# BPIC2020: Analyzing the travel authorization and travel expenses process using Disco Fluxicon and Python tools

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Almost any organization among the business processes has a travel component. This work is dedicated to finding the best routes for obtaining permits for international travel, as well as analysis of applications for payment of travel expenses.

As the research methods were used automated detection of process models, building event logs, variance analysis and root cause analysis, as well as visual analysis of processes.

The data were analyzed by Disco Fluxicon tool, pandas, numpy and matplotlib libraries for Python were used for process deviation detection and visualization.

Keywords: BPIC2020, process mining, Disco Fluxicon, Python, pandas, numpy, matplotlib.

## Terms

| | |
|---|---|
| Declaration throughput | number of declarations processed per unit of time |
| Declaration payment level | the share of declarations that end up in payment. |
| Duration | total length of the declaration review path. |

## Abstract

In today's world an incredible amount of knowledge and events about the real world is reflected in information systems. Thus, we have access to the history of changes and execution of business processes of interest.

Process mining technology, the ideologist of which is Vil van der Aalst, appeared recently and has become exactly the method that allows us to analyze all kinds of external data to find bottlenecks and improve business processes.

This technology is focused on automated creation of business process models, which in turn are presented in the form of a specific event log. In the future, each of them is compared with a certain action in the business process under consideration, we can extract information about what action the subject of analysis performed, at what time, what actions it performed. The process models that have been presented after processing with Process mining tools, together with process execution time data and organizational structure components, allow us to reach the bottlenecks that provide business process owners with information for their further improvement.

In our work we tried to find answers to the following questions:

1. What is the throughput of the travel declaration from filing (or closing) to payment?

2. Is there a difference in throughput between national and international travel?

3. Are there differences between declarations clusters, e.g. between cost centers/departments/projects, etc.

4. What is the capacity at each stage of the process, i.e. representation, judgment by different responsible roles and payment?

5. How many travel declarations are rejected at different processing stages and how many are never approved?

6. Where are the bottlenecks in the travel declaration process?

7. Where are the bottlenecks in the process of obtaining a travel permit (note that there may be multiple payment requests and declarations for one permit) and a number of others.

As this was the first time our team had encountered process analysis with Process Mining tools, we developed the following action plan for ourselves:

1) Using Disco Fluxicon's analytical tool to build a process graph and clean up data from anomalies.

2. Uploading data from Disco to a .csv file and further analyzing it using statistical libraries for Pathon (pandas, numpy).

3. Visualize the results of your analysis with matplotlib and generate answers to the questions.

The work contains 4 chapters. Chapter 1 deals with the question of a common understanding of data and the process. Chapter 2 contains the analysis of the declaration bandwidth. Chapter 3 reflects the analysis of differences between declarations clusters. Answers to other questions are reflected in Chapter 4.

# Chapter 1

In this part of the work we will talk about the initial data analysis and the initial understanding of the process under study, built with the help of Disco Fluxicon tool.

## 1.1 Data

The data recorded in the event logs reflect the process of obtaining travel permits, domestic and international declarations for 2018 for all departments and partly for 2017. The journal includes 86581 cases related to 7065 travel permits. The concept of a case adopted for the journal is a separate element of travel authorization (RK).

The data contain several attributes:
- case id - ID of the action identifier;
- activity - stages of the process of sending an employee on a business trip;
- timestamp - information about the date and time of the stages of the process of sending the employee on a business trip. In our example, the following date format is taken: dd.mm.yyyyHH:MM:SS;
- Resource - a staff member or a system.
Most of the attributes are at the level of the case recorded for each element:
- Variant;
- Variant index;
- (case) Adjusted Amount;
- (case) Amount;
- (case) Budget Number;
- (case) Declaration Number;
- (case) Original Amount;
- (case) Permit Activity Number;
- (case) Permit Budget Number;
- (case) Permit ID;
- (case) Permit Organizational Entity;
- (case) Permit Project Number;
- (case) Permit Requested Budget;
- (case) Permit Task Number;
- (case) Permit id.1;
- (case) Permit travel permit number;
- (case) Requested Amount;
- (case) id;
- (case) travel permit number;
- org:role.
There are 51 types of different actions in the log. The six most frequent actions: "Declaration submitted by an employee" - 7574 cases, "Payment is processed" - 7544 cases, "Payment Request" - 7541 cases, "Permission granted by employee" - 7331 cases, "Start of trip" - 7065 cases, "End of trip" - 7065 cases (Table 1).

Table 1. Common types of actions (created in Disco Fluxicon).

| Activity | Frequency | Relative frequency |
|---|---|---|
| Declaration SUBMITTED by EMPLOYEE | 7574 | 8.75 % |
| Payment Handled | 7544 | 8.71 % |
| Request Payment | 7541 | 8.71 % |
| Permit SUBMITTED by EMPLOYEE | 7331 | 8.47 % |
| Start trip | 7065 | 8.16 % |
| End trip | 7065 | 8.16 % |
| Permit FINAL APPROVED by SUPERVISOR | 6300 | 7.28 % |
| Permit APPROVED by ADMINISTRATION | 5715 | 6.6 % |
| Declaration FINAL APPROVED by SUPERVISOR | 5641 | 6.52 % |

| | | |
|---|---|---|
| Declaration APPROVED by ADMINISTRATION | 4782 | 5.52 % |
| Send Reminder | 2303 | 2.66 % |
| Permit APPROVED by BUDGET OWNER | 2048 | 2.37 % |
| Request For Payment SUBMITTED by EMPLOYEE | 2033 | 2.35 % |
| Request For Payment FINAL APPROVED by SUPERVISOR | 1753 | 2.02 % |
| Declaration APPROVED by BUDGET OWNER | 1717 | 1.98 % |
| Declaration REJECTED by EMPLOYEE | 1688 | 1.95 % |
| Request For Payment APPROVED by ADMINISTRATION | 1531 | 1.77 % |
| Declaration REJECTED by ADMINISTRATION | 1476 | 1.7 % |

The table provides an overview of the number of documents for each action of the journal. As we can see for the analyzed period the University staff has made 7065 trips, also a considerable part of actions (7574) falls on "Declarations submitted by the employee".

## 1.2 Process[1]

The question "Where to start?" always comes up.

Before you start analyzing data, you need to understand the process being analyzed. This is no less important stage, because without understanding and immersion in the regulated process it will not be possible to correctly structure the data to create a table and evaluate the real process. It is possible to distinguish several stages in the process analysis:

- an understanding of the regulated process;
- collection and preparation of logs;
- process analysis AS IS;
- search for "bottlenecks" and deviations from the regulated process.

This process is the process of obtaining travel permits, which in turn are divided into international and domestic.

Consider the process of business trips, summarized in the system (Figure 1):

1. Determining the time to start and end a business trip.
2. An employee fills in the Travel Permission.
3. Permission is approved by the administration.
4. a Permission is finally approved by the manager.
5. Provided that the business trip is approved, the employee goes and comes back from the trip.
6. After the return, the employee fills in the Declaration of payment.
7. The Declaration is considered by the administration.
8. If there are no comments, the Declaration is finally approved by the manager.
9.  A payment claim for reimbursement of travel expenses is created.
10. Completes the process of reimbursement of travel expenses to the employee.

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[1] Materials from the articles were used in the preparation: "Secrets of process mining" or "PM: simply about the complex", 03.06.2020, Ksenia Khandogina (https://newtechaudit.ru/sekrety-process-mining-ili-pm-prosto-o-slozhnom/); "Process Mining: technology for analyzing processes or a way to visualize chaos?", 14.12.2018, Andrey Koptelov (https://kachestvo.pro/kachestvo-upravleniya/protsessnoe-upravlenie/process-mining/).
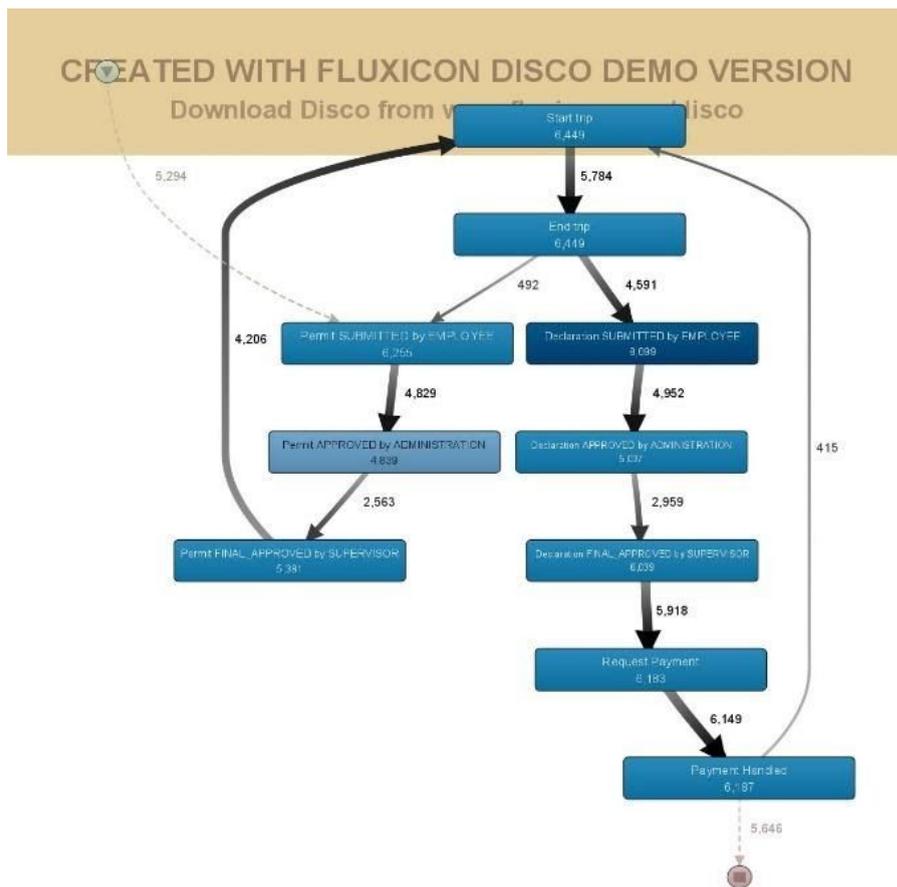
Figure 1: Simple process of employee's business trip (created in Disco Fluxicon).

This is the ideal process for an employee to go on a business trip, but more often than not everything is much more complicated: the manager may not approve the permission, the budget limit for travel may run out, there may be other reasons (Figure 2).
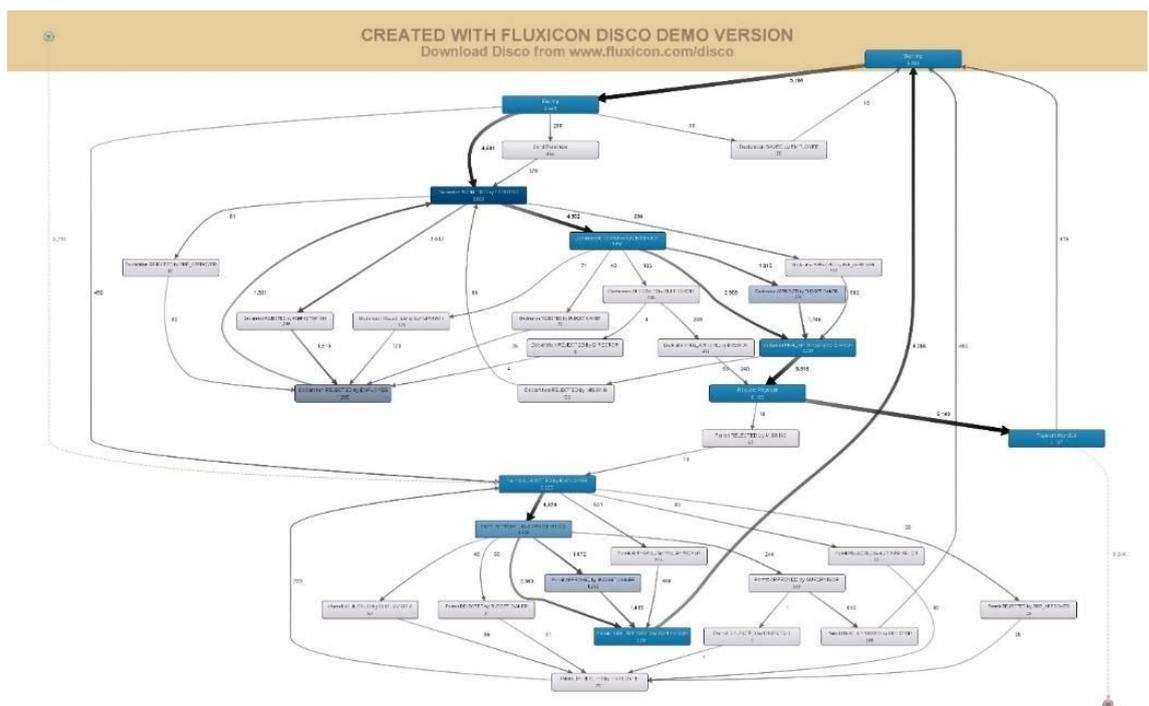
Figure 2: Employee travel process requiring analysis for operational effectiveness (created in Disco Fluxicon)

To restore an individual process instance, you need the primary data on how to work with this trip permission. The recovered process instances become the basis from which Process Mining will collect the actual process model according to certain algorithms. It is then analyzed to improve operational efficiency.

When the model is restored in the Process Mining toolkit, the analyst can:

- See process bottlenecks: those operations for which there are not enough resources.

- Identify and analyze those process instances that take much longer to execute than others.

- Search for the most successful process instances by various parameters.

- Reconcile the regular and actual execution times of the process even after the test upload of data.

Even the simplest analysis in Process Mining shows in most cases serious violations of threshold values of most process data.

One of the analysis options is to search for "matching loops". These are the places, or elements, in the process from which the work flow often returns to the process - to refinement. Thus, the total time of process execution increases and its cost increases.

With the help of Process Mining you can see the actions of the process participants that have increased the duration of this or that instance. This, in its turn, makes it possible to perform benchmarking between employees involved in the process.

The key advantage of using Process Mining software is the ability to rely on facts rather than speculation when analyzing a process.

And so the most difficult stage is the correct unloading of data from information systems to restore the process. You need to be sure that the "right" data in the information system has been taken to identify the fact of this or that operation in the process. Otherwise, the entire result of the analysis can be refuted.

# Chapter 2

The chapter is devoted to the answer to the question about the throughput capacity of travel declarations and its variability depending on different indicators.

Remember that by bandwidth we mean the number of travel declarations processed per unit of time (month). In addition, we focus on the analysis of two unrelated documents - domestic and international declarations.

In addition, let's calculate the level of payment for the declarations, as it is quite indicative when analyzing the bandwidth.

## 2.1 Analysis of declaration throughput on a monthly basis. Differences between domestic and international declarations.

We chose the Python toolkit for analysis of submitted data because it gives excellent results on large data volumes.

We have followed these steps to get the final conclusions for each type of declaration:

1. We uploaded a .csv table file to Jupyter Notebook and built tables for analysis.

2. We have performed monthly grouping, clearing of duplicate rows and calculation of the total number of submitted declarations (Figure 3).
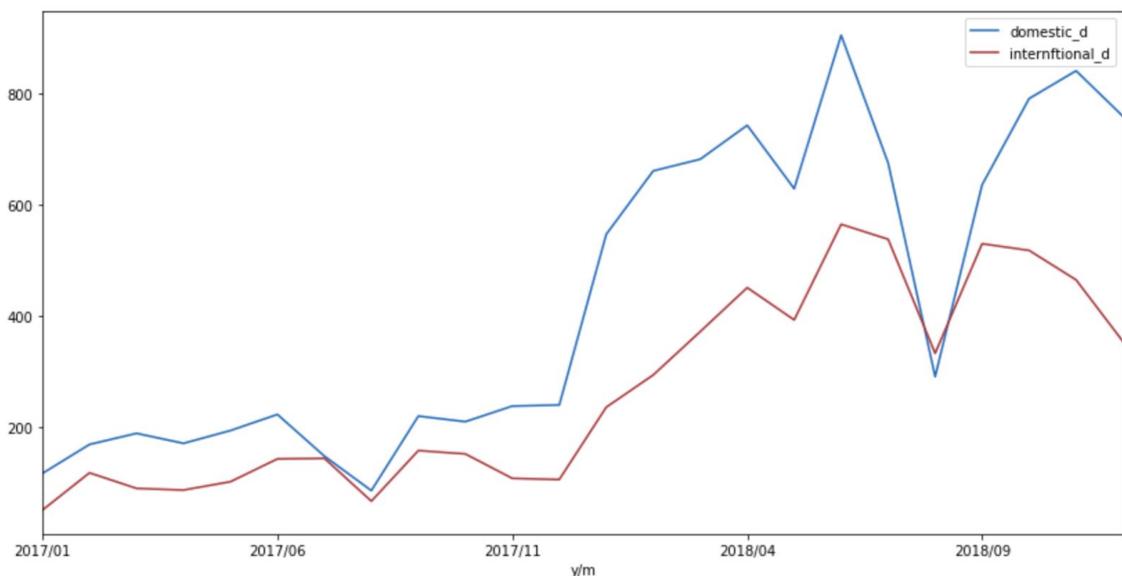


Figure 3: Total number of submitted declarations.

3. Calculation of the number of paid declarations. Paid declaration was recorded in statistics in the month of filing.

To search for paid declarations, we left the events on the establishment and payment of the declaration and removed the declarations, which were started again (in case of rejection at some stage), but were never paid.

4. We determined the share of paid declarations in the total volume of submitted declarations (figure 4).
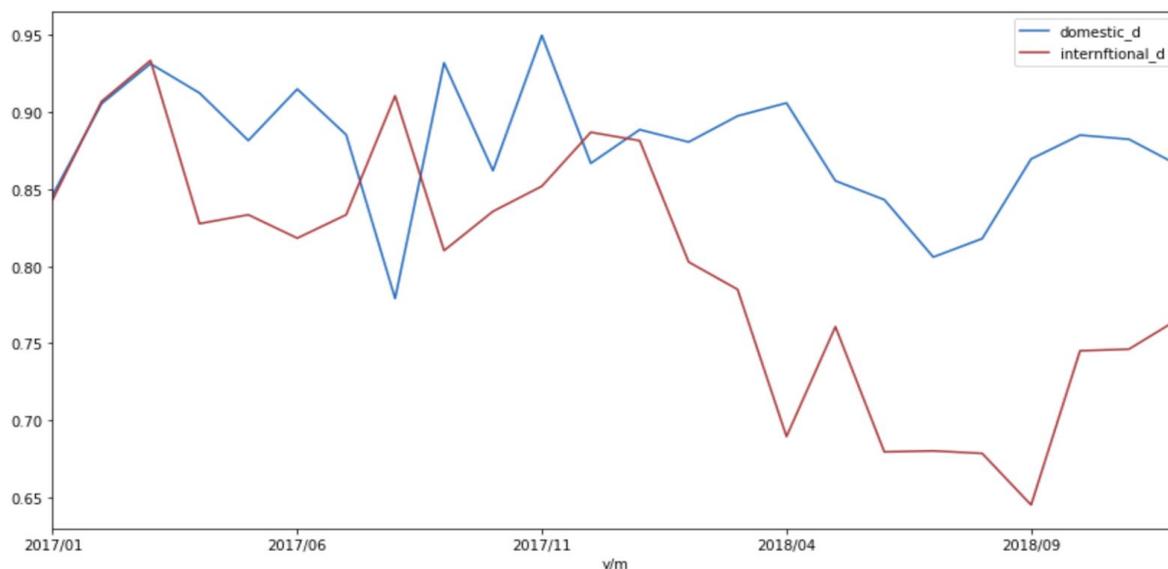


Figure 4: Share of paid declarations.

A summary of statistical information on the number of domestic and international declarations filed is presented in Table 2.

Table 2. Statistical evaluation of throughput of declarations at the filing stage

| declaration type | Internal declarations | | | External declarations | | |
|---|---|---|---|---|---|---|
| Year/figure | average number of filings | average returns paid | filing rate | average number of filings | average returns paid | filing rate |
| 2017 | 183,75 | 164,75 | 0,89 | 110,50 | 74,17 | 0,85 |
| 2018 | 680,00 | 590,67 | 0,87 | 329,83 | 242,08 | 0,74 |
| 2017-2018 | 431,86 | 377,71 | 0,88 | 265,62 | 199,92 | 0,80 |

Based on the results obtained, the following conclusions were drawn:

- In 2018, there was a noticeable increase in both types of declarations (by 3.7 times for domestic declarations and by 3 times for international declarations). Probably, this can be explained by the fact that 2017 was a pilot year, and the process was fully operational only in 2018.

- Annually, in the summer months (June, July, August), the number of filed declarations is significantly reduced, because this time of vacation and university staff are not engaged in science activities, business trips become much less.

- The peculiarity of the process is that the number of filed internal declarations is 1.5-2 times higher than the number of filed international declarations. It is easier to make internal trips and to reimburse expenses on them. But, despite this, the share of paid declarations on domestic travel is on average 88% against 80% for international.

- The share of paid international declarations in 2018 is significantly reduced by the end of the year: from 88% in January 2018 to 75-77% in November-December 2018.

- The share of paid internal declarations decreases insignificantly and is 89% in January 2018, 87% in December 2018.

In addition, we have calculated the throughput of declarations also on the total number of cases that are in the process of processing at different stages in each month. This was done using time filters in Disco Fluxicon (Figure 5).
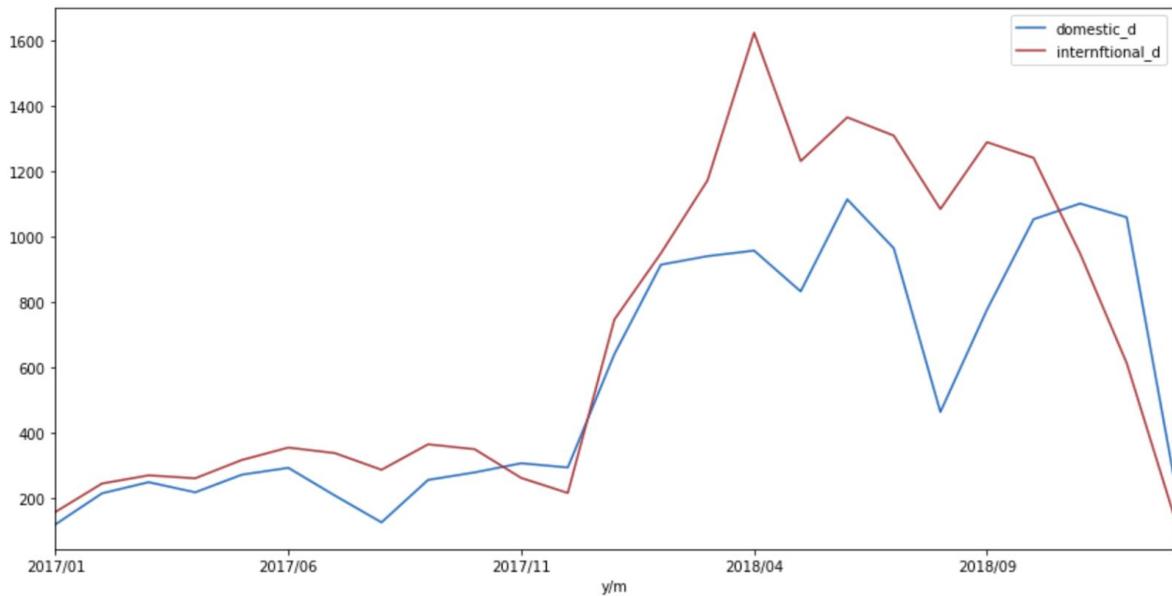


Figure 5. Throughput of declarations by cases being processed

Based on the analysis, it is possible to conclude that the bandwidth of the international declaration exceeds the national declaration at peak times.

There is also a trend to increase the number of processed declarations after the pilot period and to put the process into industrial operation. Further, a sharp decrease in the number of declarations is probably due to the exhaustion of the limit on travel expenses, which is typical for many organizations by the end of the fiscal year.

## 2.2 Analysis of declaration throughput at each of the process stages.

During the analysis, we have completed the following steps:

1. To determine the throughput of declarations at each stage of the process, we took the most common options for analyzing the declaration.

2. Then we grouped the data by process stages separately by domestic and international declarations.

**2.2.1 Internal declarations.**

In the analysis of internal declarations, Variant 1 - Variant 6 variants of harmonization of declarations (more than 1000 references) were taken, the diagram of distribution of declarations by stages of harmonization in the context of months was drawn (Figure 6).
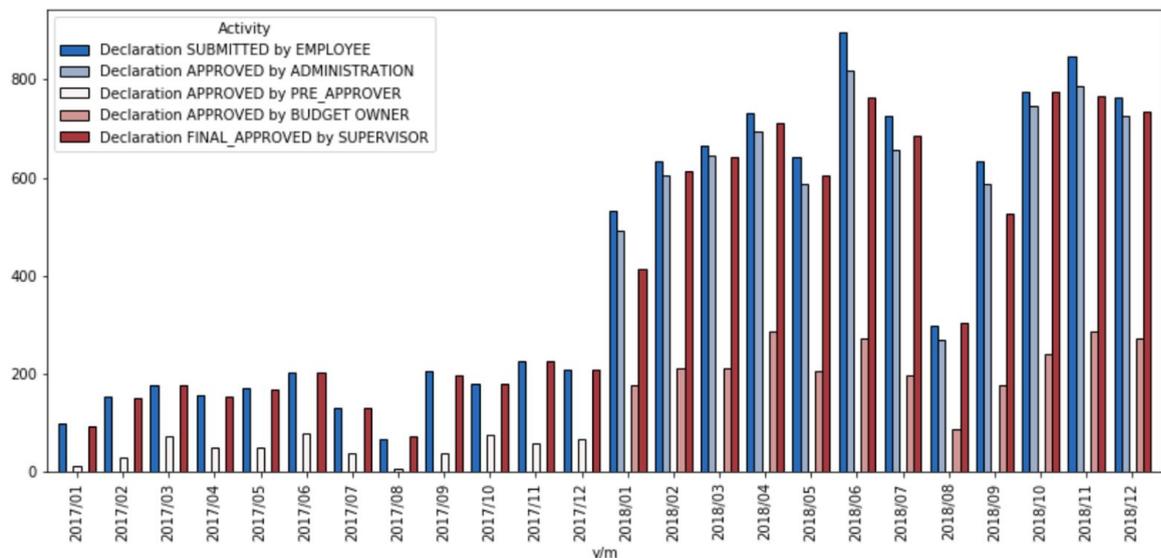


Figure 6. Throughput of internal declarations by stages of approval

The following conclusions were drawn on the basis of the obtained diagram:

- One can notice the difference in processes between 2017 and 2018. So in 2017 there was a stage of approval by the preliminary agreeing, while in 2018 there were two new stages - approval by the administrator and the owner of the budget.

- There is also a noticeable increase in the number of declarations in 2018 compared to 2017 more than 2 times due to the transition process from the pilot to trial operation.

- The diagram shows that the stage of approval of the budget by the owner gets about half of the declarations to be approved. The remaining stages are about 95% of the declarations.

- Maximum throughput was observed at the stages 'Declaration SUBMITTED by EMPLOYEE', 'Declaration APPROVED by ADMINISTRATION' in June 2018, 'Declaration FINAL_APPROVED by SUPERVISOR' in October 2018, 'Declaration APPROVED by BUDGET OWNER' - in April 2018.

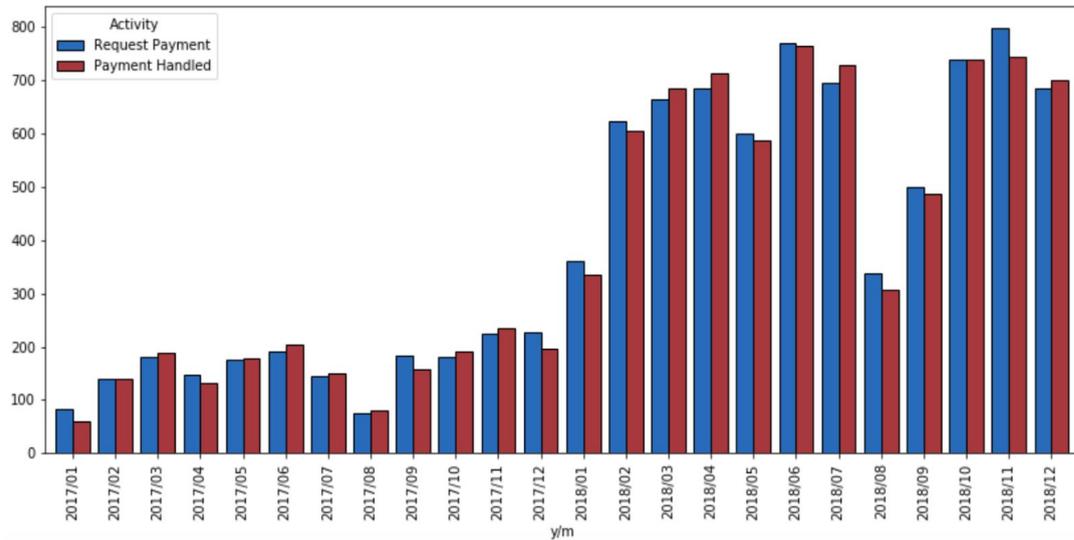The diagram on payment of declarations for illustrative purposes is constructed separately (figure 7).



Figure 7: Throughput of internal payment declarations

According to the data on payment for internal declarations, it can be concluded that the declarations are paid in full, but in some cases not in the month of filing, but with a delay of 1-2 months. There is also a clear period of decline in the number of payments in a certain period during the year. This is always the beginning of the year and the last month of the summer period.

**2.2.2 International declarations**.

In the analysis of international declarations were taken Variant 1 - Variant 7, Variant 9 variants of harmonization of declarations (more than 1000 references), built a diagram of the distribution of declarations in the stages of harmonization in the months separately for travel permits (figure 8) and directly to the declarations (figure 9).
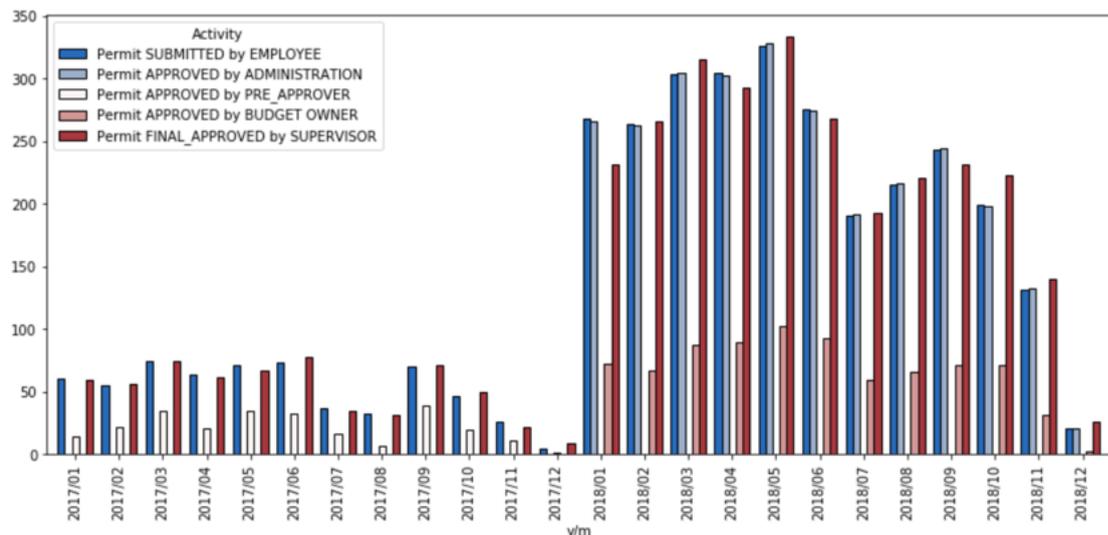


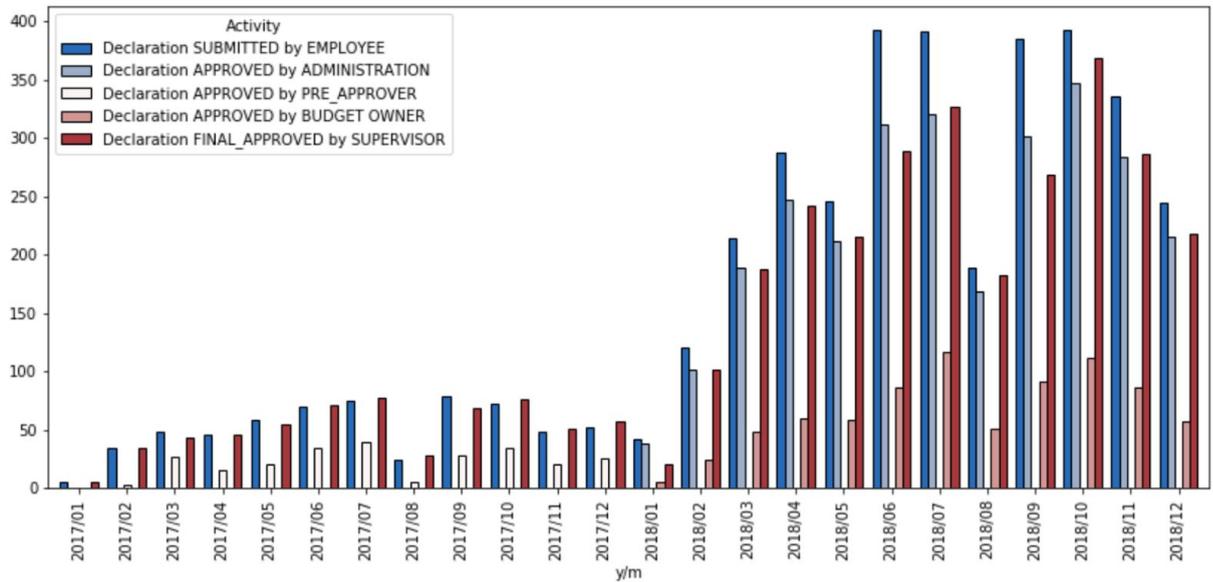Figure 8. The throughput of the travel permit

Figure 9.The capacity of the international declarations on stages

We can said something about the process of approving travel permits:

- The number of travel permits increased approximately 3 times in 2018 compared to 2017.

- Only a third of permits are sent to budget owners for approval.

- The maximum number of travel permits was obtained in may 2018.

- Starting in the second half of 2018, the number of travel permits is reduced to 21 by the end of the year. (in January 2018-268 PCs.).

- An analysis of the process of approving international declarations allows us to draw the following conclusions:

- International declarations are unevenly distributed throughout the year, and there is no clear trend.

- The maximum throughput is observed for the 'Declaration SUBMITTED by EMPLOYEE' stage in June, July and October 2018, for the 'Declaration FINAL_APPROVED by SUPERVISOR', 'Declaration APPROVED by ADMINISTRATION' stages in October 2018, and for the 'Declaration APPROVED by BUDGET OWNER' stage in July 2018.

- The 'Declaration APPROVED by BUDGET OWNER' stage gets a third of the declarations.

- We can say that the transition from the stage to the stage of agreeing on international declarations is taking place with delays.

The chart on payment of declarations is constructed separately for clarity (Figure 10).
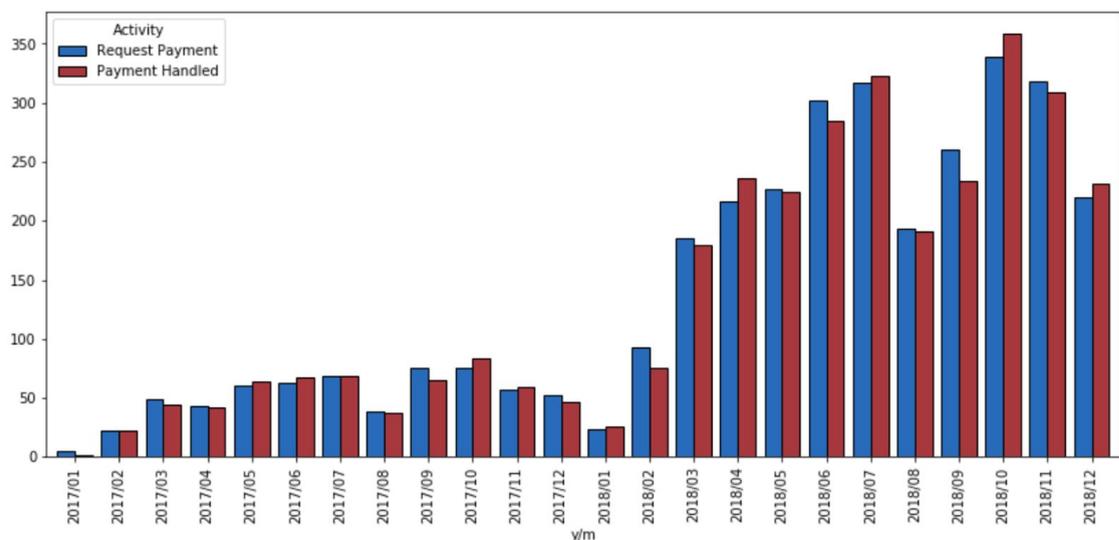


Figure 10. Throughput capacity of international payment declarations

According to the data on payment for international declarations, one can also conclude that the declarations are paid in full, but in some cases not in the month of filing, but with a delay of 1-2 months. The maximum number of payments falls on July, October, November 2018.

# Chapter 3

The analysis of differences between declarations clusters (cost centers/departments/projects) can be performed only on international declarations.

We performed this analysis using Disco Fluxicon.

1. To begin with, filters were installed according to a specified condition (budget owner or division number).

2. A descriptive analysis was performed and similar and different characteristics were identified.

The analysis was carried out in the context of Budget Number and Permit Organizational Entity.

For Permit Activity Number, Permit Project Number cannot be analyzed, because more than 93% and 37% of measurements, respectively, do not have the specified identifier.

## 3.1 Budget Number.

In the context of Budget Number there are 4 main owners of the budget (have more than 600 measurements) (Table 3):

Table 3: Comparative analysis of declaration clusters in the context of the Budget Number.

| Characteristics/Number | budget 146697 | budget 146681 | budget 146666 | budget 146776 |
|---|---|---|---|---|
| Share, % | 0,95 | 0,94 | 0,91 | 0,85 |
| Cases | 58 | 54 | 53 | 56 |
| Events | 683 | 681 | 659 | 615 |
| Variants | 23 | 24 | 28 | 18 |
| Max duration | 147 days 5 hours | 189 days 4 hours | 301 days 20 hours | 252 days 6 hours |
| Mean duration | 72,2 days | 91 days | 86,5 days | 95,2 days |
| Median events per case | 10 | 10 | 10 | 10 |
| Activities | 22 | 25 | 24 | 20 |
| First in case | -Permit SUBMITTED by EMPLOYEE<br>- Start trip | -Permit SUBMITTED by EMPLOYEE<br>- Start trip | -Permit SUBMITTED by EMPLOYEE<br>- Start trip | -Permit SUBMITTED by EMPLOYEE<br>- Start trip |
| Last in case | - End trip<br>- Payment Handled<br>-Declaration SAVED by EMPLOYEE | - End trip<br>Payment Handled | - End trip<br>- Payment Handled<br>-Declaration REJECTED by EMPLOYEE | - End trip<br>-Payment Handled<br>-Declaration REJECTED by EMPLOYEE<br>-Declaration SAVED by EMPLOYEE |
| APPROVED by BUGET OWNER | 30% permit<br>25% declaration | 49% permit<br>52% declaration | 41% permit<br>39% declaration | 19% permit<br>20% declaration |

A number of conclusions can be drawn from this comparative analysis:

- The total number of declarations is distributed evenly across different budgets, or there is a certain limit on the number of declarations that cannot be exceeded.

- The maximum travel time is set within budget 14666 and is 301 days and 20 hours.

- The number of passed steps is maximum within the budget 146681 and is 25 steps.

- The initial stages are the same in all variants: Permit SUBMITTED by EMPLOYEE, Start trip. This tells us that a number of declarations do not have travel permits.

- Within all budgets, there are a small number of declarations that end at the End trip stage and then are not refundable.
- Approval of travel permits and declarations by the owner of the budget is not the same depending on the budget and is 19 to 49% for permits and 20 to 52% for declarations.

### 3.2 Permit Organizational Entity.

The Permit Organizational Entity is also distinguished by 4 main organizational units (with more than 9000 measurements) (Table 4):

Table 4 . Comparative analysis of declaration clusters in the context of Permit Organizational Entity.

| Characteristics/Number | organisational unit 65458 | organisational unit 65455 | organisational unit 65456 | organisational unit 65454 |
|---|---|---|---|---|
| Share, % | 21,6 | 15,69 | 14,93 | 13,17 |
| Cases | 1 432 | 1 081 | 889 | 957 |
| Events | 15 585 | 11 322 | 10 774 | 9 505 |
| Variants | 296 | 158 | 178 | 153 |
| Max duration | 1 year 2 days | 1 year 24 days | 2 year 12 days | 1 year 93 days |
| Mean duration | 81 days | 81,4 days | 75,5 days | 129,5 days |
| Median events per case | 10 | 10 | 10 | 10 |
| Activities | 34 | 29 | 26 | 29 |
| First in case | - Permint SUBMITTED by EMPLOYEE<br>- Start trip | - Permint SUBMITTED by EMPLOYEE<br>- Start trip | - Permint SUBMITTED by EMPLOYEE<br>- Start trip | - Declaration SUBMITTED by EMPLOYEE<br>- Start trip<br>- Permint SUBMITTED by EMPLOYEE<br>- Declaration SAVED by EMPLOYEE |
| Last in case | - End trip<br>- Payment Handled<br>- Declaration REJECTED by EMPLOYEE<br>- Declaration REJECTED by MISSING<br>- Permit REJECTED by MISSING<br>- Declaration SAVED by EMPLOYEE | - Declaration FINAL_APPROVED by SUPERVISOR<br>- End trip<br>- Payment Handled<br>- Declaration REJECTED by EMPLOYEE<br>- Declaration REJECTED by MISSING<br>- Permit REJECTED by MISSING<br>- Declaration SAVED by EMPLOYEE | - End trip<br>- Payment Handled<br>- Declaration REJECTED by EMPLOYEE<br>- Send Reminder<br>- Declaration SAVED by EMPLOYEE | - End trip<br>- Request Payment<br>- Payment Handled<br>- Declaration REJECTED by EMPLOYEE<br>- Declaration SAVED by EMPLOYEE |

The following conclusions can be drawn from this analysis:
- The total number of declarations by organizational units is distributed in proportion to the share they occupy in the total volume of declarations (similar situation with cases and options).
- Maximum duration in all cases exceeds 1 year, the average duration varies from 81 to 129.5 days.

- The worst situation in terms of duration at the moment is at 65456, where the gap between the average and maximum is more than 650 days.
- According to organizational unit 65456, there is an atypical case of ending the journey - Send Reminder. This indicates the ineffectiveness of the selected policy to alert about unfinished cases.

# Chapter 4

We decided to devote a separate chapter to receiving answers to other questions and forming conclusions.

## 4.1 Analysis of different stages of processing, at which tourist declarations are rejected.

To obtain conclusions we have performed such steps:

1.The data of the tables were uploaded with the help of Disco tool to the csv file, they were cleaned from the take.

2.We have formed summary tables in the section of stages using Excel.

3.Calculated the number of rejected declarations, taking as a basis for the number of declarations at the stage Declaration REJECTED by ADMINISTRATION (maximum rejected), excluding the number of declarations involved in other stages.

4. The number of declarations that have never been approved shall be calculated.

The results are presented in Table 5 and Table 6.

Table 5. Statistical evaluation of rejected declarations at different stages.

| Stages of Declaration processing | Internal declarations | International Declarations | Total |
|---|---|---|---|
| Declaration REJECTED by ADMINISTRATION | 805 | 1246 | 2051 |
| REJECTED by BUDGET OWNER | 42 | 23 | 65 |
| Declaration REJECTED by DIRECTOR | 0 | 1 | 1 |
| Declaration REJECTED by MISSING | 80 | 85 | 165 |
| REJECTED by PRE_APPROVER | 77 | 70 | 147 |
| Declaration REJECTED by SUPERVISOR | 247 | 75 | 322 |
| Declaration was never approved | 333 | 209 | 542 |

Table 6: Statistical evaluation of rejected declarations at different stages (calculation using Disco tool).

| Stages of Declaration processing | Internal declarations | International Declarations | Total |
|---|---|---|---|
| Declaration REJECTED by ADMINISTRATION | 952 | 1549 | 2501 |
| REJECTED by BUDGET OWNER | 59 | 40 | 99 |
| Declaration REJECTED by DIRECTOR | 0 | 4 | 4 |
| Declaration REJECTED by MISSING | 91 | 103 | 194 |
| REJECTED by PRE_APPROVER | 86 | 84 | 170 |
| Declaration REJECTED by SUPERVISOR | 293 | 126 | 419 |
| Declaration was never approved | 333 | 209 | 542 |

Based on the results obtained, the following conclusions were drawn:

- In 16% of cases (2751 out of 16949) paid declarations are rejected, 3387 declarations are rejected at different stages, the maximum number of rejected declarations in the Declaration REJECTED by ADMINISTRATION stage. It should be noted that the same declaration was rejected up to 5 times at this stage.

- In total 2751 declarations were rejected, including 1500 international and 1251 domestic ones. 542 declarations, 333 domestic and 209 international have never been approved.

## 4.2 Analysis of availability of travel authorization when executing international declaration.

Using the Disco tool, we were able to determine that 194 international trips were made without permits (out of 6449 trips with permits, only 6255 were made).

## 4.3 Analysis of declarations not approved by budget holders for more than 7 days and automatically forwarded to managers.

Using the MS SQL tool, we were able to find that 19 statements were not approved by budget holders in a timely manner.

The maximum number of days to process the declaration by the budget holders is 12 days.

## 4.4 Bottlenecks in international declaration process. Some conclusions on the work performed.

In order to identify bottlenecks in the process, we analyzed the maximum number of days of processing. The analysis was performed using Disco Fluxicon.

### 4.4.1 Domestic declarations.

Cases with duration exceeding 90 days were taken for analysis. There are 70 such cases. For the selected cases the term of the declaration review was up to 1 year 104 days.

Among them the main reasons for the delays were:

- In 39 cases (56%) the declaration was under consideration for up to 1 year 104 days (declaration 100723).
- 13 declarations (19%) were reopened by employees with an interval of up to 356 days.
- 9 declarations (13%) were delayed at the Request Payment stage for up to 284 days.

Other reasons include: passing the stage of REJECTED by MISSING, delay of the declaration by a pre-approval officer, delay at the stage of approval.

- In the latter case the payment under the declaration was made in 84 days.

The analysis was performed using the Disco Fluxicon tool by superimposing duration filters and further examining individual cases.

### 4.4.2 International.

Cases with a duration of more than 180 days are taken for analysis. Such cases are 510, the maximum time for review of declarations was up to 2 years 12 days.

Among them the main reasons for the delays were:

- According to one of the options, payment for the declaration took place before the trip, and accordingly, the gap between Payment Handled and Start trip was up to 1 year and 83 days. There were 150 such cases (29%).
- The next most common case was when the travel authorization was obtained long before the trip, the gap between Permint FINAL APPROVED by SUPERVISOR and Start trip was up to 177 days. We identified 46 such declarations (9%).
- In 31 cases (6%), the beginning of the agreement is the Start trip, then comes the consent to travel, filing a declaration and the final stage is the End trip. In this case there is a big gap between the Payment Handled and the End trip. It is up to 338 days.
- In 18 cases (4%) of the total number of declarations the approval path is the same as in the previous version, but a large time lag (up to 144 days) lies between Permint FINAL APPROVED by SUPERVISOR and Declaration SUBMITTED by EMPLOYEE.

The analysis was also performed using the Disco Fluxicon tool by superimposing diffusion filters and further examining individual cases.

# Conclusion.

In conclusion, we would like to note the most interesting conclusions that we came to during the process study.

## General conclusions about the process

1. The difference in processes between 2017 and 2018 is the following: in 2017 there was a stage of approval PRE_APPROVER, while in 2018 there were two new stages - approval ADMINISTRATION and BUDGET OWNER.

2. At the stage of harmonization BUDGET OWNER gets about half of domestic declarations and a third of international declarations to be approved.

3. every year in the summer months (June, July, August), the number of filed declarations is significantly reduced, because this time of vacation and university staff are not engaged in scientific activities, business trips become much less, thus reducing the burden on the process.

4. The share of paid international declarations in 2018 is significantly reduced by the end of the year: from 88% in January 2018 to 75-77% in November-December 2018.

5. According to the data on payment for internal declarations can be concluded that the declaration is paid in some cases not in the month of filing, but with a delay of 1-2 months.

6. There are differences in the clusters of declarations: approval of travel permit and international declaration by the owner of the budget is not the same depending on the budget under consideration and ranges from 19 to 49% for permits and from 20 to 52% for declarations, there is also a difference in average travel time depending on the organizational unit (from 75.5 to 129.5 days) and the first and last stages of the review process.

7. In 16% of cases (2751 out of 16949) paid declarations are rejected, 3387 declarations are rejected at different stages, the maximum number of rejected declarations at the stage of Declaration REJECTED by ADMINISTRATION, it should be noted that the same declaration at this stage was rejected up to 5 times. In total, 2751 declarations were rejected, including 1500 international and 1251 domestic ones. There have never been 542 declarations approved: 333 domestic and 209 international.

## Private findings

1. The payment under the internal declaration 95149, 95691 is made after the employee's retention, without the approval stage.

2. In 82 cases (0.7%) in 2017, after approval by the supervisor, internal declarations are transferred to the status of MISSING. In 2018, such an event is not established.

3. In 14% of cases (991 out of 7909) on international declarations revealed an atypical end of the way - Send Reminder. That is, the receipt of permission to travel and return from a business trip does not follow the institution of a declaration.

4. There are 134 internal declarations and 75 international declarations in the database, for which the process ends at the stage of saving the declaration by the employee, they have never been paid.

## Recommendations.

1. Upgrade/improve the process during summer months (June-August).

2. Reconsider the importance and necessity of the stage of budget approval by the owner, as not all declarations go through this stage.

3. Establish clear rules for filing declarations for employees to reduce the percentage of rejection of declarations at different stages.

4. 4. To save space, establish a timeout for statements that were saved by the employee, and then do not work with the rejected statements. After a certain amount of time is over, they are allocated from the system (the so-called "garbage collectors").

## Thank you for your attention!

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