

Implementation of new Planning Production – The case of Iberol

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Abstract

Throughout this dissertation, the subject of production planning is discussed, in the context of an industrial chemical company, specifically, a biodiesel producer company. The company, Iberol, located in Alhandra, Portugal, recognized the importance of an efficient planning production in order to obtain good production and financial results. Accordingly, decided to proceed to the implementation of a new planning model for of their production. The main goal was to create and implement a set of Microsoft Excel tools, able to support the in management and the decision making about planning production. These tools were applied to in each level of the organization planning production system: Strategic Level, Tactical Level and Operational Level. It was also created another Microsoft Excel tool, to assist in the management and purchase of subsidiary materials, used in the different production processes and essential to the production. After the implementation of these tools, several improvements were reached, namely: the increase of the planning compliance rate, the improving of the information flow and communication between the company departments involved in this task, the reduction of work steps and rework, the improvement of occupancy rate in production processes and the increase of optimization of the optimal formulation of biodiesel to produce. The occupancy rate of the transesterification, the production process which takes the production of biodiesel, increased from 55% to 76% in the same periods from of 2015 and 2016 respectively. The compliance rate of implementation of the plan, seen in the months after the implementation of the new tools, has been, in average, very close to 100%. It is also possible to observe that the new tool for the optimal formulation calculation has allowed a consecutive growth in optimizing the price of the biodiesel blend. Additionally, some enhancement opportunities for the near-future were identified and some proposals for future work were also suggested.

Keywords: Planning Production, Production, Chemical Industry, Logistics, Biodiesel, Excel Tools

1.Introduction and Iberol Presentation

Nowadays, in the competitive environment that exists in the business area, many factors can be considered decisive for the performance

of organizations. However, the most important factors are the quality of the produced products and services, customer satisfaction, and lower production and distribution costs. Organizations that are able to have long-term strategic plans

for these factors are considered viable organizations [1].

The Iberol - Iberian Society of Biofuels and Oilseeds, SA initially designated by Iberol -.. Iberian Society of Oilseeds, SA is a national company specialized in the production of biodiesel and meals for animal feeding. Formed in 1967, has hosted up and established its manufacturing facilities in Alhandra, in the municipality of Vila Franca de Xira, Portugal.

Given their physical nature, it can be said that currently, Iberol, has two main types of products in its portfolio. The solid products and the liquid products. In the solids are included two products: grain / seed and the resultant meal of the vegetable oil extraction process. For liquids its range is considerably larger. This set of products includes the Vegetable Oil, Biodiesel and Biodiesel Byproducts. It is important to note that the grain / seed is considered the main raw material and flour and biodiesel are considered the main final products. There is also a set of materials that are considered essential for the different production processes, which are called subsidiary raw materials, such as chemicals.

The main goal of this project is the implementation of a new planning production. Thus, it was proposed to act in three hierarchical levels defined for planning production (Strategic, Tactical and Operational). Therefore, it was intended to develop and implement a set of tools using Microsoft Excel:

- Tool to work at the Strategic level;
- Tool to perform the Tactical level;
- Tool to act at the Operational level;

It is expected that after the construction and implementation of these tools, significant improvements are going to be observed in the Iberol activities, namely:

- Improvement the flow of information between the different stakeholders, also reduction the possibility of data loss or the existence of wrong information;

- Reduction of the complexity of the production planning process by automating it and creating procedures;

- Creation of links between the different tools and various company departments involved in planning;

- Increase in the efficiency of production planning, creating a perfect relationship between planned and executed;

- Increase in the occupancy rate in the different production processes, especially in the transesterification process;

- Maximize the optimization of biodiesel production formulation;

When developing a project, the evaluation of metrics is undoubtedly one of the most important aspects of the study, since it is the basis for analysis, recommendations and development improvements [7].

Thus, to analyse the success of the solutions implemented in the new production planning a set of metrics were selected:

- Comparison between the price of real Blend and theoretical Blend;

- Occupancy Rate in Extraction, Neutralization and Transesterification;

- Compliance Rate (Forecast vs. Real);

2. Literature Review

2.1. Introduction to Planning Production

Not being a guarantee of success, as the future is quite unpredictable, the consequence of not planning or making poor planning can bring serious damage to organizations. It is, therefore, essential to be an ambitious thrive in the markets and business sectors in which one operates. These organizations are best prepared for the future, often by creating expectations. That is, although the information for the future - forecast - is not completely reliable and complete, this allows for a reasonable set of assumptions to be formed [6].

Thus, forecast demand represents an input considered essential for planning production, because it allows managers to manage adequately the resources needed by the organization [4].

For production systems to meet customer expectations, the existence of an effective

planning production process appears to be fundamental. This covers a set of methodologies that are expected to be able to ensure improved customer service, reduced inventories and reducing response times [3].

This dissertation, addresses the planning production, in the context of an industrial organization. Although the main focus is the planning of production and its model, it is important to understand the relevance of their strictly necessary interconnection with the other departments of the organization [5].

Indeed, so that you can implement an appropriate system of planning production it is assumed that the factory in question, has reached a certain level of maturity, since this is a highly complex process.

The Planning is the known process by which the organization defines a way forward, outlines plans and defines the guidelines that allow it, taking into account the exogenous contingencies, current and planned for the future, imposed from the outside, and its internal resources, their skills and qualifications, achieve goals and thus achieve your vision and fulfill its mission [2].

An important factor of planning production is the time horizon. In this sense, the planning production can be Strategic, Tactical or Operational, featuring up, respectively, for a long, medium and short-term time horizon.

2.2. Planning Production in the Organizations

In all organizations, planning production, takes usually a singular responsibility, usually assigned to an engineer. The responsible for production planning requires close monitoring of all existing dynamics in the plant, that could interfere directly or indirectly with the production and its planning. Examples of situations that require the attention of this person: are machine breakdowns, quality problems of the product, lack of raw materials, lack of human resources, the need for deliveries to customers, among many others [5]. Therefore, the function responsible for planning production involves constant decision making, so you should have access to a wide range of information and data,

considered essential for a reasoned decision and consequent correct planning production.

Note also the extreme importance of keeping constantly updated all data and information used - inputs. It is, therefore, important a strong connection and constant collaboration between the Planning and Production Department, Sales Department and Finance Department [5]

Finally, the lack of an efficient planning production provides situations that are harmful for the organization, comprising a set of additional costs caused by: excess and / or rupture stocks.

3. Opportunity Identification

The Iberol's administration has carried out, over the past few months, a number of investments that have as main objective the financial recovery of the company and the increase of production efficiency. In this sense, a considerable number of improvement opportunities, in more specific areas - both at administrative level and at the level of production, were identified with the help of the Kaizen Institute. For example, areas such as logistics, production, administrative proceedings and even maintenance tasks were identified with improvement opportunities.

The administration, together with the engineers responsible for production, found the existence of the possibility for significantly improving the way the planning production was done and how the model was designed.

It was unanimous that the way the planning production was being held, did not reflect the actual requirements, for which the company has to be able to respond. It was strictly needed a new way to manage the entire planning production, so it could be possible to make the most of the productive capacity of the company to reduce lead-times and reduce unnecessary costs.

At the tactical level, production planning at Iberol was made based on an Excel file built for the purpose. However, this tool had many limitations and did not include, in its calculation, all variables and constraints that should be considered. In fact, it is wrong to state that the

tool used previously was able to give an estimate of the monthly planning production. This tool did not provide any monthly production plans for the different production processes of the two plants - Extraction, Neutralization and Transesterification.

This tool, used by the responsible for UPB Engineer (Biodiesel Production Unit), which has as one of its functions, the planning of the plant's production, used an optimization model applied in SOLVER, only suggested a great formulation for Biodiesel produce, taking into account:

- Stock of Neutral and Crude Oils;
- Biodiesel quantities to produce (not specifying by the client);
- Oil's properties;

The only information that this tool provided, was the optimal formulation for biodiesel and forecasts of neutral oil consumptions (to be used in the production of biodiesel). These forecasts were calculated from the optimum formulation suggested and quantities to produce.

Based on the optimal formulation suggested for biodiesel that this tool produced, as well as the forecast of oil consumption, the engineer, had to rely on its own experience and knowledge to then make the monthly planning production able to meet the customer orders on the planned dates.

4. Solutions – Implementation of a new planning production.

In order to get a complete production planning for the whole of the two companies, it acted at all the three levels of planning production: Strategic level, Tactical level and Operational / Execution Level. However, during the internship, it was impossible to work at the Strategic level of planning production.

The new planning production implemented adds a set of tools constructed in Microsoft Excel, based on mathematical formulas (applied directly in Excel), VBA macros and linear programming models applied in solver. All developed tools are protected with a password against any trouble.

To operate at the tactical and operational level of the planning production, were built two Microsoft Excel based tools:

- **Tactical Planning Tool** - to serve the tactical level of planning production. This tool not only suggests the best monthly production plans for the different production processes of the company, but also calculates the optimal formulation of biodiesel. This tool presents monthly solutions, and can be used well in advance, depending on the availability or not of inputs for the period. Thus, it is possible to say that this tool operates in a medium-term timeline.
- **Operational Plan Tool** - to act at the operational level of planning production. This tool operates in a short-term timeline, being used daily to monitor and plan the day-to-day production in different months.

In addition, we use a set of Excel files named Daily Reports, that involves the registration information of daily plant operations: consumption, production, stocks, among others. Note that in the case of Iberol, this file already existed and could be used. However, in the case of Partner Company, there were not daily bulletins or something similar, where it could be removed information daily. In this sense, it was created for the Partner Company, a Microsoft Excel file in similar way to the daily Iberol's bulletin, allowing the functionality and flow of information between all the tools.

4.1. Tactical Planning Tool – Tactical Level

Once identified the improvement opportunity, then broke for the development of a suitable solution to solve all the limitations implied checked at the planning level of production. Indeed, the solution was developed jointly between Iberol and the Kaizen Institute, where I developed a collaborative, monitoring and aid work in its construction.

The solution took on the construction of a new and more complete tool in Excel, likely to offer a true answer to planning production problems.

The work, developed between all entities involved, can be divided into two main phases:

Phase 1: Construction and implementation of the tool and its model;

Phase 2: Creation of new features in the tool and setting procedures;

4.2. Operational/Execution Planning Tool – Operational Level.

To act at the Operational level of production planning, it was created a new Excel tool named: Operational/Execution Planning Tool, with the purpose of being used by Iberol and the Partner Company, adding the production values of the two factories. It is intended that this tool is used daily by the factories' responsible. For the full functioning of the tool, each responsible must update it daily with production data from the daily bulletins. However, if you can not perform the daily update, the supervisor must then enter all the data for the days not updated. Additionally, whenever created a new forecast of the monthly production by Tactical Planning Tool this should also be introduced in this tool.

4.3. Tool for Purchase and Management of Subsidiaries Materials

A tool to assist in the daily management of stocks and purchases of subsidiary materials, was designed based on two fundamental bases:

- The daily automatic aggregation of all the relevant information on the subsidiaries materials of the two plants.
- A calculation model which allows obtaining daily if there is a need to make custom any one of the subsidiary materials.

It is intended that this tool is used daily by the responsible for these purchases and that can easily be used for replacement in case of absence.

The tool (built in Microsoft Excel and VBA programming), was structured to be able to present all the relevant and essential information for the application of capable calculation model, identifying or not, the need to purchase any of the subsidiary materials.

This tool, which is built to be able to serve the two companies (Iberol and Partner Company), refers to the reports of operations that are issued daily (also in Microsoft Excel) and placed on the company server. Since information on this tool is present on a given day, you have to charge it with the two files corresponding to the operations bulletin of that day. You just have to press a push button, select the operations bulletin from that day and the information is automatically updated (VBA macros). This tool is based on a flow of information between the daily operations reports (of both companies) and the Base Tool.

5. Analysis of metrics

5.1. Blends Price Comparison

A very important metric, that has been subject to regular monitoring by the administration, is the price of the blend of biodiesel.

This metric is used to analyze the two factories - Iberol and Partner Company – since the production and sale of biodiesel is joint.

The following statement provides a comparison between the theoretical blend price and the real blend price. The price of the theoretical blend refers to the price of the optimal blend, suggested by the tactical planning tool, when calculating the optimal formulation of biodiesel. On the other hand, the real price of the blend is, as the name indicates, concerning with the final price of biodiesel produced in the two factories.

For this analysis, data from the two blend prices, since June 2015 until May 2016, was used. The purpose of choosing this timeline is to be able to compare the price relationship during the period before and after the implementation of the new planning tool tactical.

Through **Figure 1** analysis, it can be seen an extremely positive fact. Prior to the implementation of the new tactical planning tool (period between June 2015 and December 2015), it is observed that the price of real blend was higher than the price of theoretical blend, which means that biodiesel was being produced at a higher price than planned.

However, more recently, in the period between January 2016 and May 2016 it is possible to understand that this has been reversed, and now the price of real blend is lower than originally planned. This is very positive financially and demonstrates that production is being optimized.

In Figure 2 you can see the successive occupancy rates in the periods between January and July, for the years 2015 and 2016. The reason for the choice of this temporal sample is to compare the changes in this process occupancy rate before and after the implementation of the new planning production



Figure 1 - Comparasion Between Blend Prices. ((For reasons of confidentiality, the price values are not displayed.)

5.2. Occupation Rate Analysis

A metric that can be analysed to assess the success, or otherwise, of a good production planning is the occupancy rate in the different production processes.

Therefore, we analysed the occupancy rate in the transesterification process in Iberol.

The occupation rate is calculated according to the following equations:

$$\text{Occupation Rate} = \left(\frac{\text{Time Presence in Shifts} - \text{Scheduled Stops}}{\text{Time Presence in Shifts}} \right) \times 100\%$$

(Equation1)

$$\text{Time Presence in Shifts} = \text{Number of days} \times 24$$

(Equation2)

As the name indicates, this metric quantifies the percentage occupancy rate of the biodiesel production process in a given period. The higher this rate is, better, as it reflects an excellent optimization of available resources.

tools. Thus, when analysing this figure, it can be observed that after the introduction of the new tactical planning tool and the adoption of new procedures related to the planning of production, the occupancy rate in the transesterification process has improved substantially.

When analysing the average for prior periods (between January and July), it can be seen that this process occupancy rate increased from 55% to 78%. This rise reflects a better utilization and maximization of available resources optimization, driven by the new planning model implemented.

5.3. Forecast vs. Execution

To assess the robustness of the successive planning forecasts of production from the Tactical Planning Tool, we evaluated the rate of compliance.

This compliance rate was calculated using the values from the forecast and the values that were actually executed.

To assess this rate, values from the first 6 months of this year were used, at which time the tactical planning tool was already in use.

To calculate this metric was considered the three principal processes of Iberol: Extraction, Neutralization and Transesterification.

For the values obtained, when the values are higher than 100% means that the production run was longer than originally planned, and if

This idea is supported by practical results, which are already possible to observe in Iberol and in the Partner Company, after the changes carried out at the level of Planning Production. It was successfully implemented a set of solutions in the Tactical and Operational levels of planning production. Currently, the Tactical Planning Tool is used by the responsible engineer for planning, at least twice a month in meetings with top management. The use of the

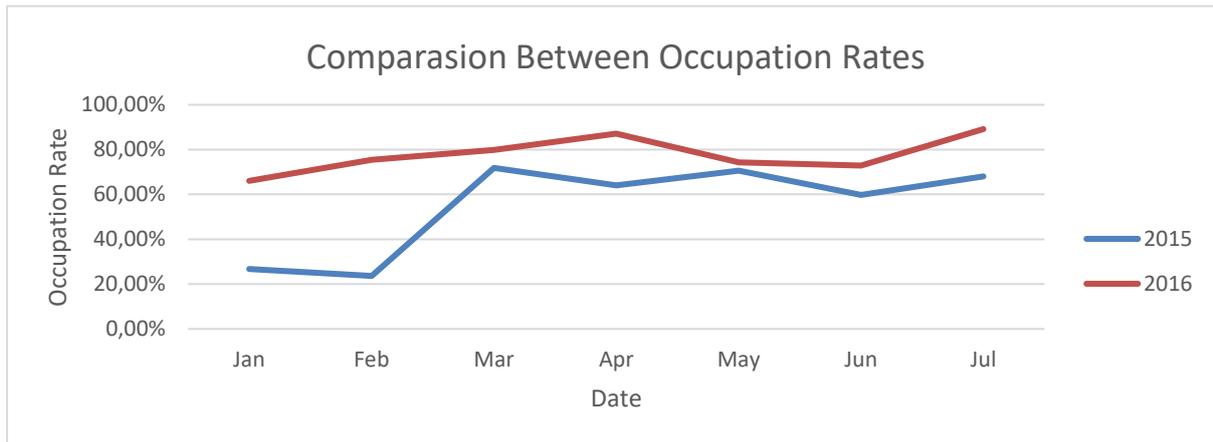


Figure 2 - Transesterification Occupation Rate

not, when is less than 100%, the actual production was lower than expected planning.

The results obtained in the different processes involved are very positive, since all values are close to the rate goal of 100%.

So, after the analysis of this metric - compliance rate - in the production processes of Iberol it can be shown that the relationship between planning and execution is quite positive. This positive relationship is a sign that the Tactical Planning Tool is providing monthly forecasts of production quite strict and robust. Moreover, it is also possible to say that a close implementation of what was planned occurred.

6. Conclusions

By using this approach, to the subject of planning production, it was highlighted the importance that planning reverts in to organizations since, once the system is optimized, converts in a considerable number of competitive advantages.

Executive / Operational Plan Tool is also used daily by the same controller. In addition, the tool created for management and purchasing subsidiary materials is used daily for Iberol and in the future for the Partner Company.

The solutions not only set up the development and implementation of a set of tools, built using Microsoft Excel Software, but, at the same time, it was also adopted a new set of procedures that did not exist and that somehow complement the use of tools created, making planning production more organized, efficient and robust.

Despite the difficulty in quantifying the successful implementation of these tools, there are two situations that reflect the observable success. First, after the implementation of Tactical Planning Tool, it was found that the price of real Blend always assumed values lower than the price of the theoretical Blend, a situation that did not occur with the use of the previous calculation tool for the optimal formulation of biodiesel. Secondly, the successful use of tools, created comprises up equally by the average rate of performance of the forecasting, assuming values of about 95%, reflecting a high proximity between the estimates obtained by using the Tactical

planning tool at the situation real, demonstrating good planning and therefore execution. However, the implementation of a new Planning Production in Iberol and Partner Company is not a fully completed task, and there is a set of tasks that, for lack of time during the internship period, were incomplete and assume improvement opportunities for future work and development.

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