Discrete & Continuous Models
& Applied Computational Science
ISSN 2658-7149 (Online), 2658-4670 (Print)

2025, 33 (2) 157–171
http://journals.rudn.ru/miph

Research paper

UDC 378.1:519.876.5:519.872
PACS 07.05.Tp
DOI: 10.22363/2658-4670-2025-33-2-157-171 EDN: MMCFUG

Business process analysis of university admissions: Combining TM Forum's eTOM framework, discrete-event simulation, and queuing theory

Konstantin M. Terentyev[1], Leyla D. Abuzyarova[1],
Irina A. Kochetkova[1, 2], Konstantin E. Samouylov[1, 2]

[1] RUDN University, 6 Miklukho-Maklaya St, Moscow, 117198, Russian Federation

[2] Federal Research Center "Computer Science and Control" of the Russian Academy of Sciences, 44-2 Vavilova St, Moscow, 119133, Russian Federation

Abstract. The increasing complexity of university admissions requires efficient, standardized processes to manage large volumes of applications and changing regulatory requirements. To address this, the paper applies the TM Forum's Business Process Framework (eTOM) from the telecommunications industry, a standard for modeling and optimizing academic admissions workflows. Using RUDN University as a case study, the entire admissions process is formalized into a hierarchical model that aligns with the eTOM level 2 processes. The approach integrates discrete-event simulation (DES) and queueing network analysis, providing detailed process modeling and analytical solutions for assessing the average execution time. DES replicates the dynamic interactions between applicants and staff. Queueing analysis provides mathematical model to analyze the average execution times for each step in the process. Together, these techniques help optimize the admissions process and ensure efficient management of large volumes of applications. Through this approach, we aim to streamline processes, increase transparency, and support digital transformation efforts within universities.

Key words and phrases: university admissions, business process, TM Forum, business process framework, eTOM, discrete-event simulation, DES, queuing network, RUDN University

For citation: Terentyev, K. M., Abuzyarova, L. D., Kochetkova, I. A., Samouylov, K. E. Business process analysis of university admissions: Combining TM Forum's eTOM framework, discrete-event simulation, and queuing theory. *Discrete and Continuous Models and Applied Computational Science* **33** (2), 157–171. doi: 10.22363/2658-4670-2025-33-2-157-171. edn: MMCFUG (2025).

1. Introduction

The organization of university admissions represents a complex and challenging task that requires the integration of various administrative, academic, and regulatory processes [1]. This process involves several stages, including document verification, entrance exams, applicant ranking, and final enrollment, all governed by strict deadlines and compliance requirements. With the advent of digital platforms like Public Services Portal of the Russian Federation, universities face increasing pressure to align their internal processes with these government platforms [2]. This creates a dual imperative for both efficiency and transparency in the admissions process. However, due to the lack

of standardized methods for modeling and optimizing workflows, different institutions often adopt fragmented approaches that fail to scale during high-volume admission periods.

The need to modernize admissions processes is emphasized by the increasing competition among universities for students [3]. For instance, at RUDN University, delays in document verification during the 2023 admissions cycle resulted in a 22% dropout rate among applicants, directly affecting institutional revenue and reputation. Globally, similar issues persist, with manual processes and isolated departmental operations contributing to inefficiencies. A 2022 UNESCO report found that 65% of universities in emerging economies lack digitalized admission systems, leading to extended processing times and dissatisfied applicants [4]. Addressing these challenges is crucial not only for institutional competitiveness but also for integrating higher education into broader digital transformation initiatives [5].

Current approaches to admissions optimization, such as BPMN (Business Process Model and Notation) for workflow visualization or retrospective statistical analyses, offer limited predictive power for complex, high-volume scenarios. While industry frameworks like ITIL (Information Technology Infrastructure Library) are effective in IT service management, they lack domain-specific adaptations for educational institutions [6]. Crucially, these methods do not provide quantitative tools for identifying real-time bottlenecks or allocating resources during peak loads. Moreover, the lack of standardized reference processes hinders cross-institutional benchmarking and perpetuates inefficiencies.

To address these gaps, our study combines three complementary methodologies: the TM Forum's Business Process Framework (also known as eTOM) [7], a hierarchical process map designed for telecommunications operations [8–10]; discrete-event simulation (DES), a computational technique that models process flows as sequences of events; and queuing network analysis, a mathematical framework that quantifies service delays, resource utilization, and bottlenecks [11, 12]. By adapting eTOM for university admissions, we aim to bridge the gap between educational process engineering and advanced computational modeling [13, 14]. This study aims to establish a unified reference framework and provide actionable insights for optimizing admissions processes based on data from RUDN University [15–17].

The main contributions of our study are as follows:

- An adaptation of the eTOM framework for university admissions, which maps activities of the university admissions process to level 2 and 3 eTOM processes.
- A DES model that allows for scenario testing under different load conditions, such as applicant surges.
- A queuing network model that can be used for analytical analysis of the university admissions process, particularly during peak periods.

The rest of the paper is organized as follows. Section 2 deconstructs RUDN University's current admissions process and identifies potential pain points. Section 3 aligns these processes with eTOM, providing a framework for best practices. Section 4 describes the simulation design and analysis. Section 5 presents the queuing model. Section 6 concludes with a discussion of policy implications, limitations, and future directions for research.

2. Business process of university admissions

The organization of university admissions is a critical and complex process that requires the seamless integration of various administrative, academic, and regulatory processes. The goal of this process is to evaluate and admit applicants while ensuring compliance with strict deadlines, standards, and institutional priorities. Drawing on the example of RUDN University, this section will outline the

general structure of the admissions process. This structure can be applied to higher education institutions at various levels (bachelor's, master's, and doctoral programs) and with different funding models (public – state-funded or private – contract-based).

The admissions process begins with document submission and verification. Applicants provide essential materials, such as academic records, identification documents, and test scores. For Russian institutions, this includes the Unified State Exam (USE) or internal entrance exams specific to the university. Admission officers carefully review these documents to verify their authenticity, completeness, and compliance with program requirements. Any discrepancies or missing information trigger notifications to the applicant, requiring revisions or additional documentation. This stage can be time-consuming, as manual verification of physical documents is still common, particularly in institutions without fully digital processes. Delays at this step can impact subsequent stages, creating bottlenecks in the admissions timeline.

After document verification, applicants may be required to take additional assessments, such as university-specific entrance exams, for competitive programs like medicine, engineering, or the creative arts. For programs that rely on the USE, results are automatically retrieved from federal databases. Internal exams are administered and graded by departmental faculty, and the outcomes are compiled into ranked lists that determine eligibility for state-funded or contract-based enrollment. A critical challenge at this stage is synchronizing data from different sources, including federal systems for USE scores and internal databases for exam results. Manual updates to spreadsheets with applicant information can also cause discrepancies and delays in data integration, leading to inaccuracies in rankings and disadvantages for applicants. These issues can strain institutional credibility.

The final stage, eligibility evaluation and enrollment, involves formalizing admission decisions and executing administrative procedures. Successful candidates are notified of their placement and asked to submit original documents in order to confirm their enrollment. For candidates funded by the state, this process is often straightforward, depending on meeting the published score thresholds. However, contract-based candidates need to go through additional steps, such as negotiating and signing tuition agreements, processing payments, and issuing enrollment orders. These orders are then published on institutional platforms and sent to federal education systems to finalize the applicant's status as a student. Despite its clear process, this phase can be hindered by last-minute withdrawals, delayed submissions of documents, and resource constraints, especially during peak enrollment times.

While the admissions process is well-structured, its implementation reveals several systemic vulnerabilities that are common across higher education institutions. Manual workflows: A heavy reliance on paper-based document checks and manual data entry lengthens processing times and increases error rates. Disconnected IT systems: Exam results, applicant profiles, and financial agreements are stored in separate systems, making it difficult to track the end-to-end process. Annual applicant surges: Exceeding 40,000 applicants at RUDN University overwhelm existing staff and infrastructure, leading to delays and dissatisfaction among applicants. Regulatory requirements: Evolving privacy laws and reporting standards demand continuous adjustments to the admissions process, but often without corresponding resource allocations for compliance.

These challenges highlight the need for a comprehensive re-evaluation of admission processes, balancing efficiency and transparency. The following sections of this paper address these issues through a structured approach, combining process standardization, computational, and mathematical modeling. By breaking down the process into its individual stages, this work aims to provide a repeatable framework for universities to navigate the complexities of contemporary student recruitment and enrollment.

3. Applying the eTOM framework

In this section, we formalize the university admissions process using the TM Forum's eTOM, a hierarchical framework for standardizing business operations. By mapping RUDN University's workflows to the eTOM's level 2-3 processes, we have established a reference model for benchmarking and optimizing cross-institutional operations.

3.1. Process with detailed activities

The admissions process consists of 14 steps, each with a unique identifier to align with the eTOM hierarchical structure (see Figure 1). These steps are numbered and described below, along with concise titles that are used in Table 1.

- Step 1: Online Admission Portal. Prospective students access RUDN University's online admission portal to create a personal account, submit an application, and track the progress. This digital platform provides guidelines, application deadlines, and automatic validation for required documents such as diplomas and identification.
- Step 2: Student Guidance & Career Counselling. Specialized advisors assist students in choosing programs that align with their academic profile and career goals. They help clarify admission criteria, scholarship opportunities, and pathways after graduation.
- Step 3: Application Submission & Data Verification. Students upload personal information and relevant documents through the platform. Admissions staff verify the completeness of the data and initiate automatic background checks (such as plagiarism detection for admission essays).
- Step 4a: Document Verification and Notification (Manual). After completing all steps, students receive a notification about the status of their application. If everything is in order, they are invited to the next stage of the admission process. Officers manually verify physical or scanned documents (such as diplomas and exam certificates) to ensure their authenticity. Applicants are notified automatically about acceptance or rejection via email or SMS.
- Step 4b: Entrance Exam Scheduling. If a program requires internal exams (for example, medicine), the system creates personalized schedules based on applicant preferences and faculty availability.
- Step 5a: Exam Administration. Exams are proctored either on-site or remotely. Results are digitized and stored in the RUDN University database. Applicants are notified about the results within 48 hours through automated alerts.
- Step 5b: Result Integration. The USE results are retrieved from federal systems and combined with internal scores to create a unified applicant profile.
- Step 6a: Eligibility Evaluation. Applicants are ranked based on their composite scores using algorithms. Their scores are compared to program-specific admission thresholds for budget and contracts.
- Step 6b: Document Request. Candidates qualifying for budget seats are required to submit original diplomas within 7 days. If they fail to comply, they will be shifted to contract-based pools.
- Step 7: Contract Offer for Non-Qualified Applicants. Applicants who do not meet the budget threshold will receive formal offers for enrollment based on a contract, detailing tuition fees, payment plans, and academic requirements.
- Step 8: Contract Review & Signature. Legal teams will draft contracts, which applicants will review and electronically sign via a secure platform. Digital signatures will be timestamped and archived.

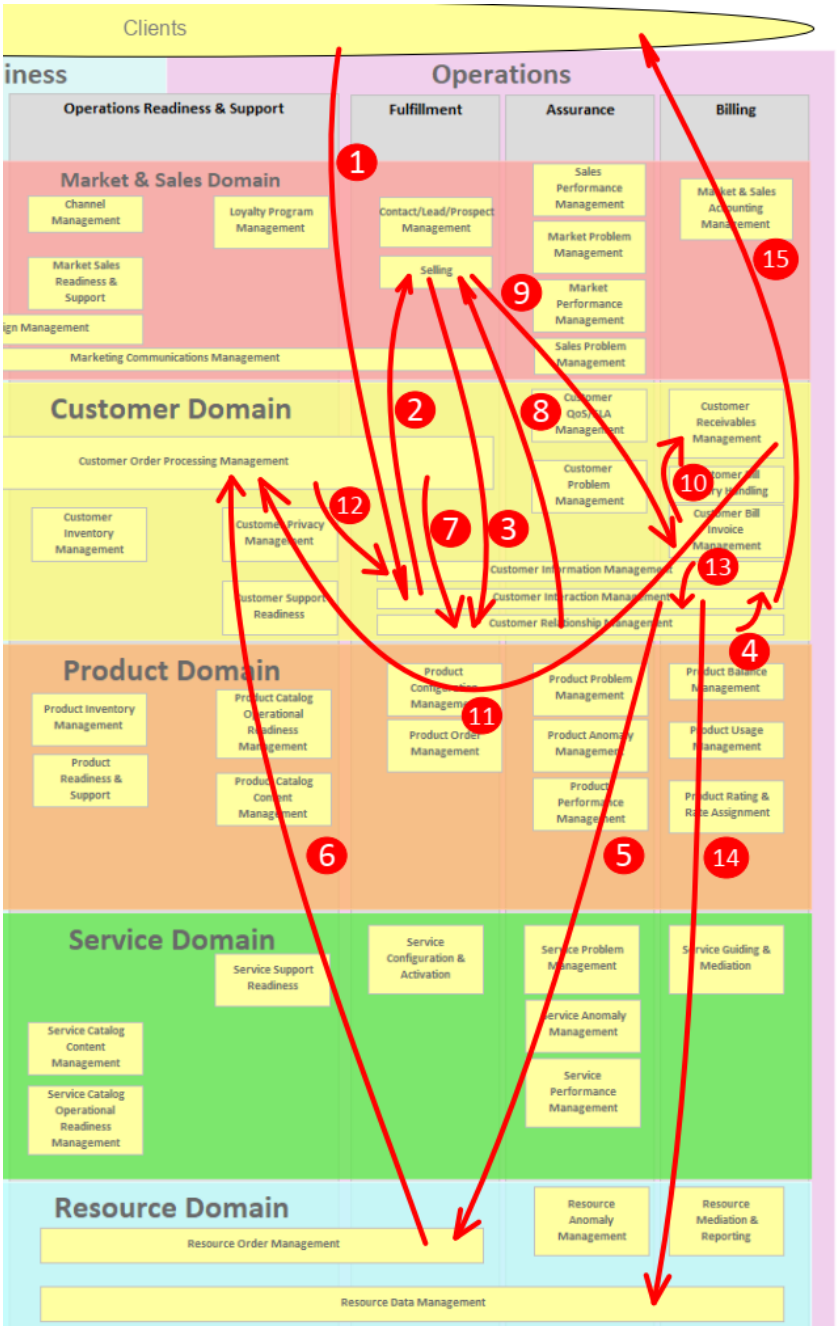

Figure 1. University admissions detailed activities on the eTOM framework

Table 1

Mapping of university admissions detailed activities to eTOM level 2 processes

No. step	eTOM level 2 process	University admissions detailed activities
1	Customer Interaction Management	Online Admission Portal
2	Selling	Student Guidance & Career Counselling
3	Customer Relationship Management	Application Submission & Data Verification
4a	Customer Interaction Management	Document Verification and Notification (Manual)
4b	Customer Interaction Management	Entrance Exam Scheduling
5a	Resource Order Management	Exam Administration
5b	Resource Order Management	Result Integration
6a	Customer Order Processing	Eligibility Evaluation
6b	Customer Order Processing	Document Request
7	Customer Relationship Management	Contract Offer for Non-Qualified Applicants
8	Selling	Contract Review & Signature
9	Customer Bill Management	Invoice Creation & Payment
10	Customer Receivables Management	Admitted Student List Preparation
11	Customer Order Processing	Enrollment Preparation
12	Customer Information Management	Enrollment Finalization
13	Customer Interaction Management	Enrollment Publication
14	Resource Data Management	Enrollment Archiving

– Step 9: Invoice Creation & Payment. Systems will automatically generate invoices reflecting the contractual terms, which will be processed through integrated banking gateways with real-time updates on payment status.
– Step 10: Admitted Student List Preparation. Staff will compile final lists of enrolled students, generating unique enrollment orders for federal reporting purposes.
– Steps 11-14: Publication & Archiving of Enrollment Records. Enrollment records will be published and archived according to the established process. Orders are published on the RUDN University website, emailed to applicants, and stored in accordance with data retention policies.

3.2. Mapping to eTOM framework

Figure 1 shows the end-to-end alignment of RUDN University's admissions process with the eTOM's level 2 processes. Table 1 provides a detailed mapping, showing how each university activity (Steps 1-14) corresponds to eTOM's standardized categories (for example, Customer Interaction Management and Resource Order Management).

Note that Steps 4a-5b (Document Verification to Exam Result Integration) correspond to eTOM's Resource Order Management, highlighting the importance of resource coordination. Steps 7-9 (Contract Proposal to Invoice Generation) reflect the focus on Customer Relationship Management, which is centered around the applicants. Parallel processes such as budget/contract enrollment are unified under the hierarchical levels of eTOM, allowing for scalable optimization.

4. Discrete-event simulation model

In this section, we describe the development and results of a DES model that was designed to analyze the efficiency of the admissions process at RUDN University. By translating the 14-step process of the institution into a computationally manageable model, the simulation identified bottlenecks, quantified delays, and proposed data-driven optimization strategies.

4.1. Process with aggregated activities

To strike a balance between granularity and computational feasibility, the original eTOM-aligned process (see Section 3) was simplified into seven aggregated stages (Table 2). This simplification prioritized tasks that depend on staff, excluding automated steps or those that are driven by applicants (e.g., document uploads and email notifications). For instance, Stages 1-4a of the original process, which involved document verification and notifications to applicants, were combined into Stage A (Document Processing) to reflect the shared responsibility of admission officers.

The normalized BPMN model (Figure 2) was implemented using the BIMP platform [18], selected for its ability to simulate stochastic events and scale to 10,000 concurrent users, which represents 25% of RUDN University's 2023 applicant volume due to free-tier constraints. Input parameters were derived from historical data. Activity durations followed normal or exponential distributions, calibrated to 2023 operational timestamps (Table 3). Branching probabilities (Table 4) governed decision points, such as document verification success (92.61%) or budget eligibility (25.6%). Resource limits mirrored actual staffing levels, with 15 admissions officers and 8 commercial team members.

4.2. Numerical results

The simulation replicated a scaled-down version of RUDN University's 2023 admission process, revealing critical inefficiencies. The average admission process took 14.2 days, and Stage A (Document Processing) accounted for 68% of the delays (Figure 3). Manual verification of physical documents, modeled as $\mathcal{N}(15, 9)$ minutes per application, created queues during peak periods. Non-working days exacerbated delays, increasing the total cycle time by 22% (Figure 4). Admission officers operated at 89% capacity during peak loads, resulting in applicant queues up to 1,240 people (Figure 5). In contrast, commercial teams remained underutilized (52%), highlighting imbalances in workforce allocation. Stages A (Document Processing) and D (Original Document Request) emerged as primary bottlenecks. At Stage A, 45% of applicants experienced wait times exceeding 2 hours due to manual checks. At Stage D, delays were caused by applicants' delayed submission of original documents.

Table 2

University admissions aggregated activities for simulation

Stage	Aggregated activity	No. steps (Table 1)
A	Document Processing: Process and verify documents	1-4a
B	Entrance Exam Management: Prepare lists and conduct the entrance exam	4b-5a
C	Exam Result Integration: Request and process the results of the USE through Super Service	5b-6a
D	Original Document Request: Request for the original documents of previous education	6b
E	Contract-Based Enrollment: Offer the option of enrolling on a contractual basis	7
F	Contract Finalization: Sign the contract and pay the bill	8-10
G	Enrollment Publication: Form and publish an order for enrollment	11-14

Table 3

University admissions aggregated activities duration

Stage	Resource	Duration	SLA threshold
A	Admissions Officer	$\mathcal{N}(15, 9)$ min	60 min
B	Admissions Officer	$\mathcal{N}(120, 15)$ min	300 min
C	Admissions Officer	$\mathcal{N}(15, 25)$ min	60 min
D	Admissions Officer	Exp(15) min	180 min
E	Commercial Team	$\mathcal{N}(10, 4)$ min	30 min
F	Commercial Team	$\mathcal{N}(5, 2.25)$ min	15 min
G	Admissions Officer	60 min	120 min

The simulation results suggested three targeted strategies to improve operations. First, automated document verification could be implemented to replace manual checks with standardized digital workflows. This would reduce Stage A processing time by 40% and lower the average duration to 9 minutes. This adjustment would shorten the overall cycle time by approximately 4 days. Second, dynamic staff reallocation could be used to shift 3 admissions officers from Stage G (enrollment publication) to Stage A during peak periods. This would reduce officer utilization by 72% and alleviate queues by 35%. Third, e-signature integration could be implemented in Stage F to digitize contract signing. This would cut processing time to 2 minutes and accelerate contract finalization by 62%. It would also reduce commercial team idle time.

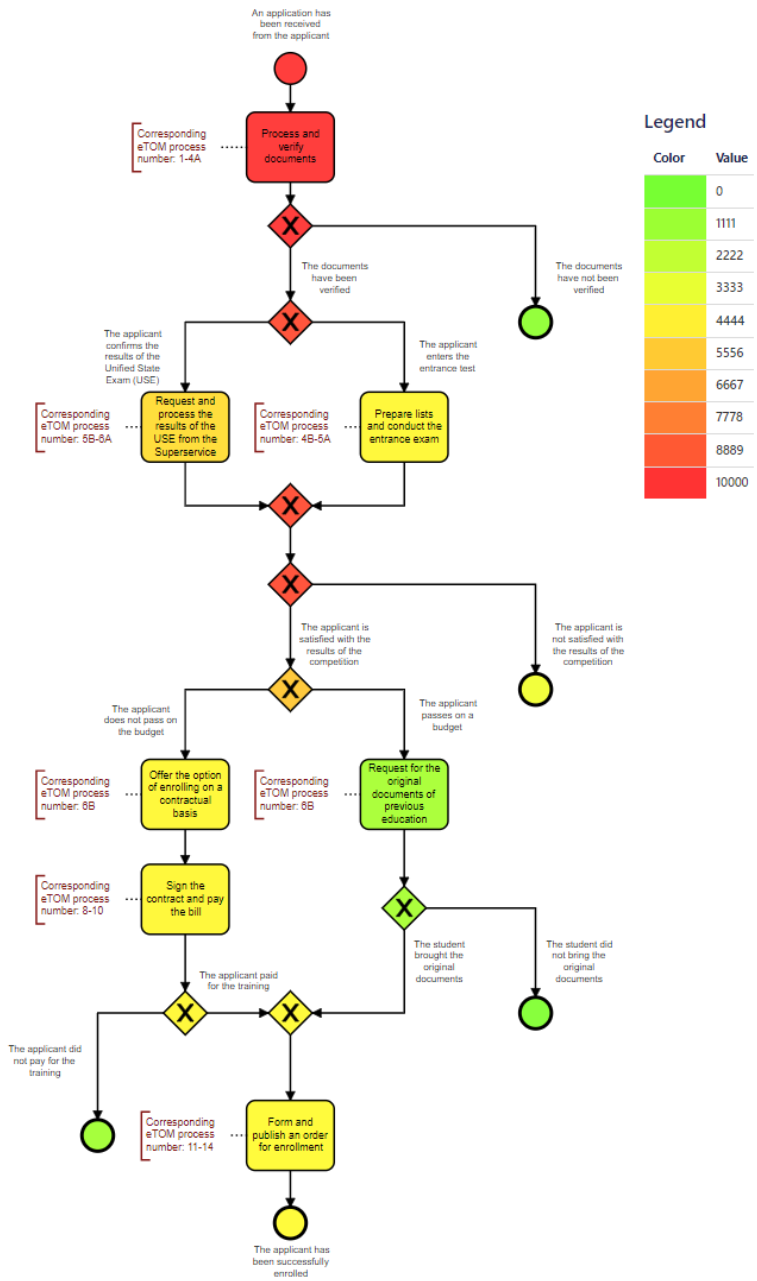

Figure 2. University admissions process for simulation

5. Queuing model

We formalize the university admissions process as an open Jackson network, leveraging queuing theory to derive analytical expressions for average execution time. The model extends the DES (Section 4) by providing a mathematical framework for stability analysis and scenario testing.

Table 4

University admissions aggregated activities branching probabilities

Gate	Decision node	Scenario 1	Scenario 2
1	Document verification	Verified (92.61%)	Not verified (7.39%)
2	Exam preference	Internal Exam (45.53%)	USE confirmation (54.47%)
3	Competition satisfaction	Dissatisfied (84.55%)	Satisfied (15.45%)
4	Budget eligibility	Budget admitted (25.6%)	Not admitted (74.4%)
5	Document submission	Submitted (77.9%)	Not submitted (22.1%)
6	Payment status	Paid (69.36%)	Unpaid (30.64%)

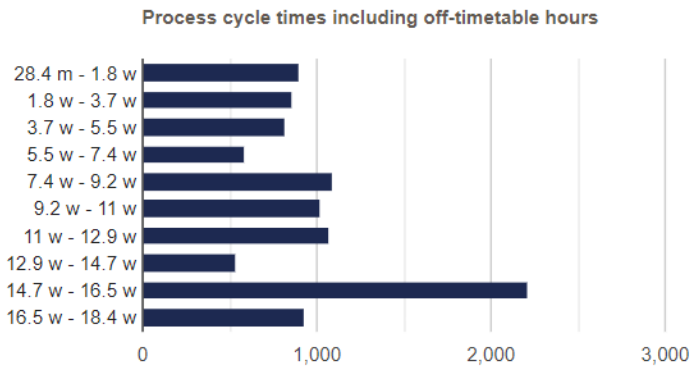

Figure 3. University admissions duration, including non-working hours

Figure 4. University admissions waiting times before activities start

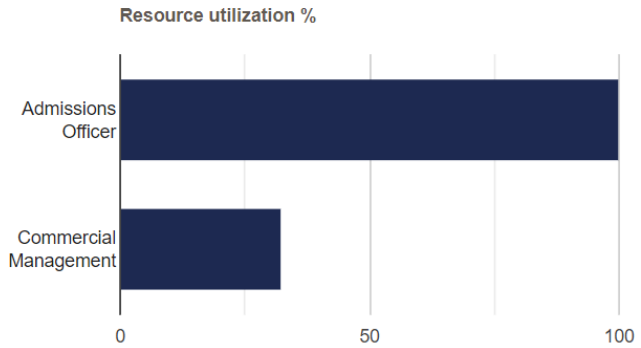

Figure 5. Resource capacity

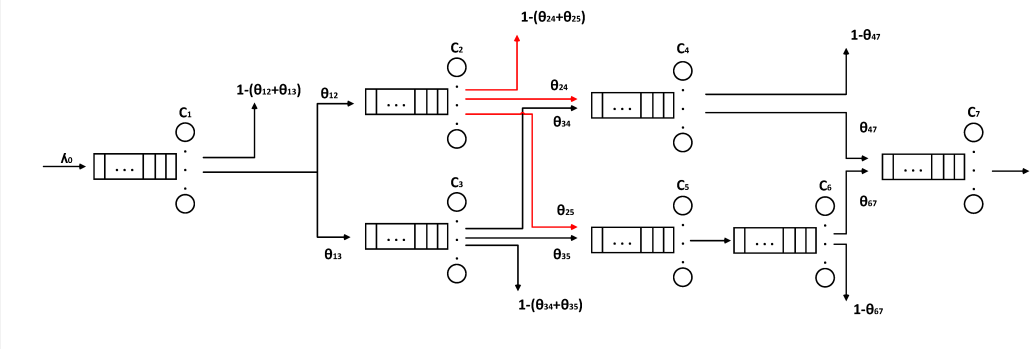

Figure 6. University admissions process as a queuing network

The admission workflow is modeled as a network of $m = 7$ service nodes corresponding to the stages in Table 2. See Figure 6 for a visual representation. For example, node 1 is Document Processing and node 7 is Enrollment Publication. Applicants enter the system at node 1 following a Poisson process with a rate of λ_0. Each node processes applications at a rate μ_i, derived from empirical data in Table 3. After processing at node i, applications move to node j with probability θ_{ij}, as defined in routing matrix (see Table 5).

The effective arrival rate λ_i at node i is governed by the traffic equations:

$$\lambda_1 = \lambda_0,$$
$$\lambda_2 = \lambda_0\theta_{12},$$
$$\lambda_3 = \lambda_0\theta_{13},$$
$$\lambda_4 = \lambda_0(\theta_{12}\theta_{24} + \theta_{13}\theta_{34}),$$
$$\lambda_5 = \lambda_0(\theta_{12}\theta_{25} + \theta_{13}\theta_{35}),$$
$$\lambda_6 = \lambda_0(\theta_{12}\theta_{25} + \theta_{13}\theta_{35}),$$
$$\lambda_7 = \lambda_0(\theta_{12}\theta_{24}\theta_{47} + \theta_{13}\theta_{34}\theta_{47} + \theta_{12}\theta_{25}\theta_{67} + \theta_{13}\theta_{35}\theta_{67}).$$

Table 5

Routing matrix for queuing network

	0	1	2	3	4	5	6	7
0	0	1	0	0	0	0	0	0
1	$1-(\theta_{12}+\theta_{13})$	0	θ_{12}	θ_{13}	0	0	0	0
2	$1-(\theta_{24}+\theta_{25})$	0	0	0	θ_{24}	θ_{25}	0	0
3	$1-(\theta_{34}+\theta_{35})$	0	0	0	θ_{34}	θ_{35}	0	0
4	$1-\theta_{47}$	0	0	0	0	0	0	θ_{47}
5	0	0	0	0	0	0	1	0
6	$1-\theta_{67}$	0	0	0	0	0	0	θ_{67}
7	1	0	0	0	0	0	0	0

We consider that each node operates as an Erlang–C model – $M|M|C_i|\infty$ queue. The network is stable if $\rho_i < C_i$ for all nodes i, where $\rho_i = \frac{\lambda_i}{\mu_i}$ is the total offered traffic and C_i is the number of servers at node i. The average time W_i spent at node i is calculated by the formula

$$W_i = \frac{\rho_i^{C_i}}{C_i!}\frac{\rho_i C_i}{(C_i-\rho_i)^2}\cdot\left(\sum_{n=0}^{C_i-1}\frac{\rho_i^n}{n!}+\frac{\rho_i^{C_i}}{C_i!}\frac{C_i}{C_i-\rho_i}\right)^{-1}+\frac{1}{\mu_i}, \qquad C_i>1,$$

$$W_i = \frac{1}{\mu_i(1-\rho_i)}, \qquad C_i=1.$$

The total average execution time aggregates delays across all nodes

$$T = W_1+\theta_{12}W_2+\theta_{13}W_3+(\theta_{24}+\theta_{34})W_4+(\theta_{25}+\theta_{35})W_5+W_6+(\theta_{47}+\theta_{67})W_7.$$

6. Conclusion

Motivated by the need to standardize and optimize university admissions processes in the face of increasing digitalization, this study adapted the TM Forum's eTOM framework, originally designed for telecommunications, to academic operations. By integrating real-world admission data from 2023 and regulatory requirements, we evaluated the effectiveness of the framework through a hybrid methodology that combined DES and queuing theory.

We have shown that integrating eTOM with simulation modeling identifies critical bottlenecks such as manual document verification (Stage A), which is responsible for 68% of delays. The queuing network model predicts an average cycle time. Digitizing document checks and contract signing (e.g., e-signatures) could reduce processing times, particularly during peak loads. Reassigning staff members to Stage A could decrease officer utilization and shorten queues. Automating contract signing (Stage F) could be useful under fluctuating workloads.

For future directions, we consider developing a centralized database for historical admission metrics for predictive analytics, as well as creating software to automatically generate queuing models from BPMN diagrams to streamline bottleneck analysis. The proposed framework could be adapted to other university workflows, such as dormitory allocation and academic advising, ensuring standardization and transparency.

Author Contributions: Conceptualization, supervision, K.S.; methodology, I.K.; validation, resources, K.T.; software, visualization, L.A.; formal analysis, investigation, writing—original draft preparation, K.T. and L.A.; writing—review and editing, I.K. and K.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data sharing is not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Kiaghadi, M. & Hoseinpour, P. University admission process: A prescriptive analytics approach. *Artificial Intelligence Review* **56,** 233–256. doi:10.1007/s10462-022-10171-y (2023).
2. Roudnitski, A. University admissions mechanism: Theoretical analysis with application to Russian universities. *HSE Economic Journal* **27,** 594–610. doi:10.17323/1813-8691-2023-27-4-594-610 (2023).
3. Shao, L., Levine, R. A., Hyman, S., Stronach, J. & Fan, J. A combinatorial optimization framework for scoring students in university admissions. *Evaluation Review* **46,** 296–335. doi:10.1177/0193841X221082887 (2022).
4. For Europe, U. N. E. C. *Sustainable Development Goals* https://w3.unece.org/SDG/en. Accessed: 2025-03-01.
5. Tampieri, A. University admission: Is achievement a sufficient criterion? *B.E. Journal of Economic Analysis and Policy* **24,** 799–833. doi:10.1515/bejeap-2023-0260 (2024).
6. Mengash, H. A. Using data mining techniques to predict student performance to support decision making in university admission systems. *IEEE Access* **8,** 55462–55470. doi:10.1109/ACCESS.2020.2981905 (2020).
7. Forum, T. *Business Process Framework (eTOM)* https://www.tmforum.org/oda/business-architecture-framework/process-framework-etom/. Accessed: 2025-03-01.
8. Horiuchi, S. & Tayama, K. Latest activities in TM Forum. *NTT Technical Review* **19,** 75–80. doi:10.53829/ntr202107gls (2021).
9. Suzuki, A., Kashibuchi, K. & Nakamura, T. Activities toward TM Forum Frameworx 17.0 and TM Forum Live! 2017 report. *NTT Technical Review* **16.** doi:10.53829/ntr201801gls (2023).
10. Horiuchi, S. & Tayama, K. Efforts by TM Forum, an operation standards organization. *NTT Technical Review* **21,** 53–58. doi:10.53829/ntr202307gls (2023).
11. Samouylov, K., Gaidamaka, Y. & Zaripova, E. Analysis of business process execution time with queueing theory models. *Communications in Computer and Information Science* **638,** 315–326. doi:10.1007/978-3-319-44615-8_28 (2016).
12. Yarkina, N., Popovskaya, N., Khalina, V., Gaidamaka, A. & Samouylov, K. Modeling end-to-end business processes of a telecom company with a BCMP queueing network. *Communications in Computer and Information Science* **800,** 279–296. doi:10.1007/978-3-319-68069-9_23 (2017).
13. Fernandes, C. & Cruz, R. A business processes model for the integration of over-the-top platforms in communications service providers operations. *Journal of Information Systems Engineering and Management* **6.** doi:10.29333/jisem/9570 (2021).
14. Dachyar, M., Zagloel, T. Y. M. & Saragih, L. R. Enterprise architecture breakthrough for telecommunications transformation: A reconciliation model to solve bankruptcy. *Heliyon* **6.** doi:10.1016/j.heliyon.2020.e05273 (2020).
15. University, R. *Admission committee* https://admission.rudn.ru/. Accessed: 2025-03-01.
16. University, R. *Electronic examination support system* https://esse.rudn.ru/?lang=en. Accessed: 2025-03-01.

17. Ivleva, M., Nezhnikova, E. & Safronova, N. The study of the impact of coaching on the efficiency of learning in the higher education. *RUDN Journal of Sociology* **24,** 523–538. doi:10.22363/2313-2272-2024-24-2-523-538 (2024).
18. Of Tartu, U. *BIMP simulator* https://bimp.cs.ut.ee/simulator/. Accessed: 2025-03-01.

Information about the authors

Terentyev, Konstantin M.—Ph.D. student of the Department of Probability Theory and Cyber Security, RUDN University; Director of the Department of Digitalization and Digital Transformation, RUDN University (e-mail: terentyev-km@rudn.ru, ORCID: 0009-0005-4379-3017)

Abuzyarova, Leyla D.—M.Sc. student of the Department of Probability Theory and Cyber Security, RUDN University (e-mail: d.abuzyarova@yandex.ru, ORCID: 0009-0007-0084-0201)

Kochetkova, Irina A.—Candidate of Physical and Mathematical Sciences, Assosiate Professor of the Department of Probability Theory and Cyber Security, RUDN University; Senior Researcher, Federal Research Center "Computer Science and Control" of the Russian Academy of Sciences (e-mail: kochetkova-ia@rudn.ru, ORCID: 0000-0002-1594-427X, ResearcherID: E-3806-2014, Scopus Author ID: 35332169400)

Samouylov, Konstantin E.—Professor, Doctor of Technical Sciences, Head of the Department of Probability Theory and Cyber Security, RUDN University; Senior Researcher, Federal Research Center "Computer Science and Control" of the Russian Academy of Sciences (e-mail: samuylov-ke@rudn.ru, ORCID: 0000-0002-6368-9680, ResearcherID: E-9966-2014, Scopus Author ID: 14009785000)

УДК 378.1:519.876.5:519.872
PACS 07.05.Tp
DOI: 10.22363/2658-4670-2025-33-2-157-171 EDN: MMCFUG

Анализ процесса приема в университет: применение карты TM Forum eTOM, имитационного моделирования и сети массового обслуживания

К. М. Терентьев[1], Л. Д. Абузярова[1], И. А. Кочеткова[1, 2], К. Е. Самуйлов[1, 2]

[1] Российский университет дружбы народов имени Патриса Лумумбы, ул. Миклухо-Маклая, д. 6, Москва, 117198, Российская Федерация

[2] Федеральный исследовательский центр «Информатика и управление» Российской академии наук, ул. Вавилова, д. 44, кор. 2, Москва, 119333, Российская Федерация

Аннотация. С каждым годом процессы поступления в университеты становятся все более сложными. Для управления большим количеством заявок и постоянно меняющимися требованиями законодательства необходимы эффективные методы. В статье используется модель бизнес-процессов Forum eTOM, которая изначально была разработана для телекоммуникационной отрасли, для моделирования и оптимизации приемной кампании. На примере Российского университета дружбы народов имени Патриса Лумумбы (РУДН) показано, как можно формализовать весь процесс поступления в виде иерархической модели, соответствующей уровням eTOM. Методология объединяет два подхода: дискретно-событийное моделирование позволяет детально анализировать динамические взаимодействия между абитуриентами и сотрудниками, а сеть массового обслуживания дает возможность оценить среднее время выполнения процесса. Проведен анализ реального сценария обработки заявок, учитывая ограничения ресурсов. Совместное использование этих методов помогает выявить узкие места, такие как ручная проверка документов, и предложить решения для их устранения. Предложенный подход способствует стандартизации процессов, повышает прозрачность операций и поддерживает цифровую трансформацию университетов. Его можно адаптировать для других учебных заведений, обеспечивая эффективное управление приемными кампаниями в условиях растущих требований к автоматизации и масштабируемости.

Ключевые слова: университет, приемная кампания университета, бизнес-процесс, TM Forum, карта процессов, eTOM, имитационное моделирование, сеть массового обслуживания, РУДН