). Recommendation of the council on regulatory policy and governance, 35.

Recker, J. (2012, September). BPMN Research: What We Know and What We Don't Know. In International Workshop on Business Process Modeling Notation (pp. 1-7). Springer Berlin Heidelberg. http://dx.doi.org/10.1007/978-3-642-33155-8_1

Recker, J., Rosemann, M., Indulska, M., & Green, P. (2009). Business process modeling-a comparative analysis. Journal of the Association for Information Systems, 10(4), 1. http://dx.doi.org/10.17705/1jais.00193

Seipel, P. (2004). IT Law in the Framework of Legal Informatics. Scandinavian Studies in Law, 47, 31-47.

Sharma, S., Gamoura, S., Prasad, D., & Aneja, A. (2021). Emerging Legal Informatics towards Legal Innovation: Current status and future challenges and opportunities. Legal Information Management, 21(3-4), 218-235. https://doi.org/10.1017/S1472669621000384

Sharma, S. K., Shandilya, R., & Sharma, S. (2023). Predicting Indian Supreme Court Judgments, Decisions, or Appeals: eLegalls Court Decision Predictor (eLegPredict). Statute Law Review, 44(1), hmac006. https://doi.org/10.1093/slr/hmac006

Sherwin, M. (2014). Better regulation: What is it? Are we achieving it?. Public Sector, 37(3), 22.

Stemberger, M. I., & Jaklic, J. (2007). Towards E-government by business process change—A methodology for public sector. International Journal of Information Management, 27(4), 221-232. https://doi.org/10.1016/j.ijinfomgt.2007.02.006

van der Aalst, W. M. (2013). Business process management: a comprehensive survey. ISRN Software Engineering, 2013. http://dx.doi.org/10.1155/2013/507984

Vergidis, K., Tiwari, A., & Majeed, B. (2008). Business process analysis and optimization: Beyond reengineering. IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews), 38(1), 69-82. http://dx.doi.org/10.1109/TSMCC.2007.905812

Voermans, W. J., Van Wijk, R., & Fokkema, W. (2011). Free the legislative process of its paper chains: IT-inspired redesign of the legislative procedure. Available at SSRN 1855595. http://dx.doi.org/10.2139/ssrn.1855595

White, S. A. (2000). BPMN fundamentals. Retrieved from http://www. bpmn. org/Documents/BPMN Fundamentals. pdf.

White, S. A. (2004). Introduction to BPMN. IBM Cooperation, 2(0), 0

Yin, R. K. Case study research: Design and methods. Sage publications. Volume 5, (2009).

About the Author

Szymon Mamrot

Szymon Mamrot is a researcher at the Łukasiewicz - Poznań Institute of Technology, Poland where he is a Deputy Head of the Digital Economy Research Group. His research interests include e-government, e-justice, digital cross-border services. He cooperates with Polish central and local public administrations. Szymon Mamrot is also a Single Digital Gateway Coordinator in Poland. He received his Ph.D. from Poznań University of Economics and Business in 2018.

