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TOWARDS THE PERFORMANCE ANALYSIS OF THE MACEDONIAN JUDICIARY SYSTEM

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Abstract
Improving the efficiency and functioning of the justice system, as well as enabling a better implementation of the international legal instruments, pointed out by the Council of Europe concerning efficiency and fairness of justice at a national level, are the cornerstones of the ongoing process of fundamental reforms that is currently taking place within the judicial system in the Republic of North Macedonia. In that context, the paper focuses on improving the effectiveness of Macedonian courts by proposing a predictive model suitable for performance evaluation, based on the utilization of the class of Deterministic and Stochastic Petri Nets (DSPNs). Grounded on the approach of the normative analysis, the aim of the paper is to propose a modeling framework appropriate for conducting performance analysis of the Macedonian judiciary system vis-à-vis the court cases' life cycle. The proposed framework can be seen also as a methodology for performance analysis of the ACCMIS system, the actual management information system that underpins the functioning of Macedonian courts.

Keywords: judiciary system, court efficiency, ACCMIS, performance modeling, Deterministic and Stochastic Petri Nets, North Macedonia

INTRODUCTION

Making the courts more productive and easily operable, i.e. more efficient is one of the most significant aims of all recent reforms vis-à-vis the judicial system in the Republic of North Macedonia. In addition, the use of performance measures for, or by, the judicial branch to analyze the degree to which courts in the country run efficiently and effectively becomes more and more evident since they are the only means to evaluate the overall progress of the reforms. The fundamental question is "How our courts perform?" In reality, practical advice and/or specific guidance for how to carry out performance evaluation for courts and/or judiciary systems is still very limited today, compared to the voluminous commentary on the myriad obstacles and challenges to its implementation (Hammergren 2014).

According to the Global Measures of Court Performance (2018), which is an integral part of the International Framework for Court Excellence (IFCE), the most compelling performance metrics include (a) Court user satisfaction; (b) Access fees; (c) Case clearance rates; (d) On-time case processing; (e) Duration of pre-trial custody; (f) Court file integrity; (g) Case backlog; (h) Trial date certainty; (i) Court employee engagement; (j) Compliance with court orders; and (k) Cost per case.

The duration of court cases is, without any doubt, a critical performance measure tightly associated with the court effectiveness and the notion of on-time case processing. It depends on a number of objective and subjective factors, including the number of steps of the court procedure, the availability of human and financial resources, the quality of court case management strategies and policies designed to deal with the delay of court cases, the IT support, and alike. If the judicial system cannot handle the number of pending cases, delays occur, and overdue cases imply further delays. The longer the court procedure, the greater the costs incurred, both direct (court costs, attorney fees) and indirect (time spent, loss of income, bribery, and corruption).

This study is an attempt to address court effectiveness and on-time processing from an 'engineering' viewpoint. The basic premise is the fact that the court processing of cases is a purely stochastic process, including a plethora of parameters, related to possible states and timed transitions from one to another state. As such, it can be modeled using some of the existing mathematical formalisms, e.g. the stochastic Petri Nets. The resulting model can provide a powerful semantics for carrying out simulations in order to gain significant insights into the judiciary system dynamics.

The paper is organized as follows. In the next section, we introduce the notions of performance and efficiency and put the focus on these *vis-à-vis* the Macedonian judiciary system. In Section 3, the ACCMIS system is described briefly. The class of Deterministic and Stochastic Petri Nets, used for modeling purposes, is presented briefly in Section 4. Section 5 focuses on the proposed performance model of the Macedonian judiciary system. Section 6 concludes.

PERFORMANCE VS EFFICIENCY

One of the crucial questions worth to be answered vis-à-vis this study is what is the difference between the terms 'performance' and 'efficiency'. 'Performance' is the measurement of the quality of the output, whilst 'efficiency' is related to the effort made in relation to the output attained (Palmer 2017). According to Griepenburg (2017), 'performance' is doing it right, whilst 'efficiency' is doing it fast with a minimum of resources.

The statistical data found in the series of documents issued by the Macedonian Supreme Court, which are based on the assessment of Macedonian courts' annual reports from 2006 to 2017 (SCoRoNM 2019), include the following performance indicators (IHR 2019):

- The number of old court cases that are taken over from the previous year;
- The number of newly accepted court cases during the actual year;
- The number of solved court cases during the actual year;
- The number of unsolved court cases during the actual year;
- The number of 'absolutely efficient courts'[118];
- The number of 'relatively efficient courts'[119];
- The number of 'inefficient courts'[120].

Obviously, the available statistical data do not include explicit information about the actual duration of court case processing, i.e. the average duration per court case. More specifically, there are no relevant data needed to draw a conclusion whether and how the processing of court cases, altogether, approaches to the criterion of 'judging in a reasonable time slot', as a single measure for assessing the court efficiency.

It is also worthy to mention that the results obtained about the judiciary system efficiency are quite obscure, due to the political influence and disrupted independence, which yields in a low level of quality and citizen's distrust in the institutions of the judicial system (MoJ 2017, 4).

According to the 'Draft Strategy for Reforming the Judicial Sector for the Period 2017-2022 with an Action Plan', the strategic goals of the judiciary reformation in the country include (MoJ 2017, 10–32): (1) Independence and impartiality; (2) Quality; (3) Responsibility; (4) Efficiency; (5) Transparency; and (6) Access to justice. Three of these strategic goals are directly related to the performances, or efficiency, of the judiciary system in the country. These include:

(1) *Independence and impartiality*: The impartiality has been seriously jeopardized by the attempts to avoid the usage of the electronic system for automatic scheduling of court cases, which raises the necessity of urgent investigation of the ways of its usage (MoJ (a) 2017, 12); In this context, one of the strategic directives is to provide means for

[118] A court is considered an 'absolutely efficient court' if the court cases remaining from the previous year were solved in a time period up to 3 months.

[119] A court is considered a 'relatively efficient court' if the court cases remaining from the previous year were solved in a time period up to 6 months.

[120] A court is considered an 'inefficient court' if the court cases remaining from the previous year have not been solved in a time period up to 12 months.

scheduling of court cases without any external influences, using the ACCMIS software system; This is considered as being one of the most significant measures for realization of the postulates that are considered as strategic goals of the Reformation (MoJ(a) 2017, 14).

(2) *Efficiency*: Despite the fact that the rate of completely resolved cases in most of the courts in the country is 100%, the overall duration of court cases from their initiation to their closure is critical, especially in a number of old cases (MoJ 2017, 20); One of the strategic directives regarding this aspect is to monitor the judiciary system efficiency through the indicators that are included in the EU Justice Scoreboard (a list of results), proposed by the European Commission for the Efficiency of Justice (CEPEJ), and other relevant international standards (MoJ 2017, 21; EC 2018, 10–16).

(3) *Transparency*: In many relevant international reports an insufficient application of the system for announcing judicial decisions has been pointed out, as well as the absence of searching tools; An obstacle for a consistent implementation of the transparency and inclusion of the public sector in the functioning of the judicial system is the absence of an efficient system for acquisition, processing, and analysis of statistical data about the court functioning; The methodology for obtaining judicial statistics is not applied to practice, because the software to support such activities is non-functioning; There is a need for implementing mechanisms for controlling the application of the software system for managing the flow of court cases, as one of the strategic directives in this aspect (MoJ 2017, 21–23).

Having minded the previously elaborated strategic goals, it is evident that the realization of all of these directives can be achieved solely by an implementation of a dedicated management information system (MIS) that will provide automatization of the processes inherent to the judiciary system functioning. In North Macedonia, such MIS is the ACCMIS system.

THE ACCMIS SYSTEM

The Automated Court Case Management Information System (ACCMIS) has become operational in all 33 courts in North Macedonia back in 2010. It has replaced the manual case processing, thus enabling the courts to become both more efficient and transparent. By focusing entirely on the flow management of court cases and the automation of court administration tasks, ACCMIS has significantly improved the country's judicial system.

ACCMIS is "a robust, full-featured system which automates and tracks all aspects of the case life cycle, from initial filing through disposition and appeal as to each individual party for Criminal, Juvenile, Minor Offenses (Traffic Violations), Civil, Small Claims, etc." (EduSoft 2019). It is a complete software solution for all professionals involved in the judiciary system, ranging from clerks to judges, and everyone in between.

The following are considered the most pertinent features of ACCMIS:

- It is highly scalable, covering all aspects of managing court cases, for all types of courts, encompassing different organizational structures;
- It provides online, real-time services 24/7, during the whole year;
- It provides increased confidentiality, integrity, and security;
- It provides possibilities for generating various kinds of reports;
- It significantly reduces repetitive tasks;
- It greatly enhances the quality of data;
- It provides enhanced statistics and monitoring.

Regarding the specific functionalities, ACCMIS offers full support to the following activities:

- Registering of cases;
- Random assignment of cases;
- Movement of court cases;
- Built-in document management system (judgments, minutes, orders, letters, summons, deliveries of documents);
- Registering of external files;
- Registering of appeals and extraordinary remedies;
- Creating statistical data warehouse for evaluation of judges;
- Registering of external files.

The effect of the ACCMIS on the Macedonian court efficiency is significant, especially on the Primary courts. After the deployment of the ACCMIS in 2010, a dramatic increase in the percentage of solved cases has occurred, and the number of solved cases prevails over the unsolved cases (Fig. 1).

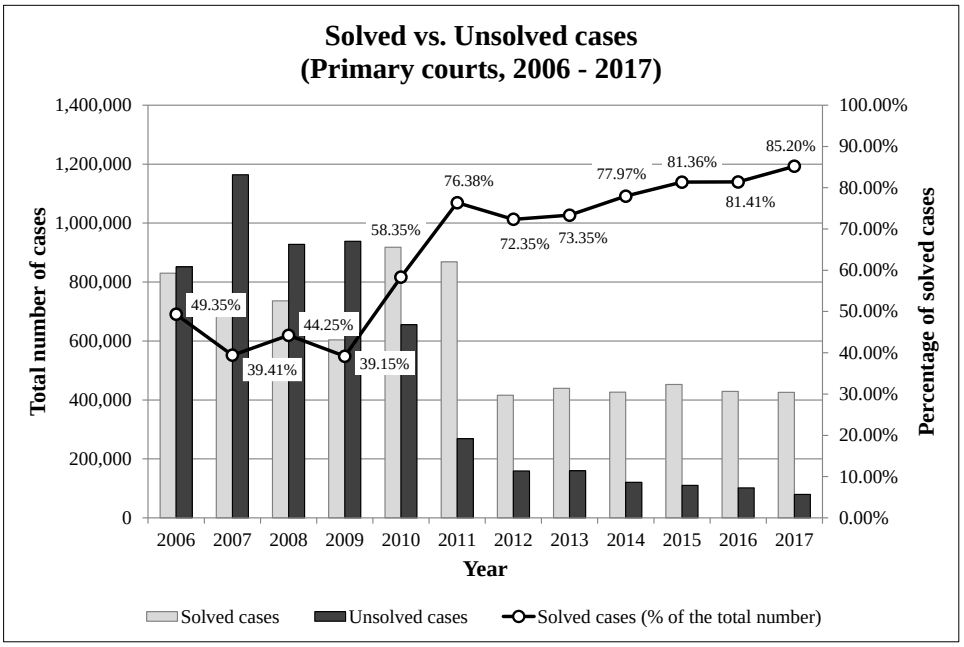

Fig. 1. Solved vs. unsolved cases with Primary courts (2006 - 2017)

As a result, the number of absolutely efficient courts has considerably increased, reducing the number of inefficient courts to zero during recent years (Fig. 2).

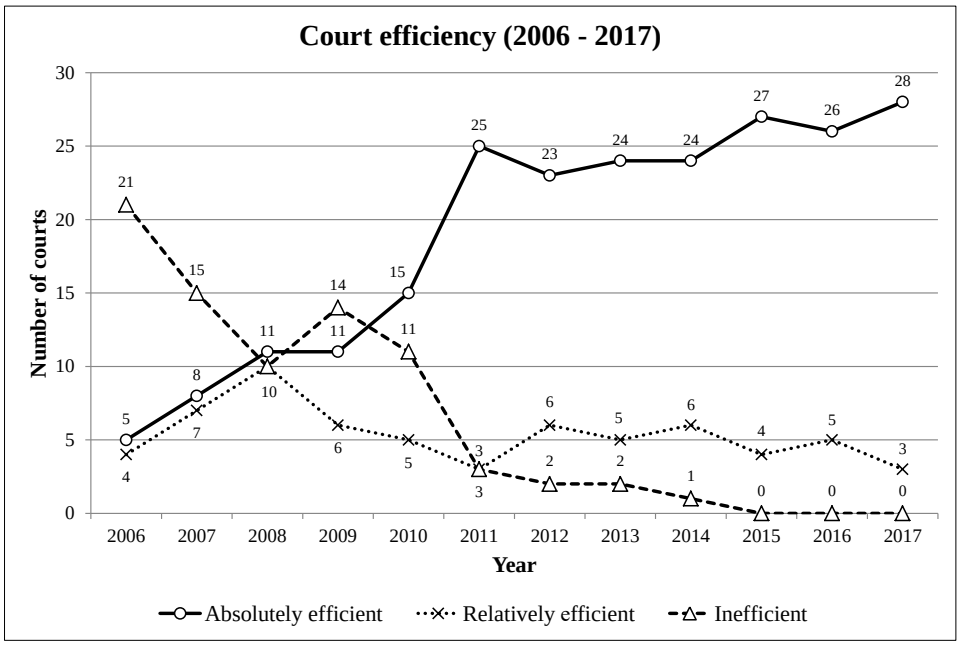

Fig. 2. The number of absolutely efficient, relatively efficient, and inefficient courts (Primary courts and Courts of appeals), from 2006 to 2017

The ACCMIS system is a highly valuable tool that has contributed significantly in the process of implementation of the Strategy for reforming the judiciary system 2017–2022, and also to the fulfillment of the tasks intended to be carried out by the Ministry of Justice and the Judicial Council in terms of establishing EU standards for an independent and efficient judicial system in the country.

THE CLASS OF DETERMINISTIC AND STOCHASTIC PETRI NETS

Deterministic and Stochastic Petri Nets (DSPNs) are recognized as a widely-known tool for performance analysis of distributed systems, which utilizes the graphical notation introduced by ordinary Petri Nets (PNs). They have been introduced as an extension to the class of Generalized Stochastic Petri Nets (GSPNs) (Ajmone Marsan & Chiola 1987). In GSPNs some transitions are timed, whilst others are immediate. Random, exponentially distributed firing delays are associated with timed transitions, whereas the firing of immediate transitions takes place in zero time, with priority over timed transitions. In addition, the selection among several possibly conflicting enabled immediate transitions is made by utilizing their corresponding firing probabilities. In general, immediate transitions are used for modeling instantaneous actions or logical actions (typically choices), whilst timed transitions with an exponentially distributed delays are used for modeling random durations of activities (events) within the GSPN model. DSPNs extend GSPNs by utilizing timed transitions with deterministic (constant) firing delays, which are used

for modeling activities (events) within the DSPN model that last for a given (pre-defined, deterministic) time.
The analysis of a DSPN model can be two-fold: (1) qualitative: performed by studying the structural characteristics of the underlying Petri Net; (2) quantitative: performed by computing the steady-state (stationary) and the transient (time-dependent) probability distributions of the underlying Generalized Semi-Markov Process, equivalent to an actual DSPN model (Ciardo & Lindemann 1994; Lindemann 1998; Lindemann & Thümmler 1999).
In this particular case, the class of DSPNs has been chosen as a modeling formalism, mainly for several reasons: (1) DSPNs are quite often used for modeling and evaluation of systems describing flows of objects (i.e. court cases); (2) In order to keep the model structure as simple as possible, the durations of all events are supposed to be random times, exponentially distributed, i.e. the times between events conform the Poisson process where events occur continuously and independently at constant average rates; (3) Since all legal terms, which are expressed in number of days, represent pre-defined, constant time periods, they are all modeled using deterministic transitions; (4) There are multiple dedicated software packages today, like DSPNexpress® or TimeNET®, offer both modeling and numeric simulation/evaluation of DSPNs.

DSPN MODEL OF THE MACEDONIAN JUDICIARY SYSTEM

The DSPN-based performance model we propose encompasses all important stages of the court cases' life cycle, supported by the ACCMIS system, including: (1) Acceptance/Registration of cases; (2) Assignment of cases to judges; (3) Completeness checking of the lawsuit; (4) Sending the lawsuit to the defendant; (5) Reception of the response to the lawsuit application; (6) Pre-trial activities; (7) Trial activities; and (8) Announcement of the verdict.
What follows is a series of DSPN sub-models that describe the civil procedure, i.e. the processing of a single civil case in an arbitrary Macedonian Basic court.
Figure 3 depicts the DSPN segment that models the process encompassing all the steps from lawsuit preparation (a token in the place *P_lawsuit_prep_start*) until the arrival of the court case in the court registry office (place *P_registry_office*). The lawsuit preparation process takes arbitrary time, exponentially distributed, and specified by the rate λ (exponential transition *T_lawsuit_prep*). After finishing, the lawsuit can be submitted to the court in two ways: either directly (firing of the immediate transition *T_submit_directly*, with a probability p_{DIRECTLY}), or via post office system (firing of the immediate transition *T_submit_via_post*, with a probability $1 - p_{\text{DIRECTLY}}$). If submitted by post, the arrival of the lawsuit to the court's reception office lasts for an arbitrary time, exponentially distributed with a parameter σ (exponential transition *T_post_office*). After arriving at the court reception office, the lawsuit resides there for an exponentially distributed time (exponential transition *T_reception_office*, with a firing rate δ), before it reaches the court registry office.
In the court registry office (a token in the place *P_registry_office*), the court case is being registered in the ACCMIS system within an exponentially distributed time $1/\varphi$ (exponential transition *P_accmis*). The ACCMIS system then automatically

allocates the case to the next judge (a token in the place *P_Jk*, $k = 1, \ldots, M$; M is the total number of judges comprising the Department of Civil Law), according to the Round Robin assignment scheme (Fig. 4).

Once a court case is being allocated to a particular judge, it takes an arbitrary time $1/\varsigma$, exponentially distributed, for a judge to check out the completeness of the lawsuit application (Fig. 5). If it is not complete, and if it was submitted by the plaintiff's lawyer, the lawsuit application is being rejected. However, if it is not complete, but it was submitted by the plaintiff personally, then the lawyer allows three days for the plaintiff to get additional copies, or eight days for it to be corrected and/or completed by supplementing new additions. If the plaintiff doesn't get additional copies within three days, the lawsuit application is being rejected. If the plaintiff doesn't make corrections and/or he/she doesn't complete the lawsuit application with new additions within eight days, it is being considered withdrawn. After all necessary corrections and/or additions are made to the lawsuit application within the legal time slot, the judge checks it out once again within a time $1/\pi$, exponentially distributed. If it is still incomplete, it is being rejected. Otherwise, the court procedure continues.

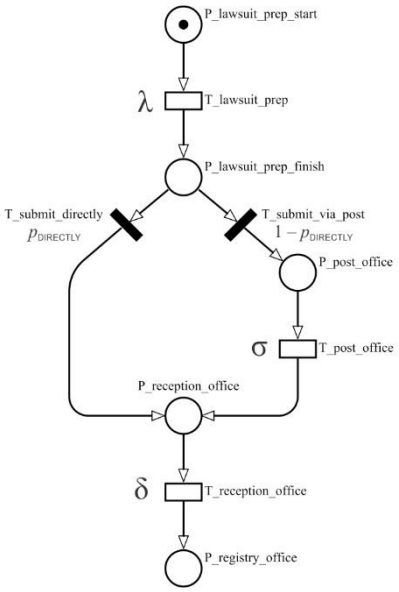

Fig. 3. GSPN sub-model of activities ranging from the lawsuit preparation to the acceptance of the lawsuit by the court reception and court registry offices

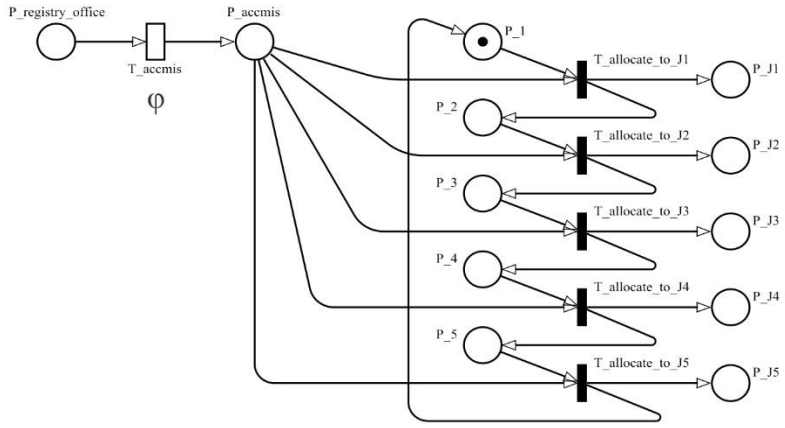

Fig. 4. GSPN sub-model of court activities found within the court registry office, including the automatic assignment of the case to the next judge

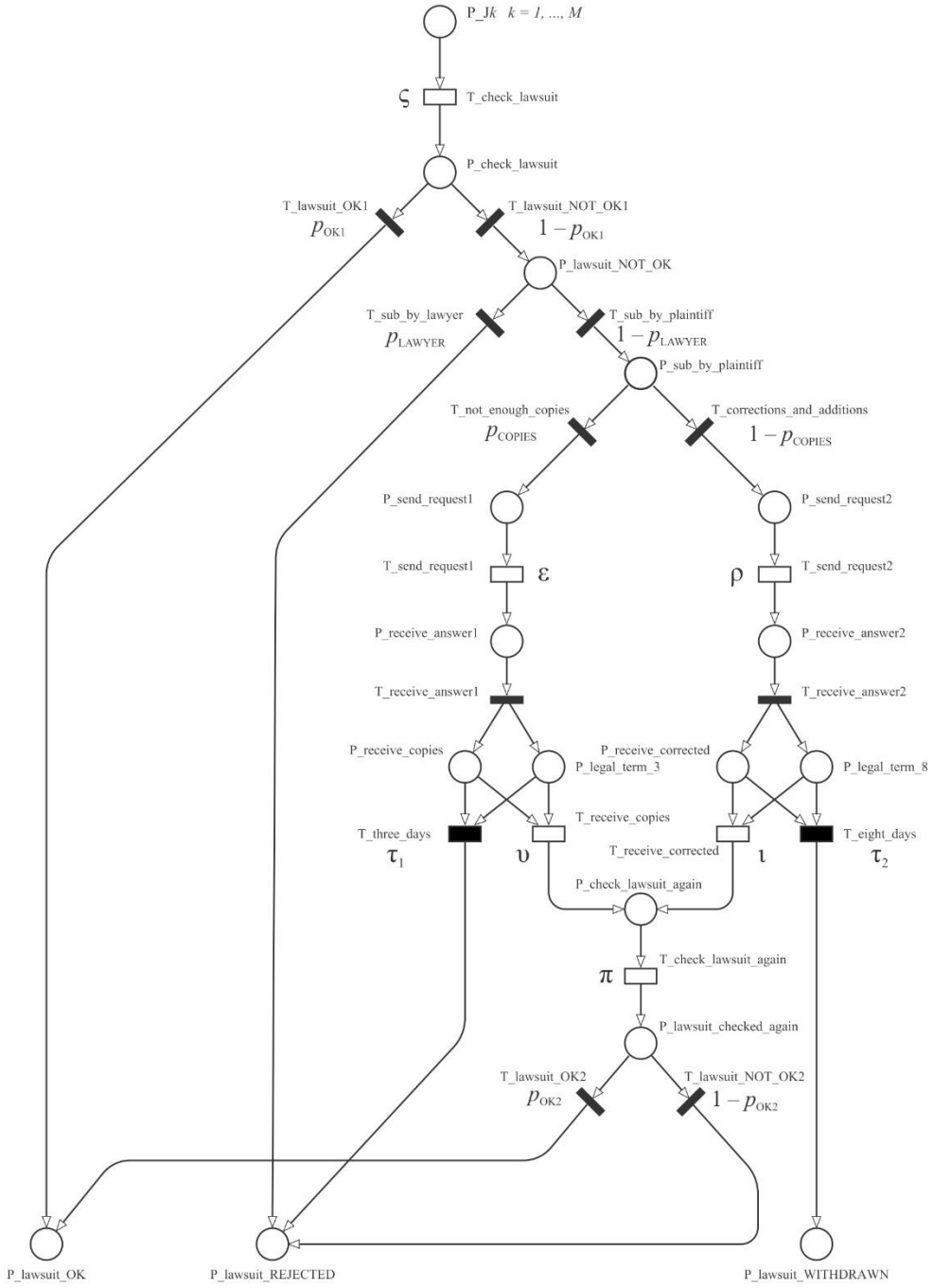

Fig. 5. DSPN sub-model of court activities being undertaken by the judge from the moment of a case assignment, including lawsuit application checking

The valid lawsuit application is then sent to the defendant along with a court summon to respond to it, within a time 1/φ, exponentially distributed (Fig. 6). The

legal terms to wait for a response are either eight days (τ_3), or fifteen days (τ_4), depending on the case.

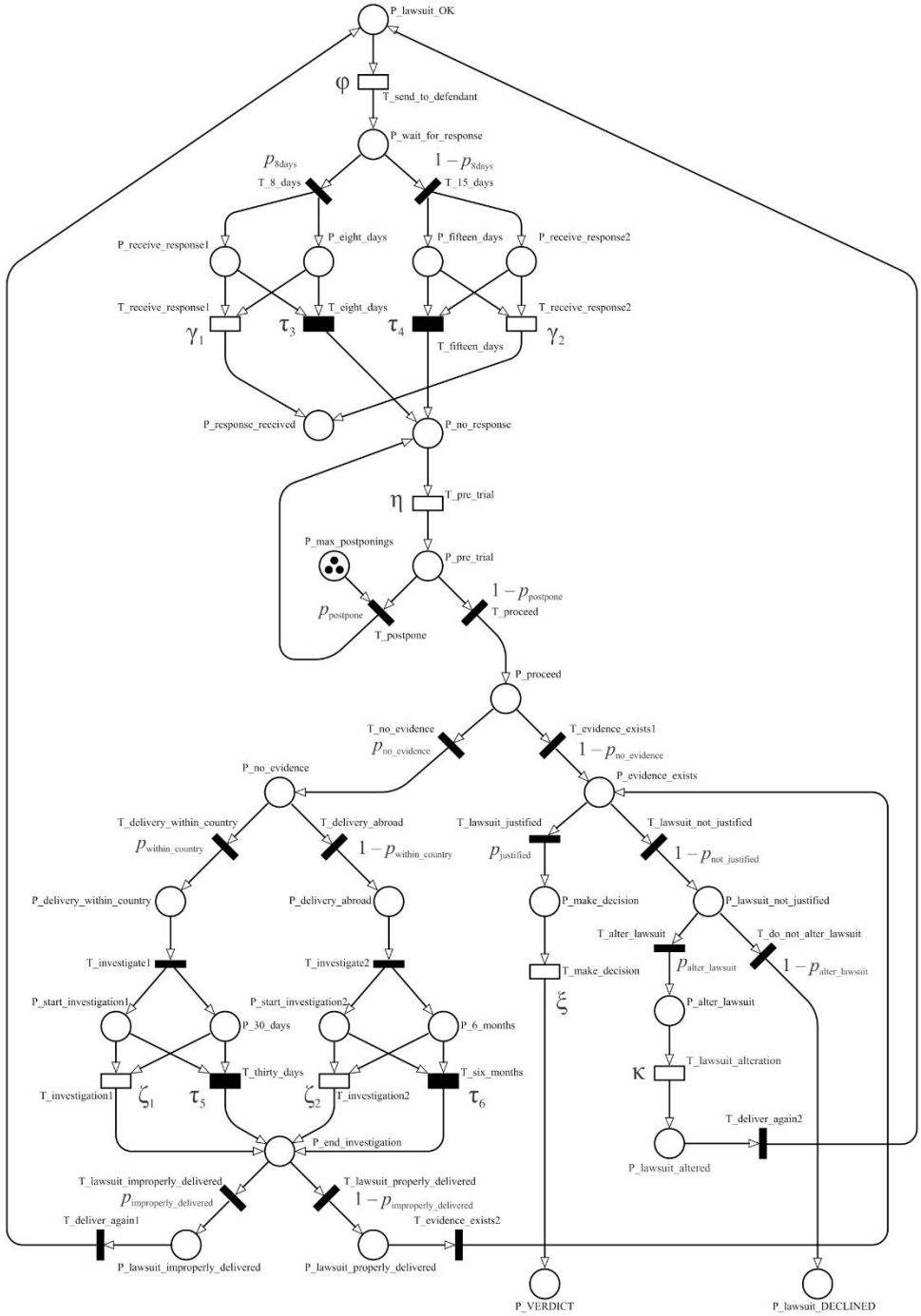

Fig. 6. DSPN sub-model of court activities including sending the lawsuit to the defendant and pre-trial activities when there is no response to the lawsuit application

If there is no response from the defendant, the judge schedules a pre-trial session. If there is no evidence of the lawsuit application delivery, the judge allows additional time for an investigation: up to 30 days if the delivery was in the country (τ_5), or up to six months if the delivery was in a foreign country (τ_6). If the investigation shows that the lawsuit was improperly delivered, it is going to be delivered again. If there is evidence of a properly delivered lawsuit application, the judge will announce a verdict, if the lawsuit application is justified, or he/she will decline it if it was not justified, and the plaintiff doesn't want to alter it. If the lawsuit application is not justified, and the plaintiff wants to alter it, then the altered one is sent again to the defendant. Figure 7 describes the activities when a valid response to the lawsuit application is being received.

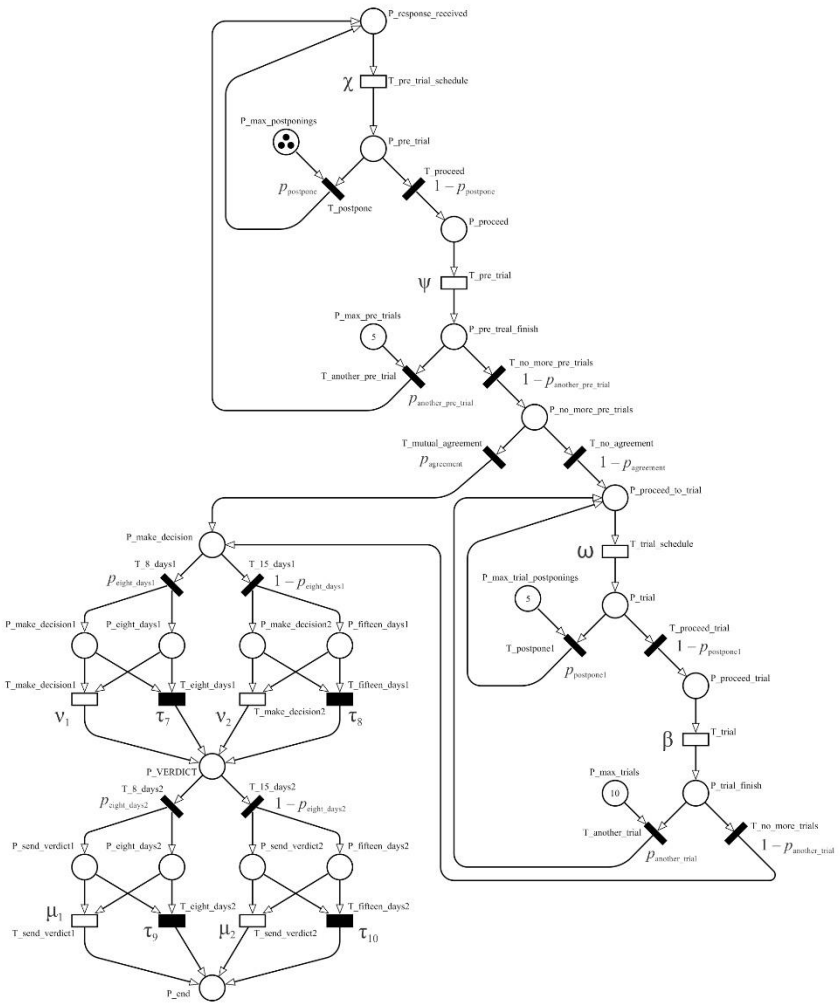

Fig. 7. DSPN sub-model of pre-trial and trial activities following the reception of a response to a lawsuit application

The sub-model showed in Fig. 7 allows scheduling a maximum of five pre-trial sessions (place *P_max_pre_trials*), and a maximum of three pre-trial postponed sessions (place *P_max_postponings*). It also allows scheduling a maximum of 10 trial sessions (place *P_max_trials*), and a maximum of five trial postponed sessions (place *P_max_trial_ postponings*). Once a pre-trial session finishes, if there is a mutual agreement between the plaintiff and the defendant, the judge will announce the verdict within eight (τ_7) or 15 days (τ_8), and will send it to both parties within eight (τ_9) or 15 days (τ_{10}). If there is no mutual agreement after the pre-trial session finishes, then the judge will schedule a trial session within a time period of $1/\omega$ days, exponentially distributed. A single trial session lasts for $1/\beta$ days.

CONCLUSION

The functioning of courts in terms of court cases' flow dynamics is highly complex and unpredictable. The involvement of multiple stochastic processes justifies its treatment as a Discrete-Event Dynamics System (DEDS), characterized by a discrete (countable) state-space and a number of events, each lasting for a random time. The complexity found among various components within the judiciary system, being considered a DEDS, justifies considering the evolution of such a system as a stochastic process that can be used to assess its performance. Moreover, the nature of the underlying stochastic processes can be successfully captured and described by the class of Deterministic and Stochastic Petri Nets (DSPNs).

To the best of authors' knowledge, this is the first and only DSPN-based modeling framework of the civil procedure in the Macedonian judiciary system. As an algorithmic description, it is quite complex, and that was the reason for its partitioning into sub-models by particular phases. The model can be successfully utilized for obtaining numerous performance measures vis-à-vis the court cases' life cycle, including the average number of court cases waiting in the system to be processed, the average number of court cases waiting at reception and registration offices, the average number of court cases being currently processed, the fraction of court cases being withdrawn, rejected, or successfully processed, the average sojourn times of court cases at different stages, the average duration of court cases' processing, the court overall utilization, etc. All of these can be evaluated against different values of input parameters. Besides the performance evaluation, it can be successfully utilized for addressing additional critical issues related to the judiciary system (i.e. ACCMIS system), such as correctness analysis, reliability evaluation, design optimization, scheduling (performance control), monitoring & supervision, court cases' traffic efficiency, implementation, system tuning, bottleneck identification, workload characterization, capacity planning, forecasting the performance at future loads, evaluation of various ACCMIS design alternatives, etc.

The proposed GSPN model is a predictive one, which can be used for evaluating various performance metrics about the actual judiciary system, in order to convey various 'what-if' analyses and test numerous operating scenarios. As such, it can contribute significantly towards the improvement of both court functioning and practice, and can also provide significant insights that can help in increasing the judiciary system efficiency in terms of shortening the duration of court cases' processing as well as decreasing the number of unsolved court cases.

BIBLIOGRAPHY

Ajmone Marsan, Marko, and Chiola, Giovanni. “On Petri Nets with Deterministic and Exponentially Distributed Firing Times”, In *Advances in Petri Nets 1986, Lecture Notes in Computer Science*, edited by Grzegorz Rozenberg, 132–45. Springer, 1987.

Ciardo, Gianfranco, and Lindemann, Christoph. “Analysis of Deterministic and Stochastic Petri Nets”, Paper presented at the Fifth International Workshop on Petri Nets and Performance Models, Toulouse, France, October 19 – October 22, 1993. https://ieeexplore.ieee.org/abstract/document/393454

EC. *The 2018 EU Justice Scoreboard*. European Commission. Publications Office of the European Union, Luxembourg, The Netherlands, 2018. https://ec.europa.eu/info/sites/info/files/justice_scoreboard_2018_en.pdf

EduSoft. “Automated Court Case Management Information System”. EduSoft, February 10, 2019. http://www.edusoft.com.mk/court-case-management-software

Global Measures of Court Performance. International Consortium for Court Excellence, 2018. Accessed April 16, 2019. http://www.courtexcellence.com/~/media/Microsites/Files/ICCE/Global%20Measures%20Pre-Publication%20-%20Sep%202018.ashx

Griepenburg, Jim. “What's the difference between performance and efficiency?”. Quora.com, 2017. https://www.quora.com/Whats-the-difference-between-performance-and-efficiency

Hammergren, Linn. *Justice Reform and Development: Rethinking donor assistance to developing and transition countries*. New York, NY: Routledge, 2014.

IHR. „Досегашниот тек на судските реформи“. Институт за човекови права, Скопје, Северна Македонија, in English: “The judicial reformation process so far”. Institute for Human Rights, Skopje, North Macedonia. February 17, 2019, http://www.ihr.org.mk/p.php?pid=38

Lindemann, Christoph, and Thümmler, Axel. “Transient analysis of deterministic and stochastic Petri nets with concurrent deterministic transitions”. *Performance Evaluation* 36-37 (1999): 35–54.

Lindemann, Christoph. *Performance Modelling with Deterministic and Stochastic Petri Nets*. Chichester, England: John Wiley & Sons Ltd., 1998.

MoJ(a). „Нацрт-стратегија за реформа на правосудниот сектор за периодот 2017-2022 со акциски план“, Министерство за правда, Скопје, Република Македонија, in English: “Draft Strategy for Reforming the Judicial Sector for the Period 2017-2022 with an Action Plan”, Ministry of Justice, Skopje, Republic of Macedonia, 2017. http://pravda.gov.mk/Upload/Documents/Нацрт%20Стратегија%20за%20реформа%20на%20правосудниот%20сектор.pdf

Palmer, Kas. “What's the difference between performance and efficiency?”. Quora.com, 2017. https://www.quora.com/Whats-the-difference-between-performance-and-efficiency

SCoRoNM. „Оценка и заклучоци на Врховниот суд на Република Северна Македонија по извештаите за работа на судовите во 2006, 2007, ...,

2017 година“, in English: “Evaluation and conclusions of the Supreme Court of the Republic of North Macedonia on the annual reports of the courts in 2006, 2007, …, 2017 year”. Supreme Court of the Republic of North Macedonia, Skopje, North Macedonia. February 17, 2019, http://www.vsrm.mk/wps/portal/vsrm/sud/izvestai/