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IMPROVING PROCESSES IN A POSTGRADUATE OFFICE OF A UNIVERSITY THROUGH LEAN OFFICE TOOLS

Abstract: *This paper reports the administrative processes improvement based on Lean Office tools in an office environment of a University department. Lean tools such as electronic standardization were applied on the six educational projects of the department. Also, some were used to organize the computer desktop and network drives to improve the supporting educational projects information. Additionally, due to the absence of Key Performance Indicators (KPI), some were defined and implemented on the department. The main results were the electronic standardization successful implementation, reorganization of the drives and the desktop. The impacts were a reduction of 84% on the files search time, improvements on the development of forms for student registration and projects managing, a 69% reduction of time searching for student information or data, a reduction of the input times and information handling in an estimated total of 12 hours/year, identification of KPI and development of a dashboard for visual analysis and monitoring of these.*

Keywords: *Lean Office; Key Performance Indicators; Electronic Standardization; Waste.*

1. Introduction

A global competition challenges organizations from different parts of the world and from all sectors. Due the current economic crisis and competitiveness in the university sector, Higher Education Institutions (HEIs) are receiving less funding from their respective Higher Education Financing Bodies (Thomas et al., 2015). Ensuring competitiveness is a highly demanding task as organizations are facing a brand new context commanded by globalization of economy, crisis phenomena, increased competition, service and process innovation and increased emphasis on time to market. HEIs needs to do more with less, develop new strategies for teaching and learning, offer differentiated products and services, become more effective and more efficient and need to implement new methodologies as Lean Office to achieve the goals and accomplish their mission.

Lean originated in industry, but is currently being used in services, as evidenced by its applicability and its success in recent studies. In the administrative area, the main difficulty is the great diversity of tasks performed, and to some extent the resistance to change from employees. The use of Lean tools and methodologies to eliminate the variability of processes and wastes within the administrative process is known by the term Lean Office (Tapping, 2005).

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This article presents the application of Lean Office tools for the administrative processes improvement of an undergraduate and postgraduate office of the Department of Production and Systems (DPS) at the University of Minho. Lean tools such as electronic standardization and electronic 5S were applied. It was also necessary to define key performance indicators (KPI). With these tools was expected to improve productivity and reduce costs in these services.

The project was carried out in the department derived from the need to continue the search for continuous improvement that started in 2014 by a reorganization of a large part of the administrative work associated with the department. In this reorganization a project called LeanOffice@DPS, started with training in Lean Office methodologies, and involved three professors; five technical assistants; one computer expert and one technician. Since January 2015, a total of 30 projects have been discussed in the LeanOffice@DPS project, of which eight projects are currently in the planning phase, four are undergoing and eighteen have been already completed.

This article refers to two projects of this team developed in the postgraduate office. Administrative processes were analyzed and office's problems identified. Whilst, different solutions were proposed based on Lean management and informatics tools.

This paper is organized into five sections. After this introduction, a brief review of the literature is presented. The research methodology and the process of implementation of the Lean Office tools are presented in sections 3 and 4, respectively. Section 5 presents some outlines, conclusions and suggestion for the future.

2. Literature Review

The term Lean Production was presented in 1990 in the publication "*The Machine that Changed the World*" (Womack, Jones, & Roos, 1990) as a designation for the Toyota Production System (TPS). TPS is a management system focused on "*doing more with less*" by eliminating seven types of waste: overproduction, waiting, transport, over processing, inventory, unnecessary motion and defects (Ohno, 1988). Additionally, emerged the eighth waste, which is the non-use of the capacity and creativity of the employees (Liker, 2004).

Lean Production has become a philosophy (Womack & Jones, 1996), which has as its basic principles: value, value stream, continuous flow, pull and perfection. Over the years, other methodologies and tools have emerged to support Lean Thinking. The principles of Lean Thinking are a problem to eliminate *Muda*, *Mura* and *Muri*, which can be translated respectively by waste, undesirable variation and instability These principles, combined with Lean tools, eliminate waste and consequently lead to increased productivity and reduced costs for organizations.

Lean Office has emerged from Lean Production and is an approach that aims to eliminate waste along the administrative processes. A methodological approach to implement Lean Office was created by Tapping & Shuker (2003). The methodology has six steps: 1) commit to the Lean; 2) choose the flow of value; 3) learn about Lean; 4) map the current state; 5) identify Lean metrics; 6) map the future state; 7) create the Kaizen plans, and 6) implement the Kaizen plans.

It is estimated that 60-80% of all costs involved to satisfy a customer's demand are administrative tasks and that about 90% of all work done in administrative settings is wasteful. Thus, the Lean applied to service organizations and administrative processes is of vital importance (Tapping & Shuker, 2003; Venegas, 2007).

In the administrative environment, an efficient information management can promote advantages and create significant financial benefits. According to Bevilacqua, Ciarapica, & Paciarotti (2015) the flow of information within organizations connects

different sectors, functions and employees. Therefore, it is important to have the flow of information and procedures standardized, updated, completed and consistent. The use of Lean tools, such as standard work, 5S value stream mapping, poka-yoke and business process management notation and key performance indicators (KPI) become important in the administrative processes.

Standard work is a method of establishing a set of standardized work procedures that are documented and describe the best way for workers to perform their tasks (Felstead, Jewson & Walters, 2005; Markovitz, 2016).

The 5S (sort, set in order, shine, standardize and systematize) is one of the methods of determining an organization's approach to its business. It is to evaluate its workplace organization capability and visual management standards with the intention of creating a pleasant environment and increasing the productivity and efficiency of the productive systems (Osada, 1991). In this way, the 5S has as main objective to eliminate several types of waste (*Mura*), not only emphasizing in the promotion of change, but the creation of habits and practices of continuous improvement, always keeping in mind the norms established previously. In administrative services, "5S" can be implemented, both in the physical and electronic working environments (Baban, Fertuck, & Vermilye, 2009; Monteiro, Alves, & Carvalho, 2017).

To be able to achieve goals it is necessary to measure results. One of the tools to measure is the performance indicators (Parmenter, 2010). When we want to influence the behavior of an organization, we are talking about an operational control, where KPIs have a high level of importance (Hamid, 2011). KPIs are numerical values illustrated that can describe various correlations of an organization. Such correlations can be achieved with results or may be future goals to motivate employees (Kennerley & Neely, 2002). Among the advantages of KPIs is that it is easy for anyone to analyze and have an overview of a situation. These indicators can be a great help and to influence major decisions from the high level direction. Normally, they need to be visually displayed in a dashboard for monitoring (Martins, Alves, & Leão, 2018). To create reliable KPIs information, they cannot be simplified because the key information behind the KPI is often used to give more information as well as to create other indicators in the future.

3. Research Methodology

The changes described require a new thinking about the way prospective workers are trained (Alves, Leão, Moreira, & Teixeira, 2018). Noticing that the administrative processes are very different when compared with industrial processes (Rüttimann, Fischer, & Stöckli, 2014), this project initially performed a search for information in several bibliographic references with the main objective of elaborating a critical literature review. In this way, it was expected to gain further knowledge of Lean tools and principles that could be used at DPS. During the development of the project it was more appropriate the usage of Action Research methodology, where the researcher participates actively in the action. The Action Research methodology is composed of five phases: I) diagnosing; II) action planning; III) taking actions; IV) evaluation and V) specifying learning. This methodology is also known as "*learning-by-doing*", which can be translated as studying a system and, at the same time, collaborating with the members to change it. The researcher focuses on transforming employees involved in researchers. People learn more and apply what they have learned (O'Brien, 1998).

4. Lean Office implementation

This section presents the description of the initial state of the postgraduate office studied, the critical analysis and relevant identified problems and improvement proposals for the administrative process.

4.1. Description of the initial state

DPS is a department of the Engineering School of the University of Minho. Its origin is in the Production and Systems area created in 1976. The facilities of the Department are divided between the Campus of Azurém (Guimarães) and Campus of Gualtar (Braga).

The main goal of DPS is to train engineers to be able to deal with the optimization and rationalization of the industry's resources. The DPS is a department with 58 professors, one computer specialist and six administrative technicians serving, approximately, 600 students and about 30 researchers per year. These students are distributed by an integrated master's degree, six master's degrees, 17 courses of specialized training and postgraduate and two PhD programs.

The search for teaching projects under DPS responsibility has always been very positive and meaningful. In the academic year 2015/16, the number of students admitted are in Table 1.

Table 1. Number of students admitted in edition 2015/16 by master program

Master program	Nr. of students
Industrial Engineering and Management (MIEGI)	50
Industrial Engineering (MEI)	78
Human Engineering (MEH)	13
System Engineering (MES)	22
Quality Management Engineering (MEGQ)	30
Engineering Project Management (MGPE)	23

The office of the Integrated Master and the other six Masters offered by the department are managed by one single technical assistance, RR. This office was chosen for the object of study for this work because it provides services for most of the teaching projects offered in the DPS. Among the tasks of the technical assistant, it can be mentioned:

1) Continuous improvement,
2) Provision of information to update the DPS website,
3) Registration of new candidates in the department database,
4) Insert student's dissertation data in the department database,
5) DPS annual report,
6) Registration of ADSE documents, and
7) School service platform.

4.2. Critical analysis and problems identification

Different problems were identified after dialogue and observation of the work done by the assistant. It was quickly realized that there were different problems related to the different tools used and also to the procedures associated with some tasks. In order to understand these problems, brainstorming sessions were conducted with the technical assistant. Strengths, Weaknesses Opportunities, Threats (SWOT) analysis and time studies measures on some tasks were also performed. Some of the problems identified are in Table 2.

Table 2. Identified problems

Nr.	Description
1	Disorganization in the desktop & lack of standardization in the files
2	Lack of electronic standardization & disorganization on network drives
3	High time for ADSE registration related documents
4	High time for data entry and computer manipulation
5	Lack of a register of occurrences
6	Lack of standardization & disorganization in the content of the students database
7	High time spent in the school service platform
8	Lack of critical skills of technical assistant
9	Lack of KPI in the department
10	Lack of surveys or system for the department's employees evaluate the working environment

The problems identified implied a lot of wastes detailed next:

• *Process waste:*

1) Unnecessary complexity – the online school platform for introducing the service is complex and unintuitive;
2) Variation in the flow of processes – the constant interruption in the work for the fulfillment of requests causes a variation in the workflow;
3) Defects – Errors in information and data have been detected in DPS activity reports that may cause misinterpretation;
4) Unnecessary information – in the register of applications and students irrelevant data is entered and there is a large number of obsolete files on the workstation;
5) Search – clutter and lack of standardization in network drives and file contents causes a high demand for information;
6) Incompatible systems – the online management platforms used in the Secretariat often do not allow the technical assistant to download the information, being necessary to ask the master director;
7) Errors and defects in the administrative environment still cause revisions and waits /delays.

• *Waste of information:* manual input and lack of standardization in the contents cause data reintroduction, duplication of information and incorrect data.

• Waste of person skills:

1) Lack of feedback – positive and less positive feedback can bring improvements, there is a lack mainly of positive feedback in the processes and procedures of the RR that have undergone improvement actions. The technical assistants do not have a tool to assess the quality of work and services and give feedback to the direction board;
2) Lack of training – there are some critical situations in the competency matrix of the department's assistants;
3) Non-use of talent – time spent by the assistant in activities that do not add value could be invested in continuous improvement actions, personal and professional projects.

• Physical environment wastes:

1) Unsafe and ergonomic environment – the department fire doors in cases of emergency or fall of energy close at a very high speed and can cause accidents. An ergonomic analysis of the assistant's working environment is missing;
2) Motion – go to the printer or photocopier, get the Public Service for Health Insurance (ADSE) box are some examples of causes of waste, and last but not least;
3) Interruptions.

Since the workstation is a computer, VideoLan Client (VLC) media player software was used to capture and record videos from the desktop. Due to the variability in the administrative processes and the need to minimize the time spent from the assistant, a typing test was used to verify the pulse per minute (PPM) of the assistant (FastFingers, 2016). The result of this test is an estimate of how many words she writes per minute without variability and no interruptions.

4.3. Improvement proposals

This section presents some of the improvement proposals to reduce the wastes identified in the previous section.

4.3.1. 5S electronic and standardization

To eliminate the lack of normalization and disorganization in the network drives a new strategy that uses some Lean principles were implemented. Due to the number of files, folders and subfolders, the electronic 5S tool

was implemented throughout the process to save time (Figure 1).

Figure 1. Situation in the desktop before and after 5S implementation.

Thus, was defined a strategy of continuous improvement for a daily implementation of this technique. A standard operating procedure was developed to create new folders on the computer. The main goal was not spent two or three days eliminating wastes but to create a strategy to eliminate the wastes daily (Figure 2).

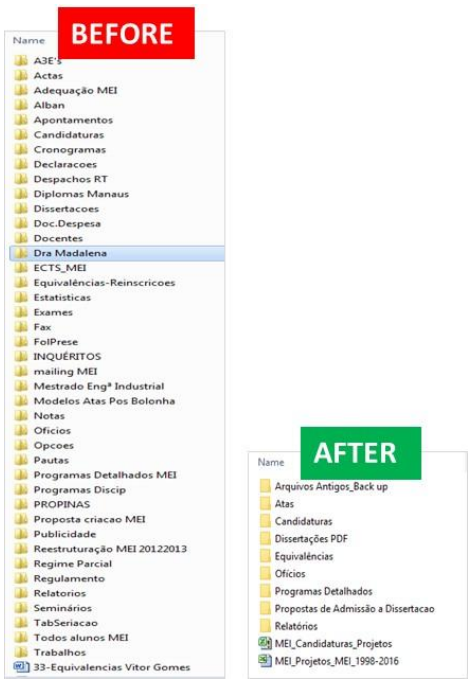

Figure 2. Situation in the network drive before and after electronic standardization.

4.3.2. Registration process improvement

The ADSE registration process was also studied to find possibilities for improvement in the process. After the new process defined, differences from the previous process were notable downsizing from 15 to 12 steps to register a health expense. The Figure 3 presents process for documents registration in ADSE, before and after the application of improvement proposals.

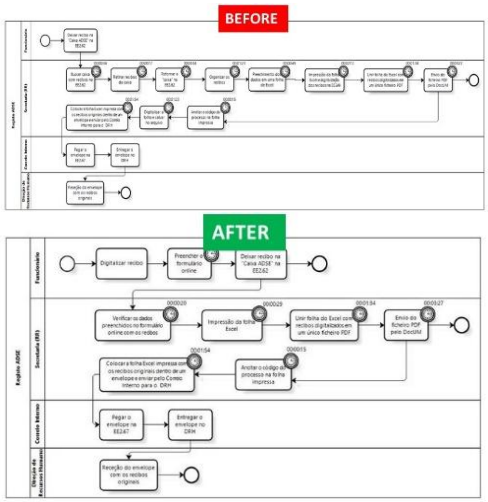

Figure 3. Improvement in the registration process of ADSE documents.

4.3.3. Recurring occurrences register

For the identification and treatment of occurrences, it was also seen in the context of continuous improvement promoted by the LeanOffice@DPS team that there were recurring problems, but because they were solved at the moment without being registered, a table was developed in meetings to record relevant occurrences in the department and thus identify the process of treatment of them. This table was fixed in the team board and activities were transferred to digital media in the Monday meetings in the form of shifts. Each week an employee was responsible for the task.

The Gualtar employees should send the scanned record sheet by the end of the afternoon on Fridays, so that in the latter all information can be updated at the same time.

4.3.4. Students database improvement

Regarding the introduction of students' data of academic projects, the first question was whether the sheet in Microsoft Excel software was the most appropriate tool, whether it would be exchangeable for another database software (Microsoft Access). Creating an electronic database within the DPS server was also a possibility. Although creating an electronic database within the department's server would seem to be the best choice, it would bring cost and dependence on third parties to the project, it is a good tool to be created for the future.

Microsoft Access is a powerful database tool, but it was soon ruled out because it required great adaptation and training to use the tool at an advanced level. The SWOT analysis of the sheets showed that Microsoft Excel is a powerful tool, so the process of tool improvement was started. Within the Microsoft Excel sheet, tools have been developed to insert, change and search students. The development of these tools was made possible through the usage of Visual Basic for Applications (VBA) (Figure 4).

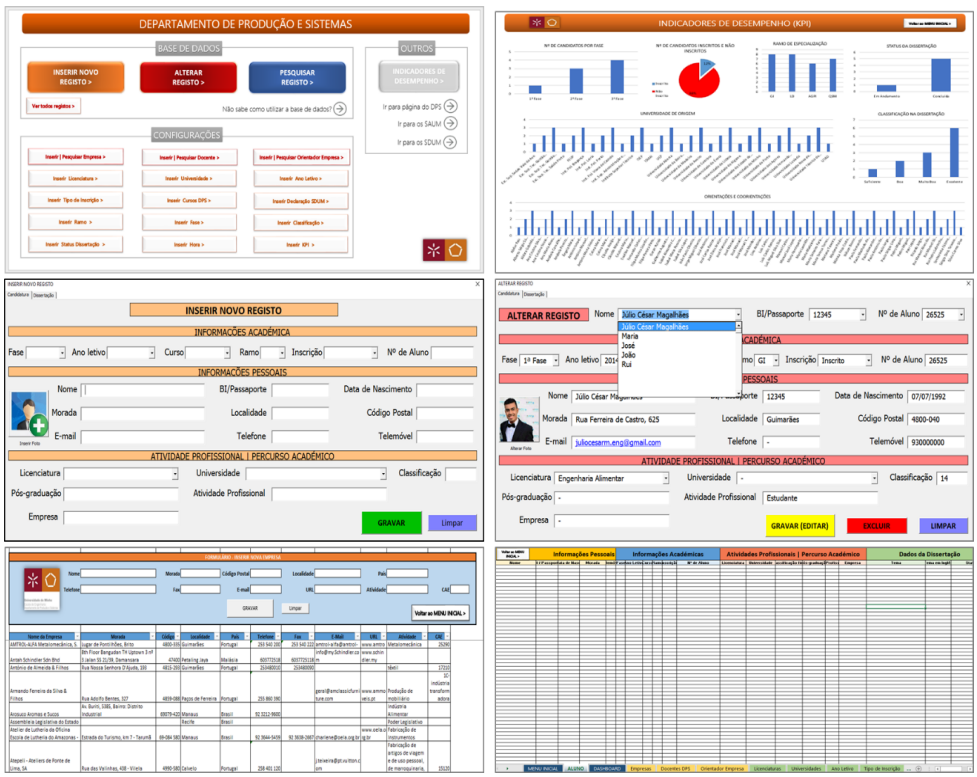

Figure 4. Example of an Excel sheet created to manage students' data with indicators

As can be seen in Figure 4 (top of the figure), a dashboard with performance indicators was created for academic projects and activities related with students' candidates number, supervisions by teachers, among others. Also, visual management was used for a better presentation of information and a process was reorganized for all existing content in the tool. Multiple Lean tools were used to make the tool efficient and user-friendly. In the Table 3 is described some examples of indicators that was proposed to be presented in this dashboard.

Table 3. Types of indicators on the dashboard.

Indicators	Description
Attendance at LeanOffice@DPS project	Level of absence of team members at weekly project meetings;
Classifications of dissertation projects	Percentage of students who scored "excellent", "very good", "good", "sufficient" or "failed" in teaching projects;
Number of ADSE records	Number of records of ADSE documents made in Azurém and Gualtar since 2015
LeanOffice projects in the department	Number of projects in progress or completed in the team
Critical situations	Tasks or competencies performed by only 1 person in the department
Requests and interruptions	Percentage of requests and interruptions in the departments and technical department of the department, and mode of interruption (face-to-face, telephone or e-mail).

4.3.5. Definition of KPI and dashboard

It was also detected that the department did not have KPI to monitor performance of its activities. So, it was prepared a proposal of some KPI and a dashboard that everyone could visualize and motorize these.

The goals for the construction of the dashboard were to:

1) Look for strengths and weaknesses in departmental activities – so resources can be prioritized for areas with poor performance;
2) Look for opportunities for improvement;
3) Define goals and align goals – instead of moving on different goals, aligning goals and achieving goals with teamwork, making work less complex;
4) Reduce costs – identify costs of non-quality and low utilization of human potential;
5) Improve decision making – reduce doubts and uncertainties in decision making, positive indicators help in the way to go;
6) Encourage continuous improvement – through recognition of strengths and support with training/coaching/support to improve weaknesses.

All the indicators developed were exposed in a dashboard in the dynamic team board of the LeanOffice@DPS team, updated weekly before the meetings and analyzed by the team. The proposal created is represented in the Figure 5.

4.3.6. Satisfaction survey

A questionnaire was developed so that technical assistants and specialists in the department could evaluate the structure and activities developed by the department. The results were not public and were intended to be reviewed by the LeanOffice@DPS team to check for possible improvements in the employees' work environment.

4.4 Discussion of Results

The application of the electronic 5S tool on the wizard's desktop reduced the number of files by 73% (from 118 to 32 files). Before applying the tool, the desktop was used as a file storage and it was as a shortcut tool for access important files and folders quickly and efficiently. The electronic normalization and electronic 5S on the network drives were implemented to meet the 3-click number to access the files. Prior to the implementation of the improvement there was an average of 48 folders on the home page of each of the drives and after the electronic normalization passed to nine folders (eight reference dies and one with the backup of the files that need to be normalized).

It was verified that before the improvement proposal, eight clicks in the mouse were required to find the application file inside the network drive and after normalization and 5S

in just a single click the file is open (shortcuts have been created for the desktop). This means a 83% reduction in mouse clicks to open the application file and an 84% reduction of the time to open it. Considering that the application file is opened, at least, once a day, in five working days per week and 12 months in the year, this corresponds to fewer 1680 mouse clicks and 76 minutes within a year to open a single file. In the Table 4 you can see the number of folders and subfolders before and after the 5S implementation.

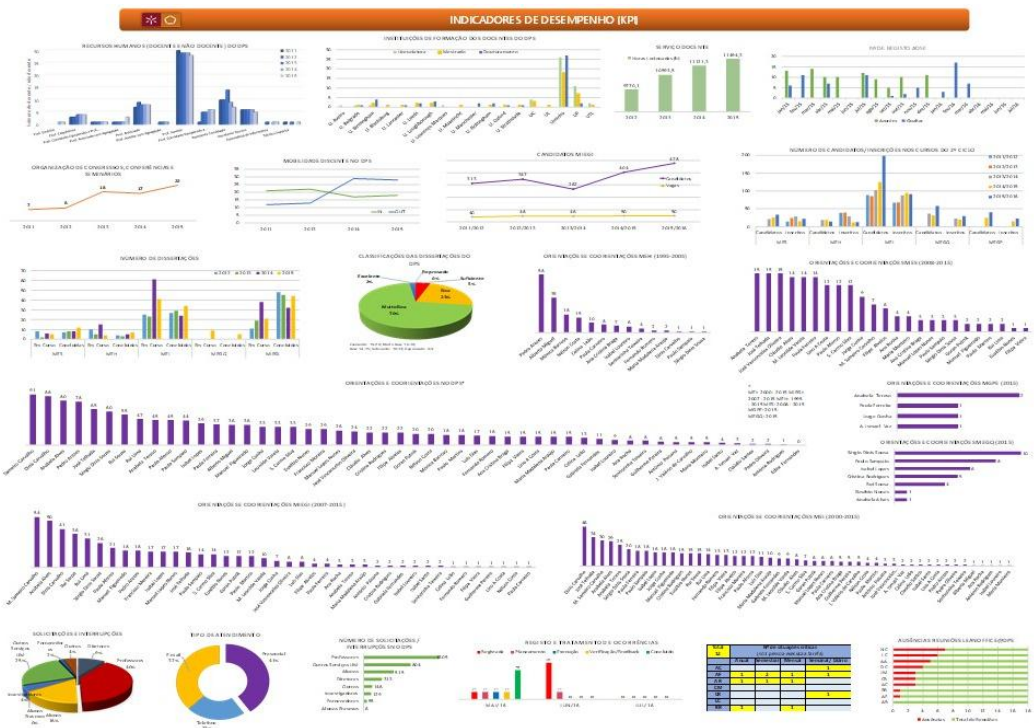

Figure 5. Dashboard with KPI defined for the department

Table 4. Number of folders/subfolders before and after the implementation of 5S.

Master Program	Folders		Subfolders	
	Before	After	Before	After
MIEGI	63	9	348	0
MEI	56	9	739	0
MEH	64	9	467	0
MES	30	6	255	0
MEGQ	67	9	66	0
MEGP	12	9	81	0

The implementations of the forms developed to insert, change, and research students will allow the observation of behaviors over many years. Tool development was costless and Lean principles were the basis of its construction. Among the advantages of the tool are:

1) Existence of an initial menu with a simple, perceptible and functional layout;
2) Creation of a tool to insert new records – taking the need to check if the data is being inserted in the correct row and / or column, remembering that the files had between 15 and 64 columns before the improvements;
3) Tool to change registration;
4) Record search tool;

5) Use of photographs in the tools;
6) Poka-yoke mechanisms;
7) Implementation of a Dashboard;
8) Content organization;
9) Greater autonomy of other assistants and masters' directors during the use of the tool, a tool that can be used by any user without a high level of difficulty;
10) Reduction of information retrieval time. In the time study, it was observed a mean reduction of 69% in time to find a specific information within the reformulated file. The RR assistant who works daily with the file reduced 72% of the time (from 33 seconds to nine seconds) to find the subject of a student's dissertation within the file, this time reduction can be applied to any information that is desired inside the file.

After verifying that the wizard reintroduced existing data, it was defined that the masters' directors should send the file with the information of the candidate students, avoiding an unnecessary reintroduction. It was estimated a time saving of, almost, 12 hours (708 minutes) in this annual task, and 300 minutes (5 hours) would only be for the introduction of Master in Industrial Engineering candidates.

The economics of enrolment time was calculated based on the typing test carried out by the assistant, the average number of applicants to the departmental teaching project and the character counter of the Master in Industrial Engineering 2016/2017 application file sent by the program director.

A major step was taken with the identification of 24 performance indicators and the construction of a dashboard for the department, which would allow a visual and faster analysis of indicators that were "hiding" in reports that few read or read in the meetings by the exhibition in a presentation. These flags can now be published on the department page if authorized. Transforming data from DPS activity reports into performance indicators showed some errors in the department's activity report and these errors were recorded in the event log and event table.

The ADSE document registration process has been completely reformulated. The costs of development of the registration tool were null and the costs in the process changes will be zero. The new process is yet to be implemented and the impact of the implementation will be studied in the future. However, among the advantages of the changes, it can be mentioned:

1) The initial process, whenever compared to the reformulated process, decreases the cycle time of the process from 14 minutes and 22 seconds to 07 minutes and 59 seconds (estimated time for recording a document);
2) Create a data verification mechanism;
3) Make a backup of the receipts left in the "ADSE box";
4) The number of employees working in the process decreases from two to one. The task can be operated on a rotating basis, when it is the responsibility of the office in Azurém, the Gualtar employee only puts the original receipts in the internal mail to Azurém.

The occurrences register produced some preliminary results presented in the Figure 6.

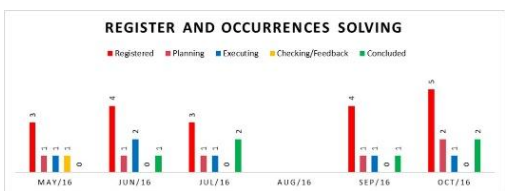

Figure 6. Number of occurrences.

Also, the requests and interruptions were registered to identify the clients that request this office services (Figure 7).

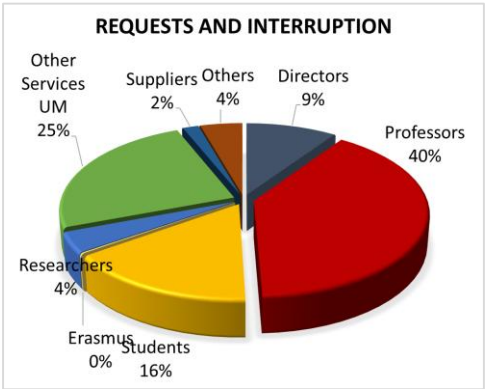

Figure 7. Type of requests and interruptions type by client.

The largest part requests were from teachers which could indicate teachers do not have information they need. Supposedly, the largest part should be from students attending this office is to assist students.

5. Conclusion and future work

The application of Lean concepts in the department of a university, particularly electronic standardization and implementation of performance indicators, was a challenge from the beginning due to the inexistence of a methodology to reach the results. Thus, the study was elaborated based on other concepts of the service sector and industrial along with the usage of some techniques and innovative computer tools.

This project was developed within the planned timeframe but, on several occasions, the methodologies, ideas and objectives were adapted to better adjust to the implementation environment and to achieve better results. During the dissertation, training activities were held at the weekly meetings of the LeanOffice@DPS team where all team members could share their knowledge, as well as sharing of new tools and methodologies to assist in completing the work.

It was concluded that the usage of these methodologies and techniques brought improvements to the office and to the department, although many of the outcomes were only visible in the long term. It is perceptible that the office technical assistant had the interest of using what was developed in this work and has the interest in continuing the search for improvements. Resistance to change was not detected at any point.

The accomplishment of this work allowed a greater knowledge of Lean techniques and tools in administrative environment, allowed to develop skills at the professional level and the opportunity to work with an excellent team composed of great professionals.

During this work, different improvements were implemented in order to solve or minimize all identified problems, always with the general objective of enhancing the different organizational results. Conducting weekly meetings, filling in Excel sheets, filling in attendance control tables and occurrences are essential to continue the work. The indicators developed so far should serve as a basis for the development of new indicators and more complex indicators and, above all, identified failures should be transformed into opportunities for improvement. The tools developed must be continually improved, adding new features or improving existing ones.

When talking about work in an administrative environment the first memory is a computer, but it is, many times, forgot other points that become important for a more efficient and comfortable work. Complaints of discomfort and pain in the wrist are recurrent and a suggestion for an ergonomic evaluation in the assistant's workstation in the future was presented.

The work developed in the office can easily be adapted in other technical offices of the departments and other departments and this should be one of the next objectives in order to have the same working conditions and the department and the team grow together.

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