UNIVERSITY OF PIRAEUS
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Big Data and Analytics

Business Process Analytics and Simulation

Title:	BPM using Bizagi on Investment Banking
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Introduction

Business process management (BPM) solutions have been prevalent in both industry products and academic prototypes since the late 1990s. Its main objective is to align the business processes of the organization with the needs and the demands of the customers. Basically, with BPM the aim is to improve the performance of an organization. To implement a business process management usually researchers, use a business process management system (BPMS). By creating an environment which works as a business process monitor, we evaluate how activities are executed within the system. The simulations provide enough data to enhance an organization's ability to make fruitful decisions. Banking sector is a very intriguing option to implement business process management because they involve many activities and too much customer related processes. On our case study we create a business process model that depicts an investment banking process. It presents the process of restructuring a customer's investment portfolio. The main roles involved are customer, customer relations officer and market analyst. Our main objective is to simulate the whole process model and analyze the results. To achieve this, we create and simulate different scenarios while also running the process model from different perspectives and roles.

Theoretical Background

Business processes have received ample attention for more than 20 years. Two definitions seem to better depict the essence of the term business process. Hammer and Champy [1], who state that "a business process is a collection of activities that takes one or more kinds of inputs and creates an output that is of value to the customer," and second is from Davenport [2], who claims that "a business process is defined as the chain of activities whose final aim is the production of a specific output for a particular customer or market." An efficient way to better understand the various business processes is through business process modeling. The choice of a modeling technique plays a major role at expressing a business process. There is an abundance of business process modeling techniques with approaches that capture different aspects of a business process, each having distinctive advantages and disadvantages [3]. Business Process Reengineering (BPR) was one of the first major steps forward in the field of process theory. The creators of this concept defined it as "the fundament rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed." The focus of BPR was to radically change the processes of an organization in order to achieve positive results. There were many critics of this approach because the implementation of a BPR tended to neglect the human factor [4]. Moreover, a lack of a well-established methodology and a difficulty to implement the theory in practice resulted to the need of a new more 'holistic' approach.

Business process management (BPM) is an approach with the aim of aligning the business processes of the organization with the needs and the demands of the customers. It has been

gradually positioned as the most common used approach for the design of modern organizational and information systems. The main objective of business process management is to improve the performance of business processes [5]. Four performance indicators could help evaluate the performance and those are:

- Efficiency
- Effectiveness
- Quality
- The removal of the non-value processes

BPM entails a holistic management approach that depicts a new way of managing an organization which is different to a functional hierarchical management approach [6]. From a process perspective, BPM is often regarded as a best-practice management principle to help companies sustain competitive advantage [7]. Business process modeling is the first and most important step in BPM lifecycle. The objective of the process modeling is to separate the 'process' from the 'application' for the underlying business process to be automated [8]. Typically, process logic is implemented and managed through a business process management system (BPMS) and application logic through underlying application components [9]. BPMS in general contain a wide range of events that document how efficiently processes and activities are executed within these systems. The integration of business analysis tools [10] on those systems helps organizations to make business decisions by evaluating the above-mentioned events. The analysis of process events can focus on the behavior of completed processes, evaluate currently running process instances, or focus on predicting the behavior of process instances in the future [11].

Peter Trkman chose banking industry as an example to evaluate the effectiveness of BPM. Banks are a very interesting example as they often disaggregate their value chain into independently operable functional units, which amplifies the importance of BPM [13]. Furthermore, the acquisition and the treatment of information is a central activity in banking and the impact of process innovations in IT is likely to be larger than in other industries [14]. The first part of the paper covers the need to further examine the critical success factors for the established BPM. Then the approach is theoretically grounded and explained with the combination of three underlying theories. The results show that in order to reach long-term success and improved performance, BPM must be linked to the organizational strategy.

Case Study

The case study that we are going to analyze in this paper is centered on the Banking Sector. Specifically it presents a series of processes that occur when a Customer applies at his bank for a restructure of his investment portfolio. The investment department of the bank receives the request and the Customer Relations officer that is assigned to that specific client makes a first evaluation of the request. There are two available paths for the CRO:

- Make a proposal himself after the evaluation.
- Issue a consultation request from market analysts that specialize in investment portfolios and then make a proposal at his client

The client can reject or approve the proposal which roadmaps two different scenarios. In case of rejection the Customer Relations officer has to re-evaluate the investment basket options and propose a new investment basket combination. In case of approval the new investment portfolio is applied and the customer is charged.

We will try to create a business process model that depicts the above mentioned case study. Moreover we will set up resources, process time indicators, performers and process calendars to simulate these processes and evaluate our results. The point of the paper is to compare and evaluate different scenarios (by setting different parameters) of the process model in order to achieve high performance.

Business Process Model

For our simulations we will use the Bizagi Software and specifically the Bizagi Studio [15]. With Bizagi Studio we can automate any business process across our case study, by turning our process model into a running application.

Our process model is consisted of three lanes, one for each of the entities and three milestones to define the three main stages of the activities.

Lanes:

- Customer: Represent the Client who wishes a portfolio restructure.
- Customer Relations Officer (CRO): The employee who handles the client in most of the activities.
- Market Analyst (MA): Make a thorough analysis of the current investment portfolio and provides an alternative at the CRO.

Milestones:

- Request Investment: Depicts the first stage of the process model where the Customer applies for a new investment opportunity.
- Proposal Evaluation: Depicts the whole Evaluation sub-process and the proposal to the client. We decided to include all these activities on one stage in order to have a better understanding of the process.
- Proposal Review: Depicts the evaluation of the proposal by the client and the final steps of the process.

On figure 1 the whole process model is depicted.

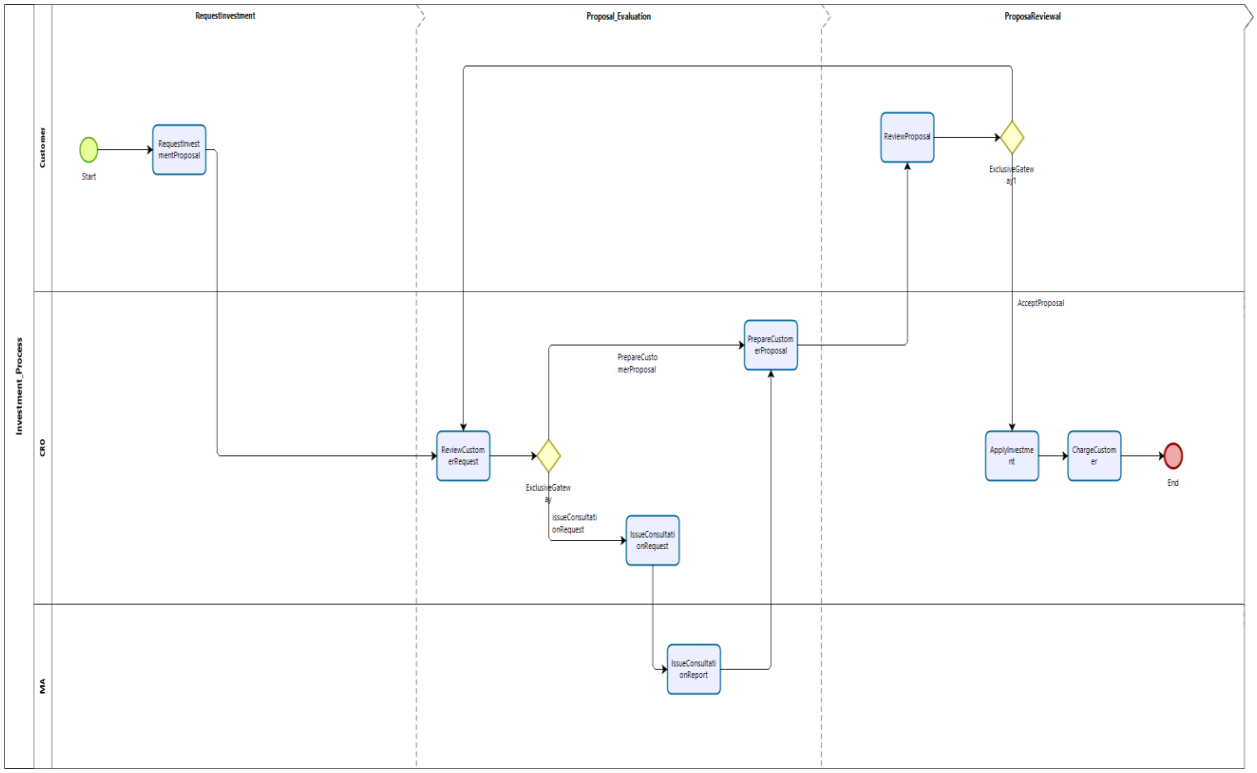
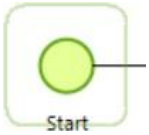


Figure 1: Business Process model.

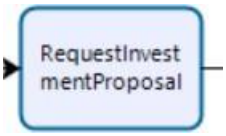
To better explain the model we would specify the different objects and describe our thought process.

Start Event:



It describes the start of the process model.

Tasks:



They depict the activities involved in the process model. With sequential order they are the following:

1. Request Investment Proposal: Customer makes a request for a new investment proposal.
2. Review Customer Request: CRO evaluates the request. It should be noted that 1 customer is assigned to 1 specific CRO officer.
3. Issue Consultation Request: CRO asks for MA assistance. There are 2 available Market analysts and either one can handle the Task. The first available is assigned.
4. Issue Consultation Report: One MA analyses the investment portfolio and provides CRO with a report of his consultation.
5. Prepare Customer Proposal: CRO makes a proposal to the client.
6. Review Proposal: The Customer evaluates the proposal.
7. Apply Investment: The Customer accepts the proposal and the CRO officer process it.
8. Charge Customer: The CRO charges the Customer for the services provided.

Gateways:

There are two gateways that show the decision paths.

The first one is the decision that the CRO has to make regarding the proposal to the Client. The CRO has to to decide if he will commit a proposal to the customer with or without the Market Analyst Consultation.

The second one is the decision of the customer after he receives the proposal. The customer has to decides if he accepts or not the proposal. If he accepts the final steps are made by the CRO and the process cycle ends. If he rejects the whole Proposal Evaluation milestone is being repeated and a new proposal is submitted.

This scenario is the reason we decided the evaluation and proposal activities should be assigned to one milestone.

Costs

We have made the decision to keep the same costs for either scenario and to have no fixed costs. The Customer Relations officers is paid 20euro per hour and each Market Analyst 12 euro per hour.

Resources	Fixed cost	Cost per hour
Customer	0	0
Customer Relations Officer	0	20
Market Analysts	0	12

Image 1: Costs table.

Scenarios

We have simulated different scenarios to check the various performances and compare them.

Normal Load

We take the following assumptions.

- One Customer is assigned to one and only specific CRO
- The evaluation gateway is 80% to require MA assistance and 20% to skip it (image 2).
- The Probability ratios of the Customers decision are 70% in favor of the acceptance and 30% in favor of the rejection.
- The calendar is set to 270 working days and the working days and hours are shown in image 3.
- A customer could only request a new investment portfolio only throughout working days and hours.

Image 2: Probability of Consultation Request

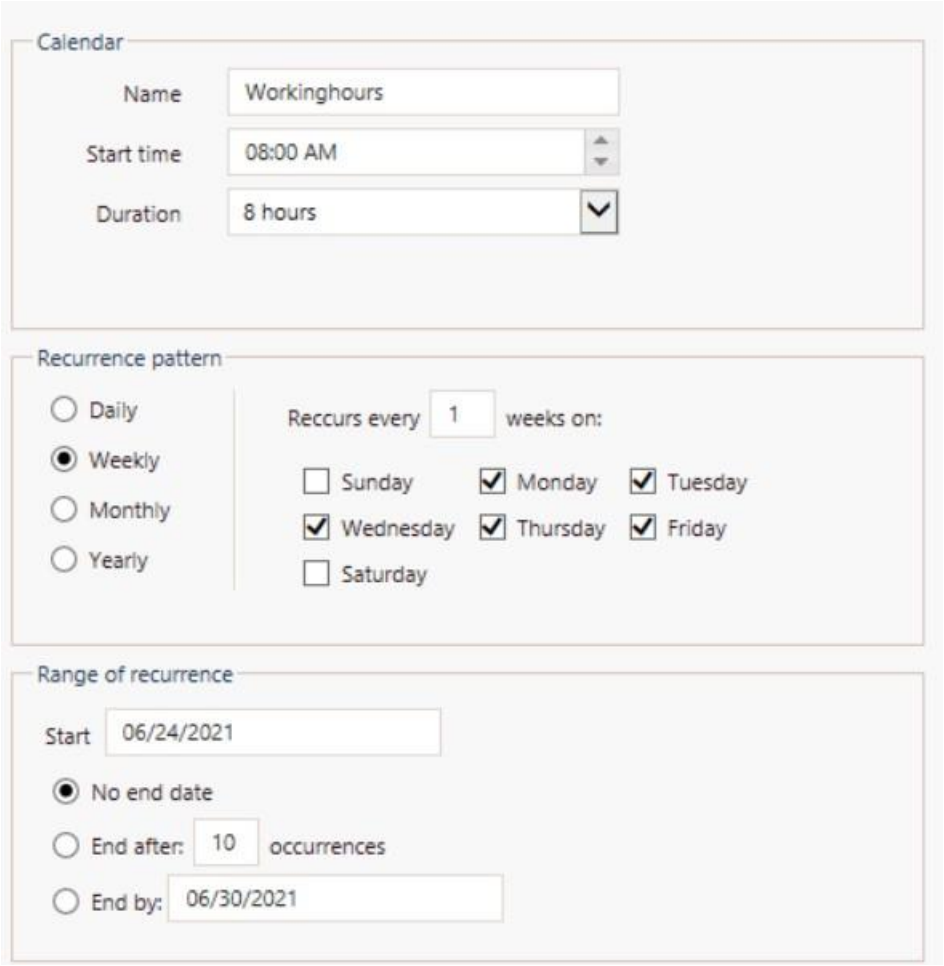


Image 3: Scenario Calendar

Resources	Default quantities	Workinghours
Customer	1	1
Customer Relations Officer	1	1
Market Analysts	2	2

Image 4: Resources Allocation

Time analysis

For this scenario we have the following time parameters per activity:

Activities	Distribution	Mins	Std	min	max
Request Investment Proposal	Poisson	30			
Review Customer Request	Negative Exp	15			
Issue Consultation Request	Normal	5	0.5		
Issue Consultation Report	Truncated Normal	60	5	45	70
Prepare Customer Proposal	Negative Exp	20			
Proposal Review	Truncated Normal	75	3	60	100
Apply Investment	Normal	15	1		
Charge Customer	Triangular	15		10	20

Table 1: Time distributions for normal load activities.

The thought process is the following:

1. Request Investment Proposal: Poisson distribution is one of the most common customer arrival distributions. The normal load is around 2 clients per hour.
2. Review Customer Request: Negative Exponential distribution is a variation of Poisson and reacts very efficiently in this type of activities. The first evaluation is 15 minutes. Usually the CRO will ask for Ma consultation (8 times out of 10). However even if he makes the decision by his own he has to choose between standard and predefined investment options, thus not aggregating the time by a lot.
3. Issue Consultation Request: This activity is pretty straight forward and fast so normal distribution reacts very well.
4. Issue Consultation Report: Truncated Normal Distribution because we wanted to assign min and max values. We estimate around 1 analysis per hour from each Market analyst. So the two market analysts cover the 2 customers per hour.
5. Prepare Customer Proposal: Negative Exponential distribution is a variation of Poisson and reacts very efficiently in this type of activities. We estimate 3 proposals per hour.
6. Proposal Review: Truncated Normal Distribution because we wanted to assign min and max values. We estimated that for this kind of decision the customer may need more than an hour.
7. Apply Investment: This activity is pretty straight forward and fast so normal distribution reacts very well. We estimate 4 applications per hour.
8. Charge Customer: Triangular to focus mainly on the peak of the triangular at 15 minutes.

The simulation for normal load shows that CRO is utilized almost at full capacity while the Market analysts seem to be under-utilized.

Resource	Scenario	Utilization	Total fixed cost	Total unit cost	Total cost
Customer	Normal load	100.00 %	0	0	0
Customer Relations Officer	Normal load	92.09 %	0	119,349.13	119,349.13
Market Analysts	Normal load	49.02 %	0	76,240.78	76,240.78
		Total Normal load	0	195,589.92	195,589.92

Image 5: Normal Load Resource Analysis.

It also shows the differnce in costs with the CRO cost to represent 61% of the total 195.589,92 budget.

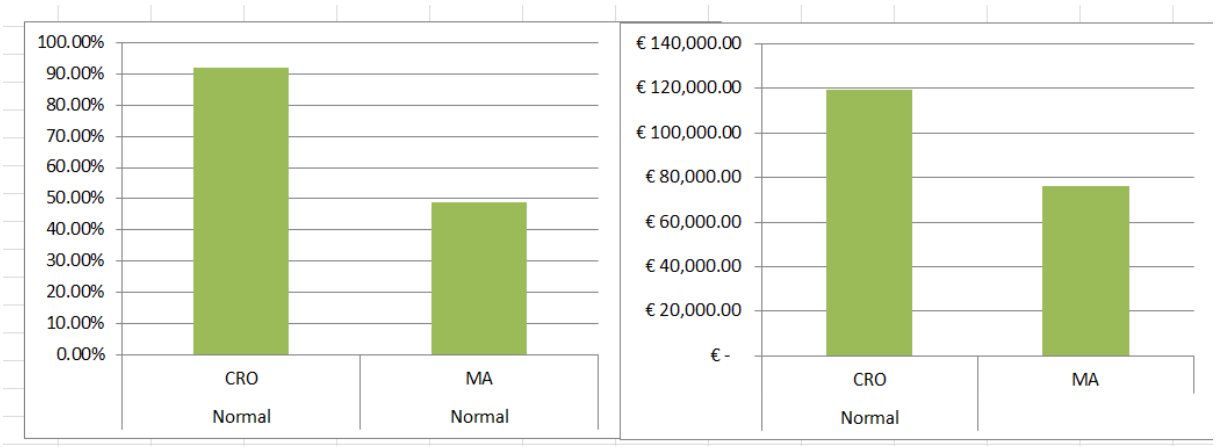


Diagram 1: Utilization and Cost Analysis

The chosen parameters seem to represent a very good time distribution between the tasks with encouraging results. Of course, the slow max times should worry us since there is a very low possibility where the customer keeps rejecting the proposals.

Name	Scenario	Type	Instances completed	Instances started	Min. time	Max. time	Avg. time	Total time	Min. time waiting resource	Max. time waiting resource	Avg. time waiting fo resource
Investment_Process	Normal load	Process	1,556	25,904	10h 2m 2s	263d 20h 25m 33s	124d 21h 18m 35s	930703d 16h 9m 31s			
Start	Normal load	Start event	25,904								
ExclusiveGateway	Normal load	Gateway	8,016	8,016							
ExclusiveGateway1	Normal load	Gateway	2,260	2,260							
End	Normal load	End event	1,556								
ReviewProposal	Normal load	Task	2,260	2,261	3h 40m 43s	193d 22h 7m 57s	97d 29m 15s	219265d 22h 16m 1s	2h 24m 37s	193d 22h 51m 37s	97d 15m 56s
ChargeCustomer	Normal load	Task	1,556	1,556	10m 29s	8h 19m 2s	1h 9m 12s	74d 18h 52m 7s	0	8h 2m 26s	54m 11s
ReviewCustomerRequest	Normal load	Task	8,016	8,016	0 s	8h 37m 30s	1h 24m	467d 15h 17m 29s	0	8h 11m 30s	1h 9m 8s
ApplyInvestment	Normal load	Task	1,556	1,556	11m 49s	8h 16m 54s	1h 14m 44s	80d 18h 29m 24s	0	8h 3m 21s	59m 44s
RequestInvestmentProposal	Normal load	Task	7,314	7,314	31m	193d 23h 5m 9s	97d 51m 45s	709720d 22h 5m 25s	0	193d 22h 40m 9s	97d 21m 48s
IssueConsultationReport	Normal load	Task	6,384	6,384	45m	4h 13m 53s	1h 12m 30s	321d 10h 55m 39s	0	3h 14m 29s	12m 47s
PrepareCustomerProposal	Normal load	Task	8,014	8,015	0 s	8h 19m 58s	1h 23m 51s	466d 16h 4m 32s	0	8h 17m 4s	1h 3m 50s
IssueConsultationRequest	Normal load	Task	6,384	6,384	3m 28s	8h 33m 35s	1h 8m 54s	305d 12h 8m 50s	0	8h 28m 30s	1h 3m 54s

Image 6: Normal Load Simulation Results

Activities	AVG time	Avg Waiting Resource time	Actual task time
Issue Consultation Request	1:08:54	1:03:54	0:05:00
Issue Consultation Report	1:12:30	0:12:47	0:59:43
Prepare Customer Proposal	1:23:51	1:03:50	0:20:01
Apply Investment	1:14:04	0:59:44	0:14:20

Image 7: Normal Load Banking Department Results

Diagram 2 shows that the only truly long in duration task is the issue consultation report, that is being processed by the Market Analysts. The rest of the tasks have actual processing times that vary from 5 to 20 minutes (diagram 3). So, it is safe to assume that the main reason for the long durations times is the waiting resource time. The Customer takes sufficient time to decide if he accepts the proposal which prolongs the rest of the tasks. That along with the possibility of rejection aggregates the average task & waiting resource times.

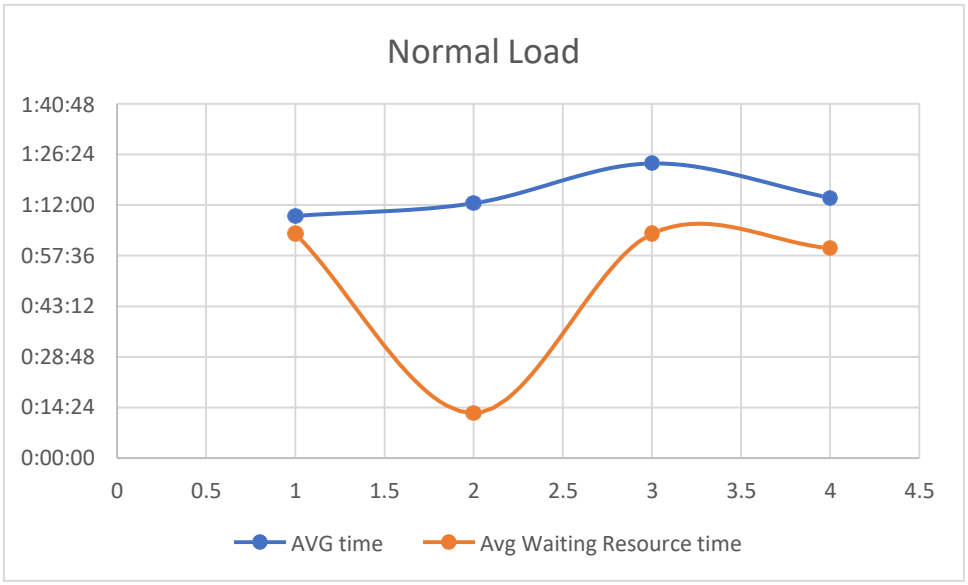


Diagram 2: Time comparison between Avg time and Avg waiting resource time.

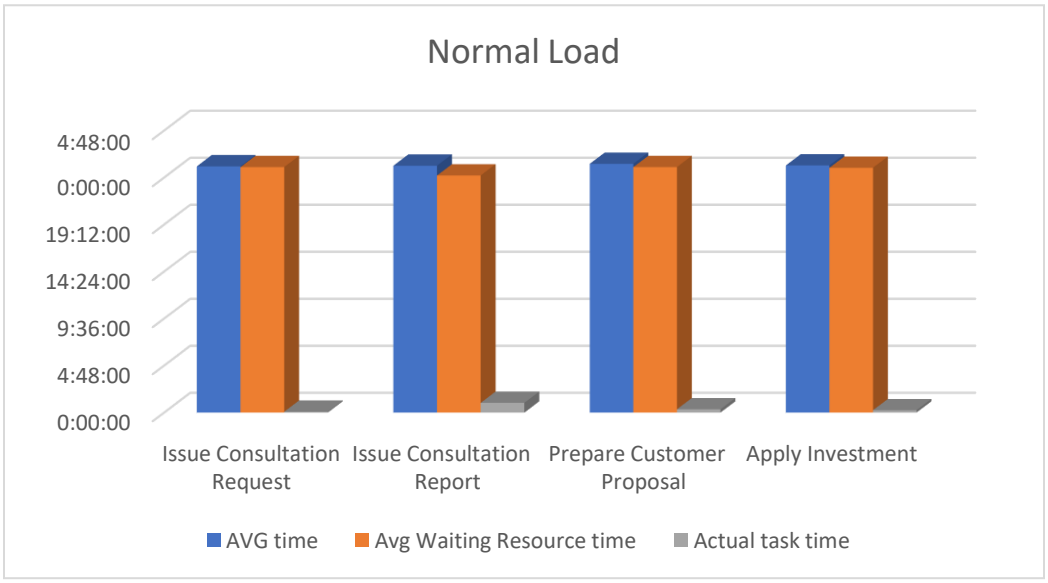


Diagram 3: Time comparisons for normal load scenario.

Heavy load

This scenario has the same parameters as normal load scenario except:

- The Probability ratios of the Customers decision are 60% in favor of the acceptance and 40% in favor of the rejection.
- The Probability ratios of the Evaluation decision are 90% in favor of MA's consultation and 10% in favor of not.
- The request investment proposal is 20minutes with Poisson distribution. So, we increased the incoming clients from 2 to 3 per hour.

We simulated this scenario in order to check how the process model reacts when there is an increase of workload. To achieve this, we both increased the incoming client and increased the clients who reject their proposal.

The simulation for heavy load shows that CRO is utilized at full capacity while the Market analysts seem to be under-utilized. However, there is an increase of 19.3% in the Market analyst workload compared to the normal load. There is also an increase of 14,2% at total cost of the department (223363,37).

Resource	Scenario	Utilization	Total fixed cost	Total unit cost	Total cost
Customer	heavyload	100.00 %	0	0	0
Customer Relations Officer	heavyload	99.99 %	0	129,589.39	129,589.39
Market Analysts	heavyload	60.30 %	0	93,773.98	93,773.98
		Total heavyload	0	223,363.37	223,363.37

Image 8: Heavy Load Resource Analysis.

Diagram 4: Utilization and Cost Analysis at heavy load.

The below shown results indicate that heavy load had a huge impact in terms of time durations with most of the tasks needing 9-10 days to complete.

Name	Scenario	Type	Instances completed	Instances started	Min. time	Max. time	Avg. time	Total time	Min. time waiting resource	Max. time waiting resource	Avg. time waiting for resource
Investment_Process	heavyload	Process	1,435	25,904	10h 19m 43s	263d 17h 1m 17s	127d 12h 36m 3s	1312465d 21h 20m 33s			
Start	heavyload	Start event	25,904								
ExclusiveGateway	heavyload	Gateway	9,364	9,364							
ExclusiveGateway1	heavyload	Gateway	2,796	2,796							
End	heavyload	End event	1,435								
ReviewProposal	heavyload	Task	2,796	2,796	2h 4m 45s	177d 4h 16m 31s	88d 16h 49m 43s	248008d 13h 1m 49s	48m 39s	177d 3h 6m 13s	88d 15h 34m
ChargeCustomer	heavyload	Task	1,435	1,435	51m 31s	19d 3h 5m 43s	10d 3h 16m 12s	14545d 12h 49m 3s	38m 18s	19d 2h 50m 1s	10d 3h 1m 11
ReviewCustomerRequest	heavyload	Task	9,364	9,364	1m 24s	19d 3h 25m 6s	9d 21h 31m 33s	92674d 16h 14m 59s	0	19d 3h 19m 47s	9d 21h 16m 3
ApplyInvestment	heavyload	Task	1,545	1,545	36m 9s	19d 2h 59m 49s	10d 2h 19m 18s	15599d 11h 5m	21m 31s	19d 2h 42m 39s	10d 2h 4m 18
RequestInvestmentProposal	heavyload	Task	8,942	8,943	19m	177d 4h 31m 45s	87d 8h 4m 57s	780965d 10h 29m 38s	0	177d 4h 12m 45s	87d 7h 59m 2
IssueConsultationReport	heavyload	Task	7,850	7,850	45m	6h 4m 32s	1h 24m 52s	462d 16h 37m 57s	0	5h 1m 52s	25m 8s
PrepareCustomerProposal	heavyload	Task	8,211	8,211	17m 44s	19d 3h 33m 19s	10d 21m 17s	82231d 9h 16m 14s	1m 56s	19d 3h 15m 9s	10d 1m 14s
IssueConsultationRequest	heavyload	Task	7,850	7,851	4m 45s	19d 3h 29m 52s	9d 22h 24m 16s	77978d 3h 45m 49s	0	19d 3h 25m 50s	9d 22h 20m 5

Image 9: Heavy Load Simulation Results

Hire an extra CRO scenario

This scenario has the same parameters as normal load scenario except:

- We hire another Customer relations officer to help with the workload.

If we hire another CRO with the assumption that both can handle every client, we notice that the workload for both sub-departments are a little more than 50% so underused. The cost is higher by 5,90% from the usual normal load. That small difference isn't that significant if there is an actual difference in time durations of the tasks.

Resource	Scenario	Utilization	Total fixed cost	Total unit cost	Total cost
Customer	HireExtraCro	100.00 %	0	0	0
Customer Relations Officer	HireExtraCro	52.95 %	0	120,901.76	120,901.76
Market Analysts	HireExtraCro	55.44 %	0	86,224.99	86,224.99
		Total HireExtraCro	0	207,126.74	207,126.74

Image 10: Normal Load with extra CRO Resource Analysis.

Diagram 5: Utilization and Cost Analysis at normal load with extra CRO.

Name	Scenario	Type	Instances completed	Instances started	Min. time	Max. time	Avg. time	Total time	Min. time waiting resource	Max. time waiting resource	Avg. time waiting fo resource
Investment_Process	HireExtraCro	Process	1,554	25,904	9h 27m 17s	265d 17h 11m 39s	124d 15h 1m 22s	931290d 10h 20m 41s			
Start	HireExtraCro	Start event	25,904								
ExclusiveGateway	HireExtraCro	Gateway	8,027	8,027							
ExclusiveGateway1	HireExtraCro	Gateway	2,255	2,255							
End	HireExtraCro	End event	1,554								
ReviewProposal	HireExtraCro	Task	2,255	2,255	3h 42m 53s	193d 19h 44m 34s	96d 19h 9m	218279d 7h 33m 1s	2h 26m 48s	193d 18h 28m	96d 17h 53m
ChargeCustomer	HireExtraCro	Task	1,554	1,554	10m 12s	2h 43m 26s	19m 18s	20d 19h 59m 36s	0	2h 29m 19s	4m 13s
ReviewCustomerRequest	HireExtraCro	Task	8,027	8,028	0 s	3h 10m 56s	21m 19s	118d 21h 36m 21s	0	3h 2m 56s	6m 26s
ApplyInvestment	HireExtraCro	Task	1,554	1,554	11m 17s	2h 4m 18s	19m 28s	21d 31m 18s	0	1h 49m 12s	4m 27s
RequestInvestmentProposal	HireExtraCro	Task	7,327	7,328	31m	193d 20h 19m 6s	97d 5h 15m 3s	712322d 2h 10m 34s	0	193d 20h 3m 6s	97d 5h 4m 6
IssueConsultationReport	HireExtraCro	Task	7,218	7,219	45m	3h 56m 33s	1h 6m 53s	335d 7h 47m 32s	0	3h 7s	7m 10s
PrepareCustomerProposal	HireExtraCro	Task	8,026	8,026	0 s	3h 59m 35s	25m 18s	141d 2h 4m 52s	0	2h 34m 54s	5m 13s
IssueConsultationRequest	HireExtraCro	Task	7,219	7,219	3m 15s	2h 37m 51s	10m 20s	51d 20h 37m 24s	0	2h 33m 4s	5m 20s

Image 11: Normal Load with extra CRO Simulation Results.

The hire of new personnel showed impressive results in terms of time duration making the whole process a lot faster. On diagram 6 we notice a huge drop in both avg task times and waiting resource times. Moreover, on diagram 7 we notice how much impact waiting resource time had on the process model.

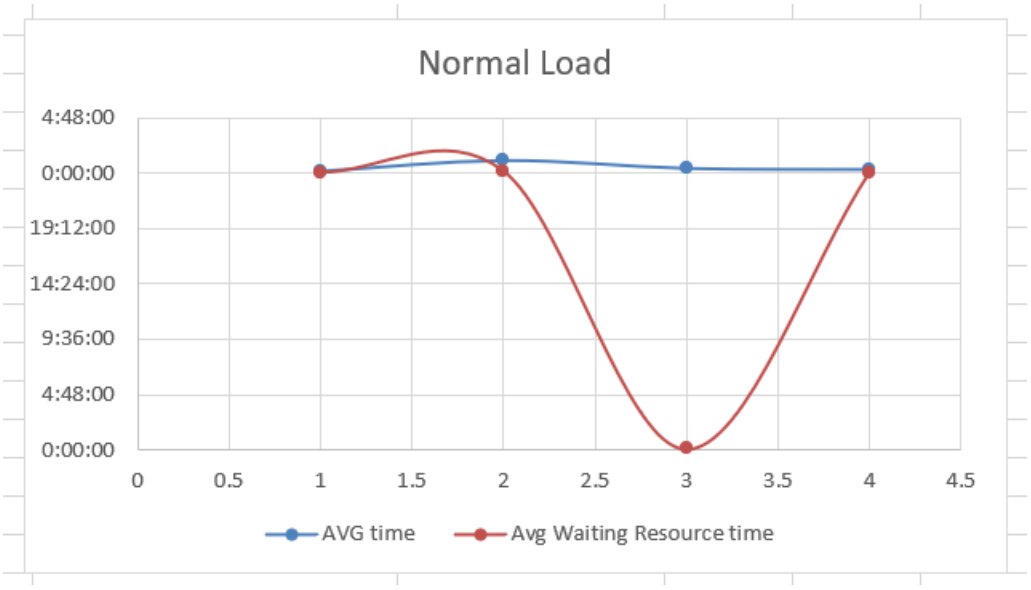


Diagram 6: Time comparison between Avg time and Avg waiting resource time with extra CRO.

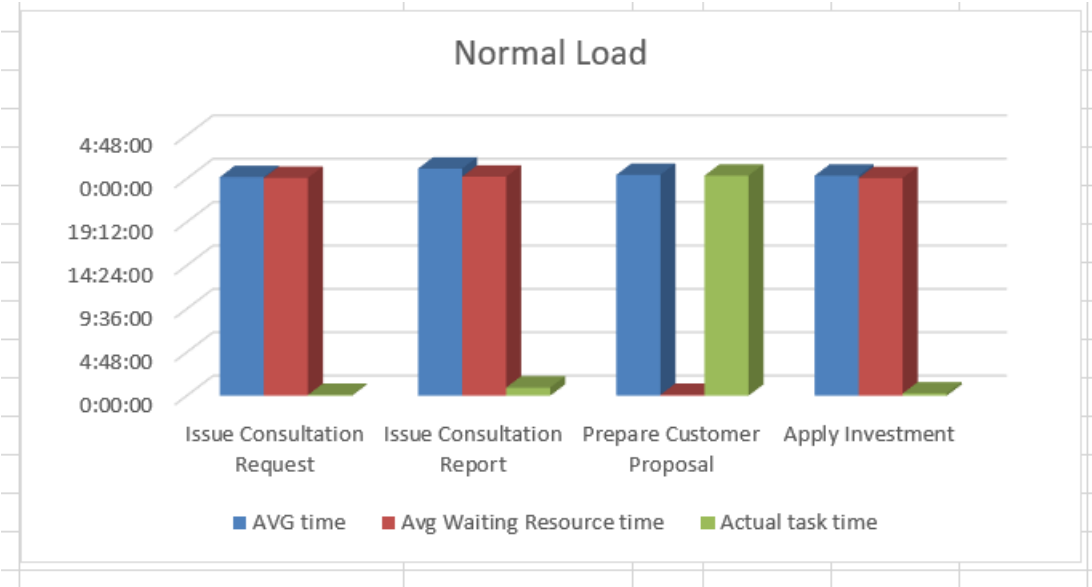


Diagram 7: Time comparisons for normal load scenario with extra CRO.

Hire an extra CRO heavy load

This scenario is the same as the heavy load but with the addition of an extra Customer Relations officer. We notice that there is bigger usage for both sub-departments but still not remotely close to full capacity. However, the 18% increase in cost compared to the previous scenario is really impactful. The time duration table shows that there is very small difference in time delays compared to the normal with an extra CRO scenario.

Resource	Scenario	Utilization	Total fixed cost	Total unit cost	Total cost
Customer	Heavy load Extra CRO	100.00 %	0	0	0
Customer Relations Officer	Heavy load Extra CRO	62.44 %	0	142,569.58	142,569.58
Market Analysts	Heavy load Extra CRO	65.56 %	0	101,957.15	101,957.15
		Total Heavy load Extra CRO	0	244,526.73	244,526.73

Image 12: Heavy Load with extra CRO Resource Analysis.

Name	Scenario	Type	Instances completed	Instances started	Min. time	Max. time	Avg. time	Total time	Min. time waiting resource	Max. time waiting resource	Avg. time waiting for resource
Investment_Process	Heavy load Extra CRO	Process	1,760	25,904	8h 19m 15s	261d 4h 43m 6s	122d 10h 59m 48s	1036175d 37m 42s			
Start	Heavy load Extra CRO	Start event	25,904								
ExclusiveGateway	Heavy load Extra CRO	Gateway	9,475	9,475							
ExclusiveGateway1	Heavy load Extra CRO	Gateway	2,981	2,981							
End	Heavy load Extra CRO	End event	1,760								
ReviewProposal	Heavy load Extra CRO	Task	2,981	2,982	2h 12m 53s	184d 7h 14m 38s	92d 1h 3m 7s	274382d 16h 13m 49s	56m 48s	184d 8h 8m 44s	92d 32m 39s
ChargeCustomer	Heavy load Extra CRO	Task	1,760	1,760	10m 12s	3h 36m 4s	22m 41s	27d 17h 41m 42s	0	3h 20m 26s	7m 39s
ReviewCustomerRequest	Heavy load Extra CRO	Task	9,475	9,475	0 s	4h 55m 13s	28m 10s	185d 10h 25m 47s	0	4h 25m 34s	13m 9s
ApplyInvestment	Heavy load Extra CRO	Task	1,760	1,760	11m 51s	3h 16m 15s	22m 29s	27d 11h 44m 41s	0	3h 2m 9s	7m 28s
RequestInvestmentProposal	Heavy load Extra CRO	Task	8,254	8,254	19m	184d 8h 15m 46s	92d 4h 2m 41s	760759d 3h 3m 40s	0	184d 7h 56m 46s	92d 3h 42m 4
IssueConsultationReport	Heavy load Extra CRO	Task	8,532	8,534	45m	7h 24m	1h 24m 25s	500d 6h 4m 21s	0	6h 28m 27s	24m 40s
PrepareCustomerProposal	Heavy load Extra CRO	Task	9,471	9,472	0 s	4h 18m 26s	29m 38s	194d 23h 8m 4s	0	3h 26m 27s	9m 29s
IssueConsultationRequest	Heavy load Extra CRO	Task	8,535	8,535	3m 15s	4h 8m 45s	16m 25s	97d 8h 15m 35s	0	4h 3m 3s	11m 24s

Image 13: Heavy Load with extra CRO Simulation Results.

Runtime Version of the Process model.

Bizagi offers the capability to have a runtime simulation of the previously mentioned process model. In order to achieve that we had to define attributes on our process tasks and as a result create an entity relations diagram (diagram 8). Basically, we will use the predefined rules and run the simulations as if we were either a customer, a customs relations officer or a market analyst.

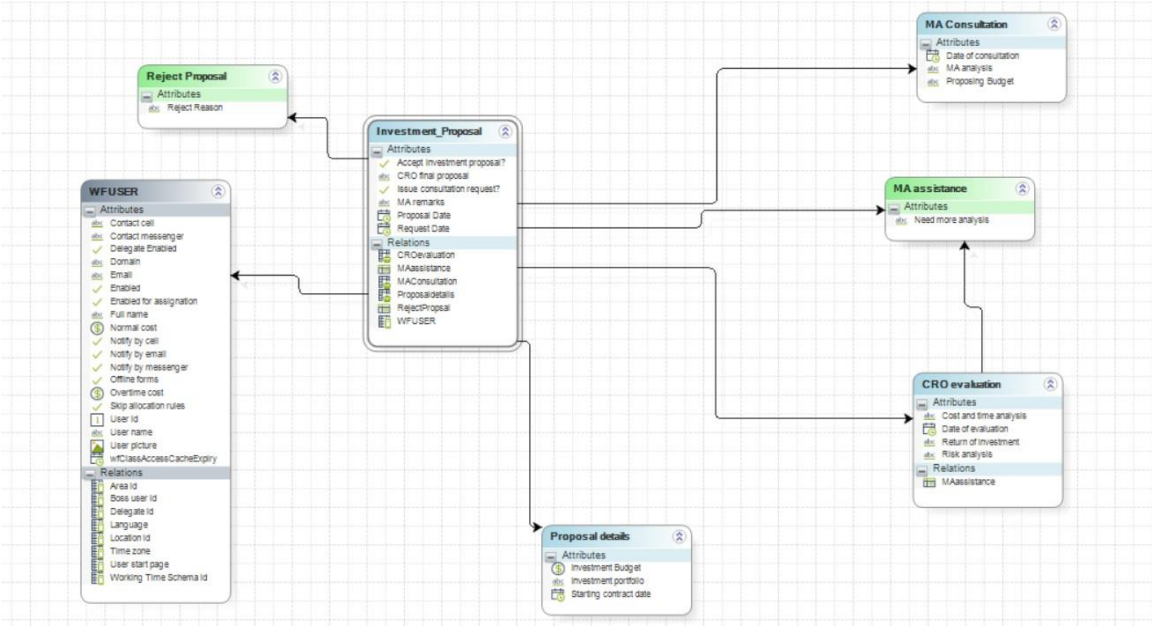


Diagram 8: Entity-relations diagram.

We defined the following roles:

- Customer1
- Customer2
- Customer3
- Customer Relations Officer (crostaff)
- Market analyst 1 (ma1)
- Market analyst 2 (ma2)

For each one of them we sign in and proceed with the task that is associated with the role. For example, one image 14 we notice that our customer relations officer has 3 requests from 3 different customers.

Image 14: CRO's inbox.

In order to proceed from one task to another there is a need for forms who define what the steps are and what attributes they include. For example, CRO must decide in the review customer request task if he will seek for market analyst's assistance (image 15). He also declares what the reason for this consultation request is.

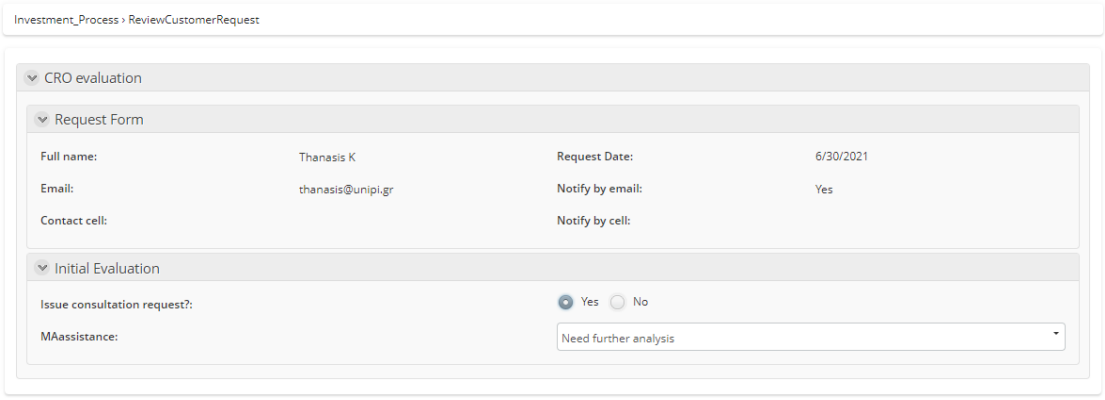


Image 15: CRO's evaluation-form.

We also notice at image 16 the form for proposal evaluation by the customer.

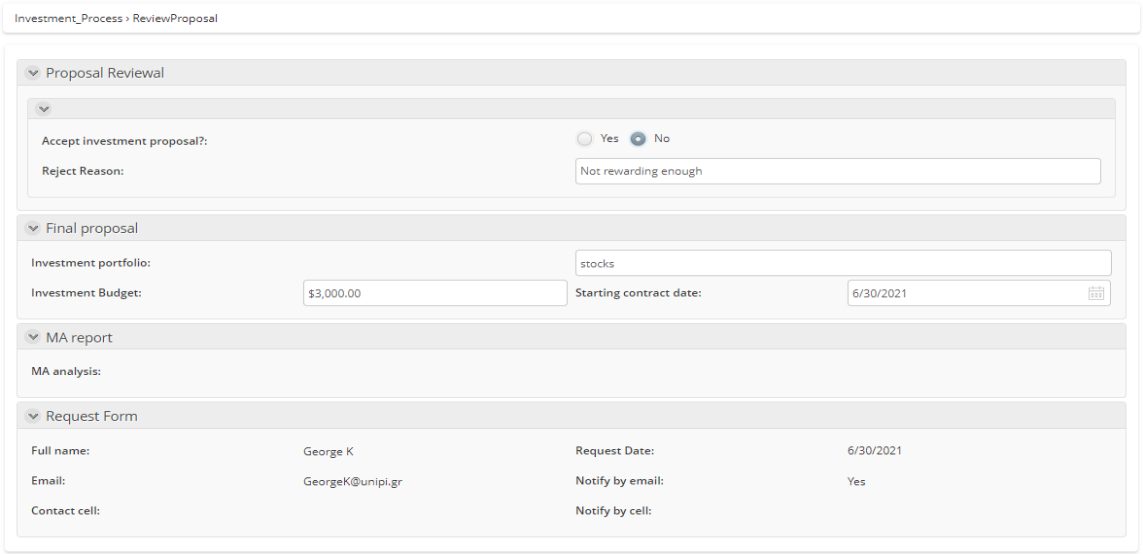


Image 16: Customer's proposal evaluation-form.

If we analyze the simulations, we had so far, we notice that the most frequent path was the one mentioned below. We notice that the path where the customer accepts the proposal at once is the most common.

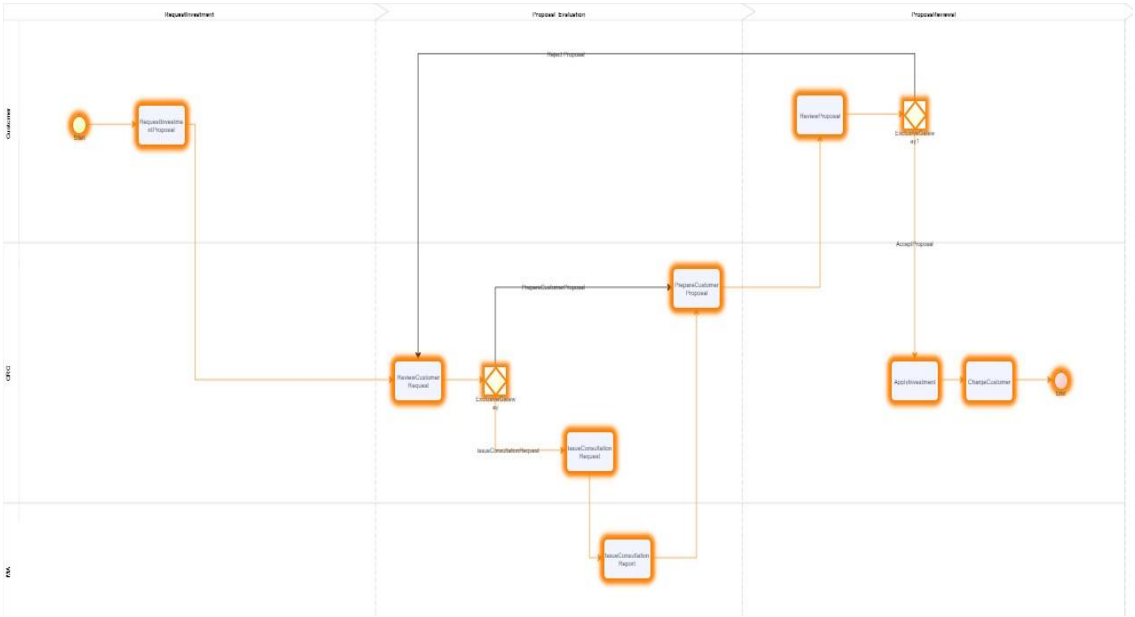


Figure 2: Most frequent path.

We could also check how many cases are overdue and how many are one time. For example, below we notice on the pie chart that 3 cases (42,86%) are overdue while 4 cases (57,14%) are on time.

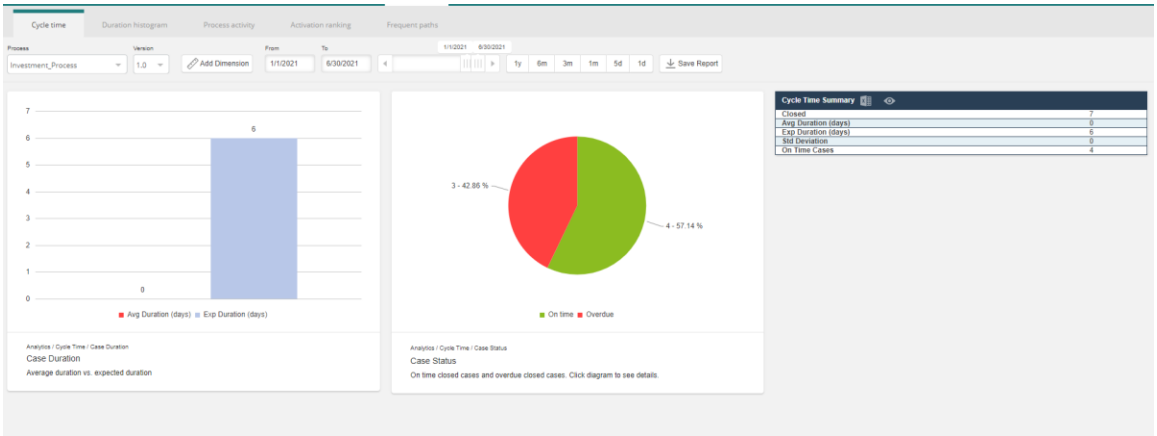


Image 17: Statistics of the cases.

Evaluating duration histogram for a specific date we notice that all the seven simulations were executed on time.

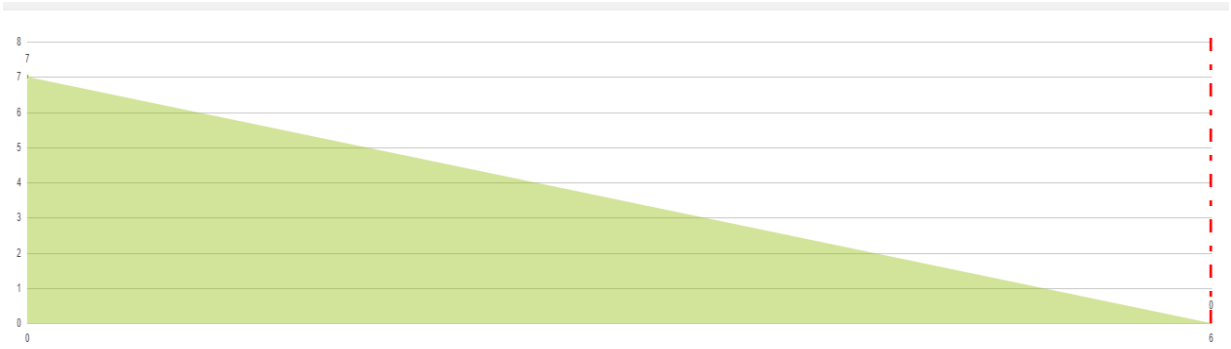


Diagram 9: Duration Histogram.

Throughout the week we notice that we have run 10 different simulations and that 7 of them are closed. Zero were canceled and only three remain active. Load analysis on diagram 11 show that all three of them are on time.

Diagram 10: Trend and Process Activity.

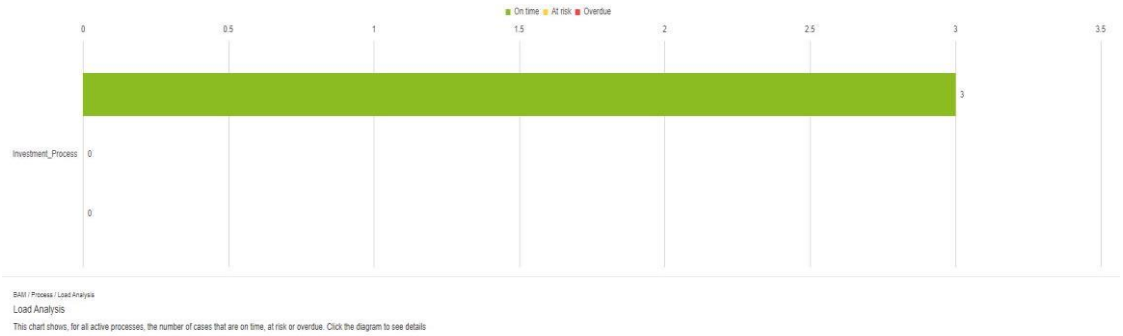


Diagram 11: Load analysis.

With the option of stopwatch, we could examine separately a series of tasks instead of the whole process. This way we can have a more detailed evaluation and thus improvement. For example, we created a stopwatch that runs only the evaluation process. Specifically, we exclude the request of new proposal investment and the tasks apply investment and charge customer.

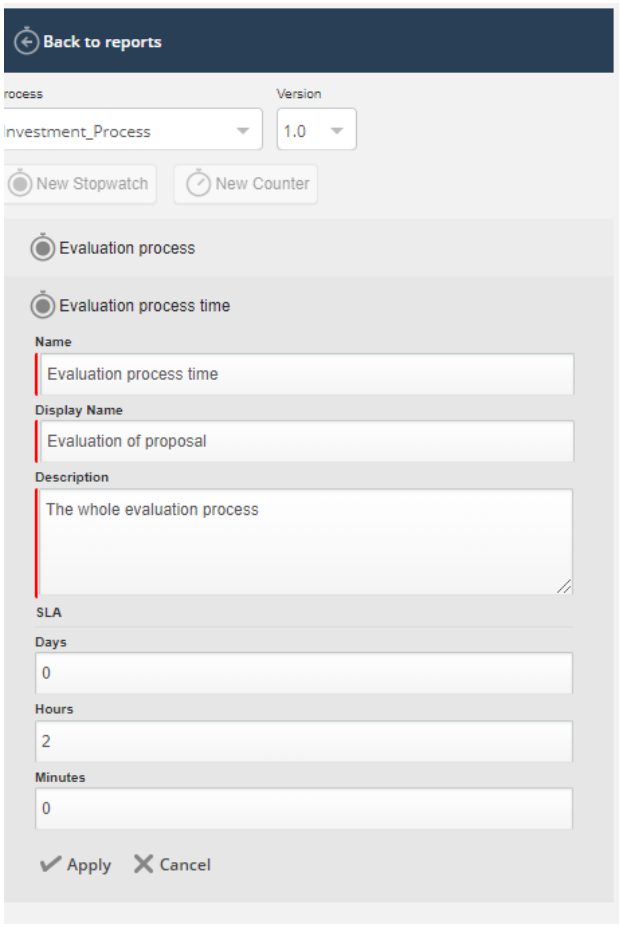
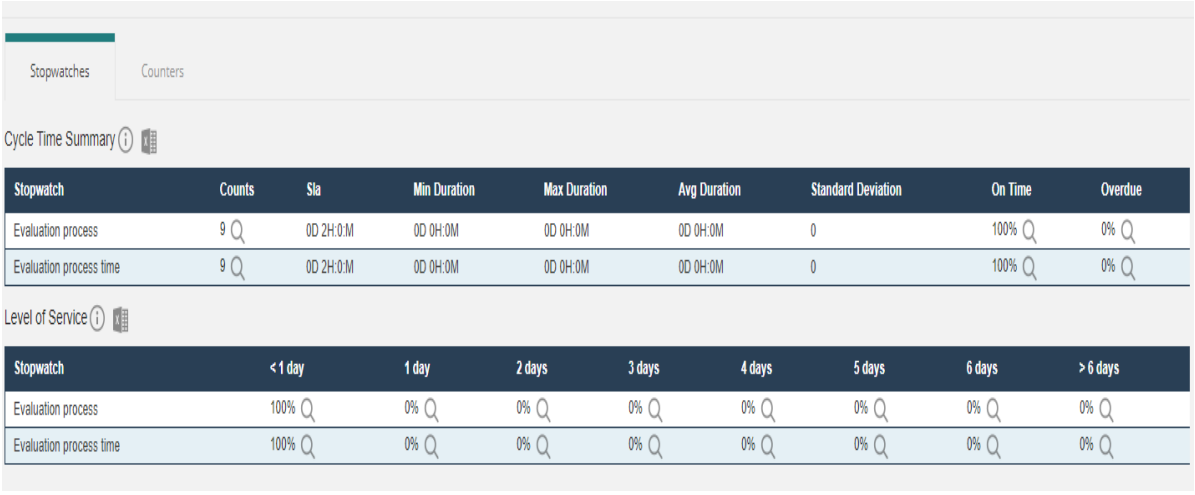


Image 18: Setting a stopwatch.

We notice that the whole stopwatch runtime was on time and all the activities were also on time. Inside the assignments of the stopwatch Market analyst 2 was not assigned to an activity cause on all of the simulations that were executed on a specific date market analyst 1 was enough in terms of load need.



Stopwatches | Counters

Cycle Time Summary

Stopwatch	Counts	Sla	Min Duration	Max Duration	Avg Duration	Standard Deviation	On Time	Overdue
Evaluation process	9	0D 2H:0:M	0D 0H:0M	0D 0H:0M	0D 0H:0M	0	100%	0%
Evaluation process time	9	0D 2H:0:M	0D 0H:0M	0D 0H:0M	0D 0H:0M	0	100%	0%

Level of Service

Stopwatch	< 1 day	1 day	2 days	3 days	4 days	5 days	6 days	> 6 days
Evaluation process	100%	0%	0%	0%	0%	0%	0%	0%
Evaluation process time	100%	0%	0%	0%	0%	0%	0%	0%

Image 19: Stopwatch results.

The runtime simulations assist to better understand the roles, the activities necessary to complete the process, the time durations of each activity, possible delays and improvements. At last our main objective is to improve the performance of the process by utilizing all the above results.

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