

NOVA

IMS

Information
Management
School

MDSAA

Master Degree Program in
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Business Process Management

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1. Qualitative analysis

Grace Hospital, located in Lisbon, Portugal, is a renowned institution that employs more than 800 employees spread over 30 different departments. In order to improve the efficiency and satisfaction of patients, the hospital decided to analyze and restructure the care process in medical consultations, with an initial focus on the orthopedics department.

The main problems identified include patient dissatisfaction due to long waiting time, frequent delays in consultations, ineffective communication between the hospital and patients, and high operating costs with supplies. Based on these challenges, the hospital administration seeks to optimize the flow of patients and the general experience of care.

The first analysis we will do will be qualitative, using Business Process Management (BPM). This approach allows you to map and understand in detail the current processes, identify points for improvement and create a solid basis for future changes. BPM is essential because it provides a clear and structured view of existing processes, facilitating the identification of bottlenecks and inefficiencies. Within this analysis we will apply two specific methods: Value-Added Analysis and Waste Analysis.

These combined methods will provide a comprehensive understanding of the processes and help develop an effective action plan to improve the quality of care and patient satisfaction at Grace Hospital.

1.1. Value-Added Analysis

Value-Added Analysis is a crucial methodology used in the management of business processes to identify and differentiate activities that add value from those that do not add value within a workflow. In the context of Grace Hospital, this analysis is especially important to optimize the patient care process, improve operational efficiency and increase patient satisfaction.

During this analysis, the activities are classified into three main categories:

Value Added (VA): These activities produce direct value or customer satisfaction, being essential to meet your needs and expectations.

Business Added Value (BVA): These activities are necessary for the efficient operation of the business, revenue collection, or compliance with regulatory requirements.

Non-Added Value (NVA): These activities do not add direct value to the customer or business and, ideally, should be eliminated or minimized.

Step	Performer	Classification
Call patient ticket	Receptionist	VA
Ask for medical consultation and citizen card	Receptionist	BVA
Insert patient information	Receptionist	BVA
Register patient data on system	Receptionist	BVA
Check list of medical appointments	Internal Staff	BVA
Call Patient	Internal Staff	VA
Direct patient to correct office	Internal staff	NVA
Greet patient into the office	Doctor	VA
Assess patient physical complaints	Doctor	VA
Register prescription on system	Doctor	BVA
Send prescription to patient's phone	Doctor	VA
Print prescriptions	Doctor	VA
Register medical exam request	Doctor	BVA
Hand printed prescriptions to patient	Doctor	NVA
End consultation	Doctor	NVA
Call patient ticket for payment	Receptionist	BVA
Place patient's payment	Receptionist	BVA
Mark prescriptions with hospital signature	Receptionist	NVA
Print justification	Receptionist	VA
Hand justification to patient	Receptionist	NVA
Ask for citizen card	Receptionist	BVA
Check doctor's agenda	Receptionist	BVA
Schedule appointment	Receptionist	VA
Print new appointment information	Receptionist	NVA
Deliver all necessary papers	Receptionist	NVA
Indicate procedures for scheduling	Receptionist	BVA

Table 1 - Value-Added Analysis

The value-added analysis of the medical process indicates that steps directly related to patient care and treatment, such as assessing physical complaints and sending prescriptions to the patient's phone, are essential and add direct value to the service provided. Administrative activities, such as registering information and calling patients, are necessary for the efficient functioning of the clinic, even though they do not add direct value to the patient. Some tasks, like directing the patient to the correct office and handing over

printed prescriptions, do not add direct value to the patient and can be seen as potential areas for optimization.

1.2. Waste analysis

The second analysis we will apply focuses on identifying and reducing waste within the patient management processes at Grace Hospital. This comprehensive waste analysis aims to pinpoint inefficiencies and areas of redundancy, providing actionable recommendations to enhance overall process efficiency and improve the patient experience. By addressing specific activities within the patient journey, from arrival to consultation and post-appointment processes, we aim to streamline operations, minimize waiting times, and optimize resource utilization. This analysis is crucial for ensuring that the hospital can deliver high-quality care in a timely and efficient manner, ultimately leading to higher patient satisfaction and better operational outcomes.

Activity	Classification	Explanation
Delays in Prescription Processing	Waiting	Delays in processing and printing prescriptions cause patients to wait longer than necessary.
Ask for patient details that is already in the system	Overprocessing	Redundant task of asking for information that is already available in the system.
Manual Data Entry Errors	Defect	Errors during manual data entry lead to incorrect patient information, requiring additional time to correct.
Check List of Medical Appointments	Waiting	Internal staff waits for doctor availability, leading to potential delays.
Patients waiting to enter in the doctor's office	Inventory	Patients in the waiting area are considered inventory waiting to be processed.
Internal goes inform the doctor that the patient arrived	Motion	Excessive movement to inform the doctor when a digital notification system could be used.
Doctor waiting for patients	Waiting	Inefficiency caused by scheduling issues, leading to the doctor waiting for patients.
Patient Arrives at the Wrong Time or Day	Defects	Patients arriving at incorrect times due to communication issues, causing disruptions and rescheduling.
Receptionist go get the costumer printed documents from the printer	Motion	Excessive movement to retrieve printed documents; could be reduced with digital documents.

Receptionist schedule a medical appointment that is canceled later	Overproduction	Scheduling appointments that are later canceled results in unnecessary work and use of resources.
Excessive Paper Use for Documentation	Overprocessing	Printing multiple copies of documents when digital versions could suffice, leading to waste of resources
Patient Queue Management Issues	Inventory	Poor queue management results in patients waiting longer in the queue than necessary.
Inadequate Patient Communication Systems	Waiting	Lack of effective communication systems results in patients being unaware of delays or changes in their appointment status.

Table 2 - Waste Analysis

In conclusion, our waste analysis of Grace Hospital's patient management processes has identified several inefficiencies, including excessive waiting times, redundant data entry, unnecessary movements, and poor communication. To address these issues, we recommend implementing real-time notification systems and automating data entry to reduce waiting times and errors. Transitioning to digital document management and enhancing patient communication systems will streamline operations and improve patient satisfaction. Effective appointment scheduling and efficient queue management systems will further optimize patient flow and reduce delays. By adopting these recommendations, Grace Hospital can significantly enhance its operational efficiency and patient experience.

2. Quantitative analysis

Regarding quantitative analysis, in order to develop an efficient simulation model, the group made sure that XOR gateways that discard patients, i.e., the gateway can lead to the patients leaving, were all in model's level 1, as well as the timer intermediate event. The resources doctor, internal staff and receptionist were added to the model as entities.

Having done these steps, we were able to configure the simulation view. Firstly, looking at the process validation level, we defined 200 as the maximum arrival count of patients in 'Patient arrived' event, then in each XOR, we delimited the probabilities of following the 'yes' or 'no' paths, all according to the lecturers suggestions.

Secondly, in regard to the time analysis, once again in 'Patient arrived' (start event), we selected the Poisson distribution with a mean of 2.4 ($1/\lambda = 1/(200 \text{ patients}/8 \text{ hours}/60 \text{ minutes}) = 2.4$). The Truncated Normal distribution was the associated with the subprocess, with a minimum of 0 and maximum of 1 billion (symbolic values), and with a specific mean to each one, being these values pre-defined, for instance, to 'Make patient

admission' it takes about 2 minutes, so has mean equal to 2. The Negative Exponential Distribution was also designated in our model, relative to the timer intermediate event, and since the wait for the doctor could take 10 minutes, that was the mean value.

Lastly, in the resource analysis level, before going directly to the model, we defined the availability (2 receptionists, 2 internal staff and 6 doctors) and fixed cost/wage of the resources (1000€, 750€, and 2000€, respectively). In each subprocess, we selected the resource associated with it, only one since for one patient there is no need to have more than one resource allocated.

Having runned the simulation model and getting the results (Figure 1, Table 3 and Table 4), we came to a few conclusions.

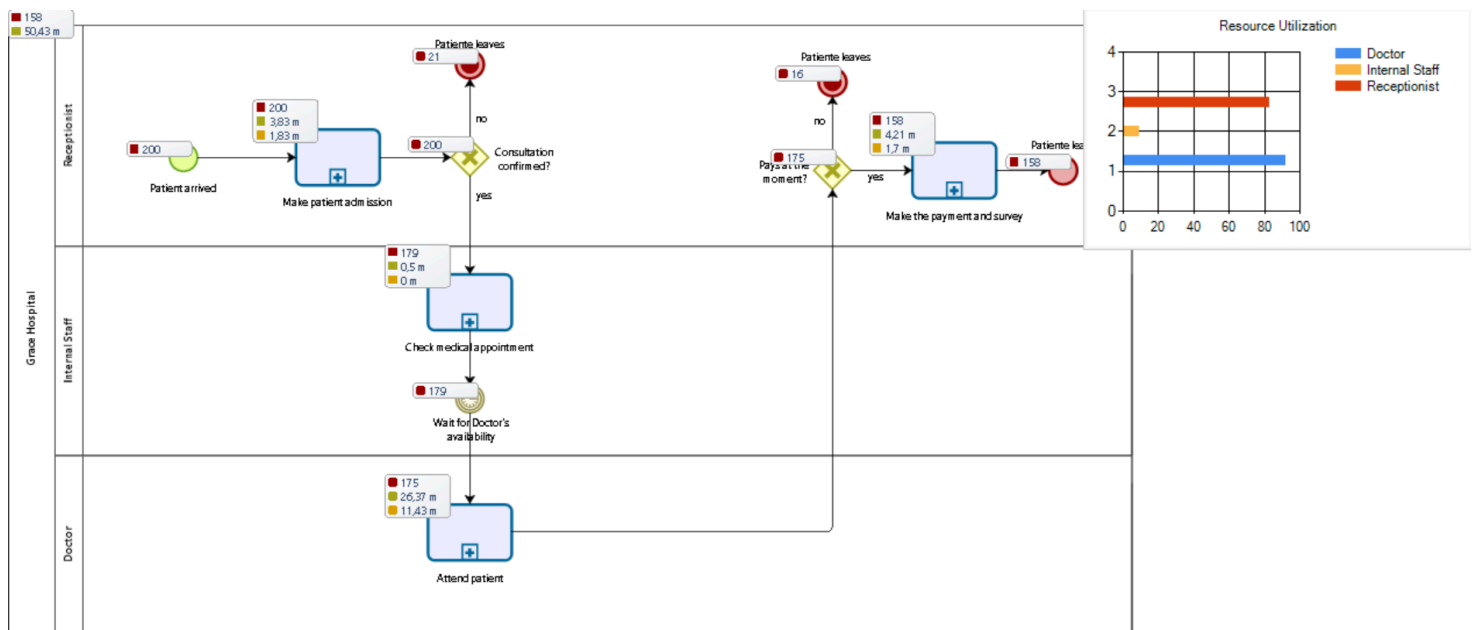


Figure 1 - Results of the simulation model (Diagram)

Regarding the resource utilization (Table 3), we can see that the Doctor is the one most utilized and with the second most high total fixed cost, being the highest associated with the Receptionist. These results indicate that Doctors and Receptionists are efficiently employed and the Internal Staff is underutilized.

Looking at Table 4, out of the 200 instances started, 158 were successfully completed, meaning that 42 are potentially inefficiencies or bottlenecks in the process.

Considering the average time, it has a total value of 50.43 minutes, so on average one patient completes the whole process in about 50 minutes. The task that is most time-consuming is 'Attend patient', with an average time of 26 minutes, but can take up to 51 minutes. Regarding the other tasks, those can be considered efficient, having average times of 4, 0.5 and 4 minutes.

The average time waiting for resources is moderate in the patient admission and in payment and survey, although when observing the average time of 'Attend patient' (11 minutes with a possible maximum of 36.73 minutes), we come to a conclusion that this task is a potential bottleneck and should be improved.

Resource	Utilization	Total fixed cost	Total unit cost	Total cost
Doctor	92.23 %	358000	0	358000
Internal Staff	9.32 %	134250	0	134250
Receptionist	82.98 %	359000	0	359000

Table 3 - Results of the simulation model (Resource Utilization)

Name	Type	Instances completed	Instances started	Min. time (m)	Max. time (m)	Avg. time (m)	Total time (m)	Min. time waiting resource (m)	Max. time waiting resource (m)	Avg. time waiting for resource (m)	Standard deviation waiting resources (m)	Total time waiting resource (m)	Total fixed cost
Grace Hospital	Process	158	200	2	103.5	50.43397	6134.4757					2681.1949826184	0
Patient arrived	Start event	200											
Pays at the moment?	Gateway	175	175										
Patient leaves	End event	16											
Consultation confirmed?	Gateway	200	200										
Patient leaves	End event	21											
Patient leaves	End event	158											
Wait for Doctor's availability	Intermediate event	179	179										
Make patient admission	Task	200	200	2	10	3.826341	765.26836	0	8	1.826341820947	1.88283958402627	365.26836418944	0
Check medical appointment	Task	179	179	0.5	0.5	0.5	89.5	0	0	0	0	0	0
Attend patient	Task	175	179	15	51.733781	26.37086	4614.9013	0	36.733781406008	11.43084111248	10.8924200893077	2046.1205591346	0
Make the payment and survey	Task	158	159	2.5	11.260008	4.207633	664.80605	0	8.7600089834220	1.696893454681	1.96164927854773	269.80605929439	0

Table 4 - Results of the simulation model (Table)

3. Explanation of the redesign actions

Optimally, one could assume that at the first time the process was well designed, continuously leading to positive outcomes. But unfortunately, Grace Hospital had already detected some dissatisfaction among its patients and employees with the current process as it is. The analysis of this feedback allowed the identification of some problems such as delays, lack of information and unsustainable printing.

To help Grace Hospital achieve its goal of improving the patient flow and providing better customer service we provided a redesign of their process (a TO-BE model). The process was redesigned trying to solve the problems they alerted us to and other problems we identified during the qualitative and quantitative analysis we conducted on their As-Is model. We used a heuristic redesign, intending not to put into question the current process structure and to solve the problems one step at a time.

1) H3/H9 – Triage and Automation

The company should launch an application which allows for the patient to make his own admission for the consultation and automatically get a calling ticket. Only the patients who don't have the app will need to be admitted through the receptionists. This change will improve the time the client spends waiting to be admitted and the time spent by the receptionists doing the admissions. Developing the application might be costly, but it would

be a great investment, aligned with the technological future.

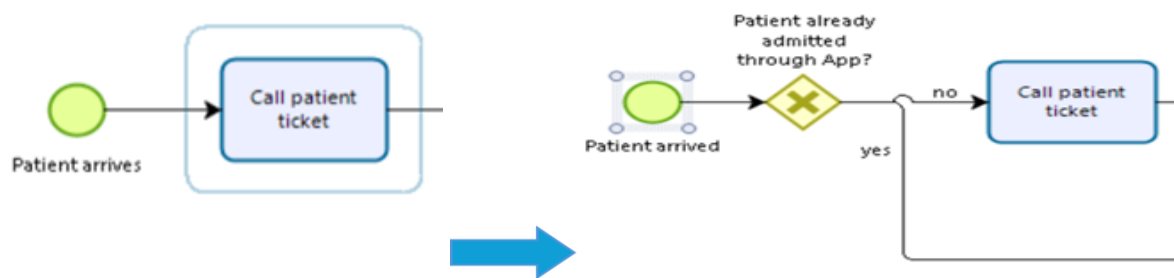


Figure 2 - Before and after of receptionist initial task

2) H4- Re-sequencing

The receptionist should confirm the consultation before proceeding to check or register the patient data on the system. This will result in time and cost improvement, as the receptionists will no longer lose time checking or registering a patient's data which is not even having a consultation, instead of doing the check and register for 100% of the patients, they will only do it to 92% as 8% usually don't have their admission confirmed.

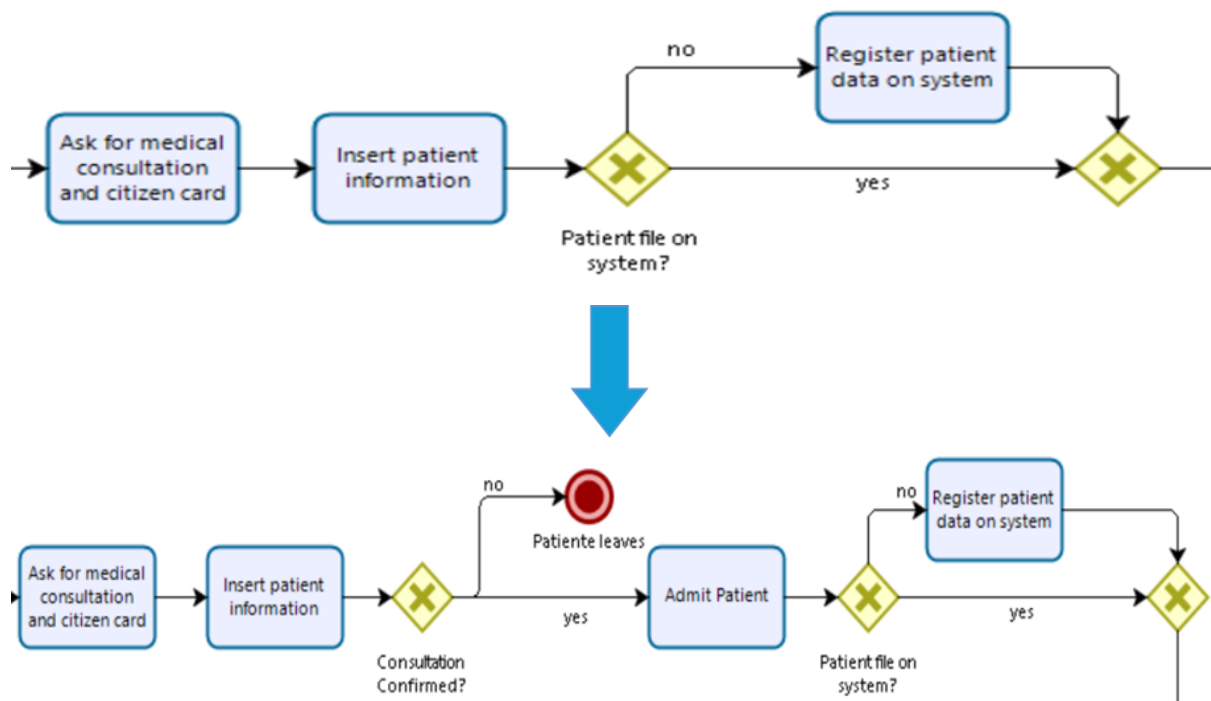


Figure 3 - Before and after of patient admission subprocess

3) H9- Automation

The internal staff whose only work is to call the patients to the doctor's room have shown to be underutilized, only generating costs. The company should replace them with a system which associates the patient's ticket and information and the doctor making the consultation, which uses a screen displaying the tickets being called and to which rooms and the tickets who are being attended. When the doctor is available he indicates it in the system, and the system will automatically call the next patient ticket to its room. This provides more quality in the information delivered to the client during his waiting and although there will be a need for an investment to purchase the screens, get the working

system and provide the required maintenance, this should not be much more than the actual costs with the internal staff remuneration. This would also reduce the information flow, directly from doctor to patient without the intermediation of the internal staff, leading to time improvement. By associating the patient's ticket and its information this would also provide improvements in future steps of the process, mainly during the payment and survey.

4) H2-Task Composition

The print and hand papers task have been merged together to reduce the time taken during the consultation realizing these tasks

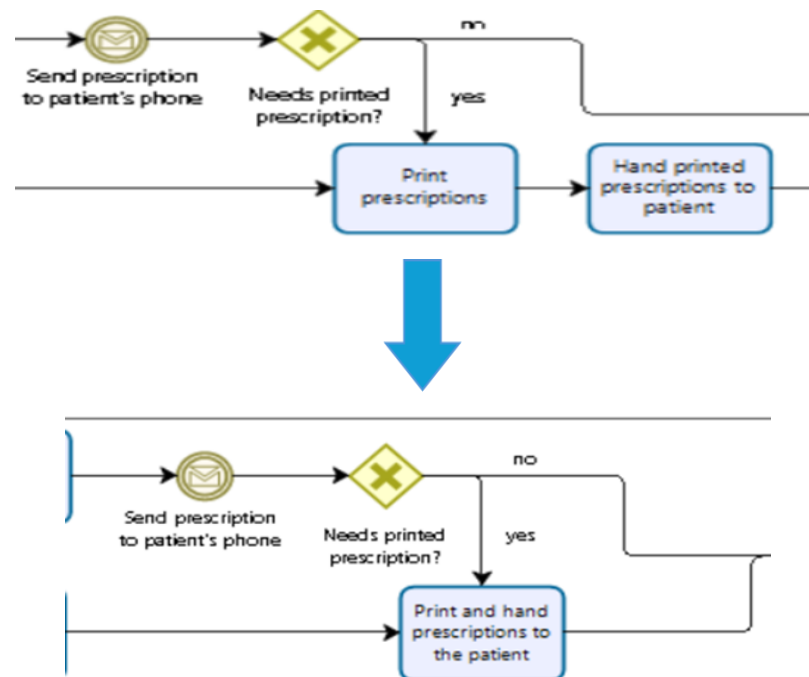


Figure 4 - Before and after of prescriptions printing by Doctor

5) H1- Task elimination

The mark prescriptions with hospital signature task is eliminated, instead we suggest the implementation of a digital signature in a bar or QR code format electronically embedded within the prescriptions papers and other papers where it is needed. This has a relatively low cost to the company, their IT department (or IT external consultants) can easily provide it and it also reduces the time taken to mark the documents, specially when the document has to be sent by email (no need to print, mark and digitalize the document). Besides, it generates an image of the hospital as technologically evolved.

6) H1- Task elimination

As the information of the patient has already been provided and is already associated with the patient's ticket on the system, asking for the patient's citizen card again becomes an obsolete task, for which it should be eliminated. Improving the time taken during the scheduling of new appointments.

7) H3 - Triage

The patients who do not need to schedule a new appointment nor a work/school justification leave right after their payment is concluded and the receptionist will not

have to go through all these following steps, unnecessarily, with that patient. This will reduce time spent by the patient waiting to finish the surveys and the time lost by the receptionist processing the check out of the patient.

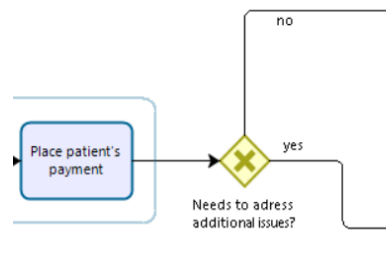


Figure 5 - Triage of patients after the conclusion of the payment

8) H5- Parallelism enhancement

The schedule of a new appointment and the delivery of a work/school justification is done concurrently. The latter can be done automatically without much focus of the receptionist by using an automatic filling with the patient's information on the system and a document with the hospital's electronic signature already embedded in it. By doing them in parallel we get

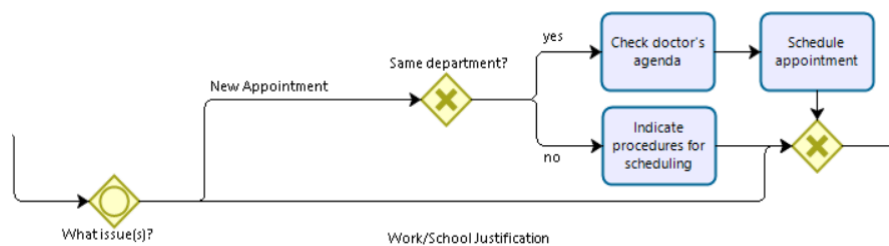


Figure 6 - Scheduling of new appointment and deliver of work/school justification done concurrently

9) H3- Triage

Instead of just printing every document to hand it to the patient, with the digital signature we now suggest starting to offer sending the documents by email as an alternative to printing the documents. With people relying more and more in technology, probably a lot of patients would adhere to this alternative generating a reduction in costs related to printings and in time taken to conduct the payment and survey subprocess.

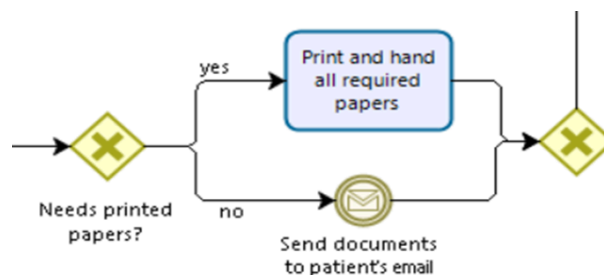


Figure 7 - New subprocess for printing of documents at payment and survey subprocess

Besides the tasks and sub-processes directly mentioned in the model, the development and implementation of the application will also allow for patients to confirm their appointments dates without having to call or go to the hospital, thus reducing the time lost by the receptionists for starting the admission process for patients who do not have appointments for the day or time. Moreover if well designed the payments can also become available on the application, reducing the time the patients have to be in the hospital and the number of patients which the receptionists have to check out. These are other very beneficial outcomes that can help the hospital decide to invest on the development of the web despite its investment cost.

4. Conclusion

To sum up, a qualitative and a quantitative analysis were developed in order to identify and optimize Grace Hospital processes. With the insights taken from these steps, the group was able to overcome some challenges and aspects that were not well employed in the previous AS-IS model, which, consequently, lead to a long waiting time and delays, for instance, and can be seen on the results driven by the simulation model.

Upon the development of the TO-BE model and application of the process management heuristics, several changes were made to our previous model. These changes aimed to optimize the process ensuring the concerns Grace Hospital presented were properly addressed. Therefore aiming to reduce the time the patients are in the hospital without being in the medical consultation, provide more information to the patients of the real time forecast of their medical consultation time, provide faster ways for the patients to check and confirm their appointment date and time, become more sustainable and environmental friendly and reduce costs with printing supplies.

5. References

- Class literature.