

A Smart Way of Planning the Enterprise Resources

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Abstract: The theme of this study is how to do a smart planning of the enterprise resources that combine the most important key operations for each resource used in companies (Human resources, financial resources, Production resources, Logistics resources). The study case is for an enterprise that has as principal activity the product customization, but this system of planning can be applied in other areas of activity also. The system proposed aims to present the most important criteria's of planning the resources in each area and how to highlight and interpretate the results obtained. As advantages of this way of planning together the resources of an enterprise we can count a good organization of the production, human resources, financial resources and stocks. The main impact after a good organization of the enterprise resources is to limit the financial and material losses, but also to obtain a good profit after selling the service or the products. The objectives of the study are plan the production resources using the specific formulas of calculating the capacity needed of each operation for production, plan the human resources needed and the costs with them, calculate the stock needed for production, calculate de cost of production and delivery, highlight the results in graphics. In order to obtain all these results we used Saga Software and Qlik Sense platform. The Saga Software was used in order to enter all the information about materials consume, human resources needed and the costs with them, obtain all the official documents needed for receive the materials, do the paying, collect the payments, administrate the stocks of materials needed, depreciation of technological equipment. Qlik Sense is used to do the Gantt chart for human resource planning, divide the production capacity needed and highlight the results obtained into graphics.

Keywords: balance of capacity, business intelligence, payroll, profit, smart resource planning, stock management

1. INTRODUCTION

The study is based on an order of 40.000 pcs of 3 items that needs to be printed with individual names, packed into a box that also needs to be printed with an individual name and after this the box needs to be wrapped and labelled. The expected profit of the commercial company is at least 15%, the company is VAT payer and the activities are organized in maximum 2 shifts. The order has deadline for 31 December and it needs to start on 3 October.

1.1 Production Operations

In the below figure from the right, we have the flow of the production operations. Each operations has an established duration of production per item and there are operations that can be done in the same time like

unpacking the items and printing them, but the rest of the operations needs to be done in the order presented in the below schema.

The duration of each production operation per item is presented below:

- Artwork for item printing: 1 minute/item.
- Artwork for box printing: 2 minutes/item.
- Artwork for label printing: 1 minute/item.
- Unpacking and printing item: 2 minutes/item.
- Pack the goods into original boxes: 0.5 minute/item.
- Print the box: 1.5 minutes/box.
- Form the boxes: 1.5 minutes/box.
- Pack the printed item into printed boxes: 0.5 minutes/item.
- Wrap the boxes: 1 minute/box.
- Label the wrapped boxes: 1 minute/box.



Fig. 1. Production Flow

2. THE BALANCE OF CAPACITY

2.1 Capacity required

In order to visualize the balance of capacity we need to calculate the capacity required and the capacity available. The capacity required was calculated with the formula below [5]:

$$C_{req} = N_{items} \cdot Operation\ Duration\ [h] \quad (1)$$

For example, the capacity needed for the items printing after we apply the formula will be:

$$C_{reg} = 120,000 \cdot 1.5 = 180.000\ [min]$$

2.2 Capacity available per operation

The available capacity for each operation can be calculated with the below formula:

$$C_{av} = z \cdot k \cdot h \cdot m \quad (2)$$

where:

z – number of working days

k – number of shifts

h – number of working hours per shift

m – number of equipments

For example, for the printing operations if we calculate the capacity available using the formula we obtain:

$$C_{av} = 62 \cdot 8 \cdot 3 = 2976\ [h].$$

2.3 Necessary of technological equipment

In order to visualize the capacity required there is needed to calculate the number of technological equipment needed besides the duration of all process of production.

The formula's used for calculate the necessary of technological equipment are shown below in the table.

$$m_c = C_{req}/C_{av} \quad (3)$$

where:

m_c – number of the technological equipment

C_{req} – required capacity

C_{av} – available capacity

The available capacity per 1 equipment is calculated using the below formula:

$$C_{av} = z \cdot k \cdot h \quad (4)$$

where:

z – number of working days

k – number of shifts

h – number of working hours per shift

The planning of the activity is done for months October, November and December 2022 (table 1) so the number of working days available on each month are:

Table 1. Number of working days

October	21
November	21
December	20

The capacity available for one equipment on these 3 months is: $C_{av} = 62 \times 2 \times 8 = 992\ [h]$.

So, for example if we calculate the number of equipment's needed for printing the items we'll have:

$$m_c = \frac{C_{req}}{C_{av}} = \frac{3000}{968} = 3,09 > 3\ \text{necessary equipments}$$

For the other operations of production, the calculations can be done using the same formula's.

2.3 The reserve of capacity

The reserve of capacity can be calculated with the help of the below formula:

$$R_c = C_{av} - C_{req} - T_{men} \quad (5)$$

where:

T_{men} – Duration necessary for maintenance on each month for each equipment.

For example, we calculate the reserve of capacity for the operation of printing:

$$\text{Reserve of capacity} = 3000 - (2976 + 72) = 96\ [h].$$

After we calculate the capacity required, available and the reserve of capacity for each operation by applying all the presented formula's we obtain the balance of capacity which was done in Qlik Sense.

Qlik Sense is a business intelligence platform which helps a lot the companies to highlight the results in a graphic way that anybody can understand.

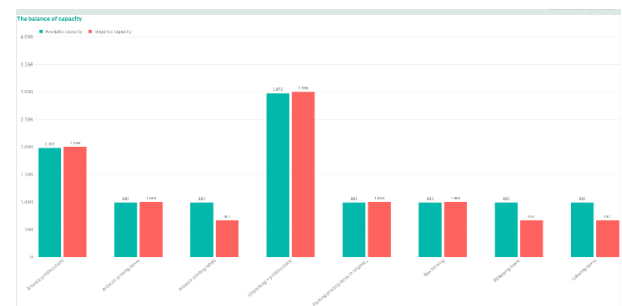


Fig. 2. Balance of capacity in Qlik Sense

In the below figure we can see 3 graphics of performance for the operations that require maintenance on each month where the capacity required is in balance with capacity available. Also there is a table with all operations with the available capacity, required capacity and the reserve of capacity for each operation.

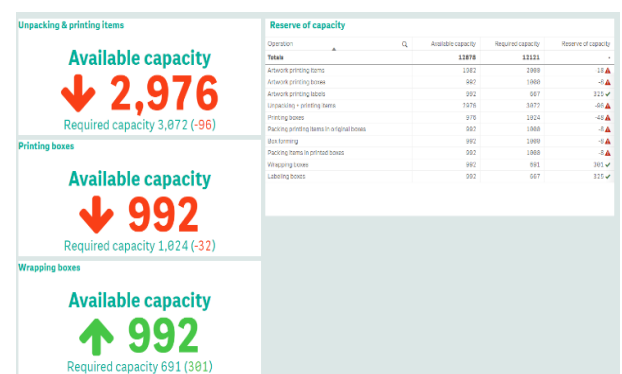


Fig. 3. Reserve of capacity in Qlik Sense

3. RAW MATERIAL

The technological losses for raw material considered in the project are considered 3%. So the

necessary of raw material for each item printed and for boxes printed is calculated below:

$$Raw\ mat.\ necessary = \frac{3}{100} \cdot 40,000 + 40,000 = 40,012\ pieces \quad (6)$$

3.1 Receive of raw material

The goods receipt note for the raw material was generated in the Saga Software [4], a fast used for accounting, payroll and stocks records.

The receive for raw material was divided in 3, at each beginning of the month was received a part of the raw material.

Nota de receptie si constatare de diferente							
Nr. NIR	Data	Gestune	Furnizor	Cod	Nr. doc.		
6	22.09.2022	MATERII PRIME	XD CONNECTS B.V	00011	12		
Cod	Denumire articol	UM	Cont. deb.	Caritate	Pret unitar	Valoare	TVA
0000002	LIGHT UP LOGO NOTEBOOK	BUC	301	14912.000	99.0000	1.387.188.00	283.565.72
0000001	LIGHT UP LOGO COFFEE MUG	BUC	301	14912.000	99.0000	112.095.00	23.111.34
0000003	LIGHT UP LOGO DEWIFE PEN/STYLO/BOUQU	BUC	301	14912.000	99.0000	152.066.00	31.412.34
Total						3.012.349.00	627.989.40
Total valoare + TVA:						3.584.970.20	
Comisia de receptie		Nume + prenume		Semnatura		Data	
		PopF				22.09.2022	
				Pimpit In gestune		Semnatura	
				PopV			

Fig. 4. Receive of raw material in Saga

The payment of the raw material was made with a CEC type instrument in the bank (payment order).

4. HUMAN RESOURCES ADMINISTRATION

All the operations are planned to take place in each month, so the total duration of each operation needs to be divided on each workday from October, November and December. If we don't do this division, we'll have on the graphic all the capacity required displayed in one day (planned start day of each operation).

The division of the total duration time for each operation was done in Qlik Sense with the help of an algorithm that I've presented at XGEN conference 2022 ("Intelligent production planning system using Qlik Sense").

This algorithm divides the total time needed for one operation in multiple sequences configured on each day of work keeping in mind a number that each sequence has and the start date planned for that operation. Applying this algorithm [3] on each day with two shifts planned to work at printing items operation we'll have a total of 62 x 2 of sequences



Fig. 5. Capacity required unpacking & printing items in Qlik Sense.

The number of each sequence will be with a difference of 10(shift1) or 5(shift2) between each next one. So, in this way we know how to display the capacity on each day on the graphic.

We have below the graphic [1] for production of printing items needed for this order:

In Fig. 5. the capacity is divided in 2 shifts and extra hours, each category is having a specific colour.

Also, for each operation and month we've done a Gantt chart [2] which shows for each day the organization of the people.

Unpacking & Printing items November							
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	
28	29	30					

Fig. 6. Unpacking & Printing Items for November

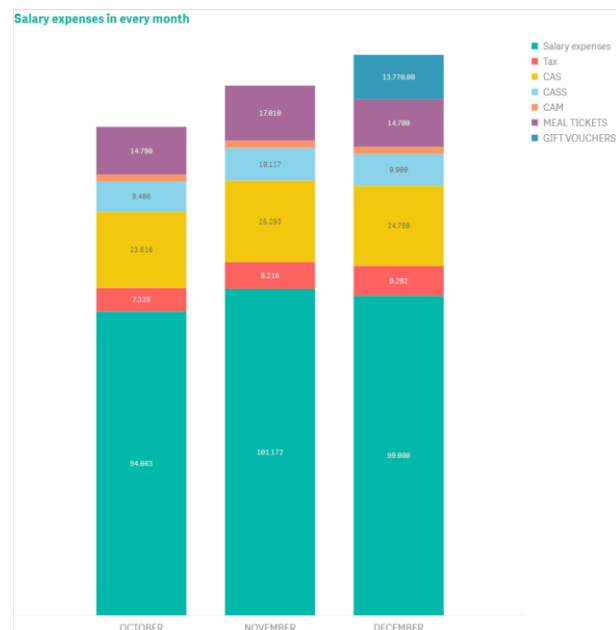


Fig. 7. Salary expenses on each month

Of course, each colour has a meaning:

- Cyan it tells us that in that day are working two persons, one in shift1 and the other one in shift2.
- Red means that in that day in the shift1 there is planned the activity of maintenance of that machine.
- Purple means that in that day we do 8 extra hours in shift1.
- Blue colour tells us that day is a free legal one.
- Gray means that day isn't a working day.

If we do the same for each operation and for each month, we have the organization of the people on each operation and it's easy after to us to plan the rest of the orders and activities.

After these graphics done in Qlik Sense it's easy to configure the employees in Saga Software: to do the state of payment and the employees' program of work.

We can see the salary expenses, the worked hours and the extra worked hours after the previous information filled in Saga and we can also highlight these results in Qlik Sense graphics.

In the below graphic we can the salary expenses on each month and on each category: Salary expenses, tax, CAS, CASS, meal tickets and gift vouchers. Each colour has a meaning as it can be visible in the legend.

To better highlight the percentage of each category of salary expenses in the below figure we have the below pie charts with salary expenses on each month:

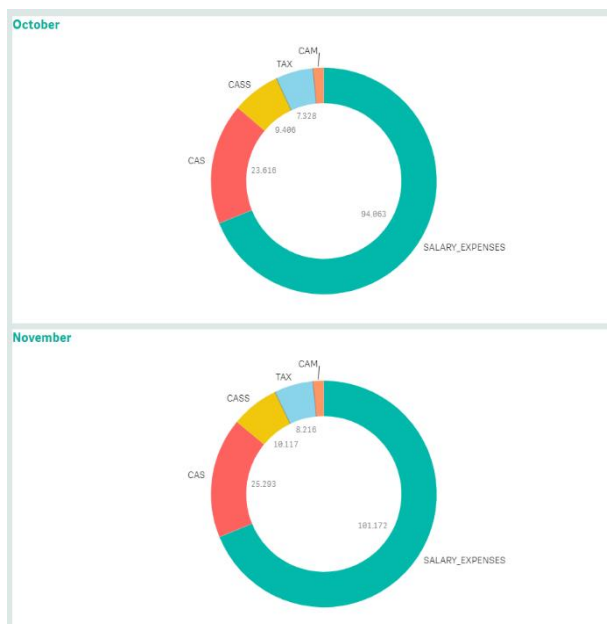


Fig. 8. Salary expenses each category percentage

The total of worked and extra hours in each month we can find in the below figure:



Fig. 9. Worked vs extra hours on each month in Qlik Sense

5. PRODUCTION COST

To be able to calculate the production cost we've used the below formula:

$$P_{cost} = Direct\ costs + Indirect\ costs \quad (7)$$

Direct Costs:

- Costs with raw material.
- Costs with auxiliar materials.
- Costs with supplies.
- Costs with the workmanship.
- Supply and shipping costs.
- Social expenses of the enterprise.
- Other direct costs: 15% · Total of all previous calculation.

Indirect Costs:

- Costs with financial worker (non-productive departments involved in the process of the order).
- Costs with maintenance, space rental, PC's, etc.

For the current study the production cost applying the previous parameters we obtain the below results from the figure 10:

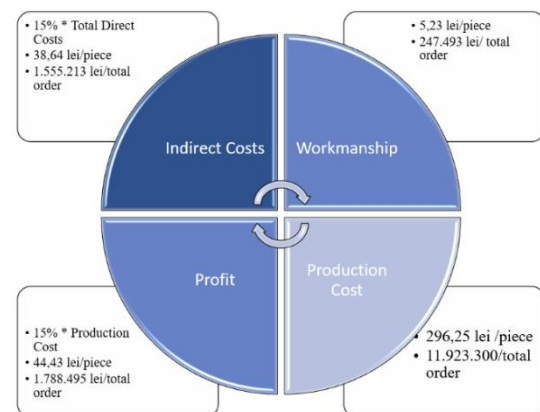


Fig. 10. Production Costs for current order

6. PAYMENTS, INCOMES AND EXPENSES

The profit estimated and expected is 15% of the Production Cost.

After doing the payments and collect the payments in Saga Software we get the below results in Qlik Sense displayed in the graphic.

In the previous graphic we have the total on each month of payments, incomes and the profit.

The orders are partially delivered to the client at each end of the month and the goods are also purchased in each month partially at the start of each month.

To be able to see all the costs, incomes and profit as a total for all month we've created in Qlik Sense the below chart which includes in one graphic the total of all circulations from Saga at the end of the December.

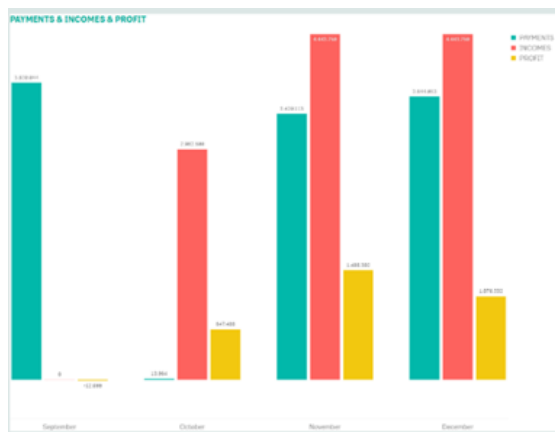


Fig. 11. Payments, incomes and profit in each month percentage.

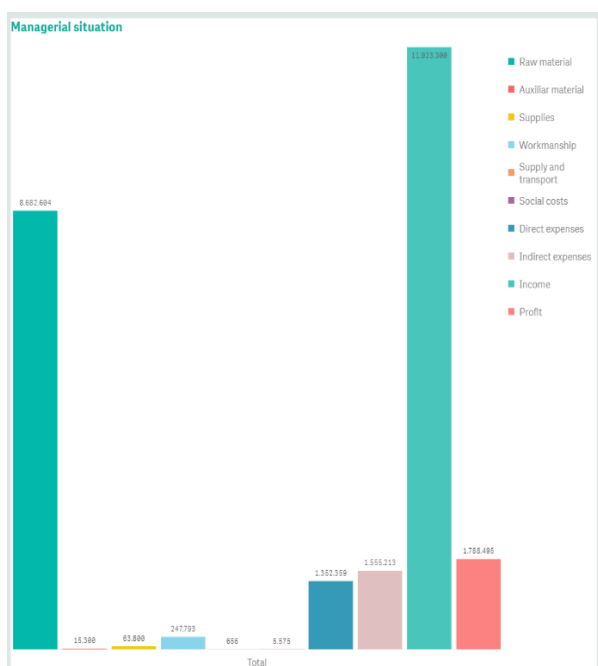


Fig. 12. All the costs, incomes, profit

The previous figure is clearly showing a kind of trial balance [6] in one graphic. We can see clearly that the profit that we really get it is closer to that one estimated.

All the documents of receiving the goods and materials, generate the salary state, generate the work program of the employees, doing the payments, doing the invoice and payments notice, amortization of the technical equipment's was generated in Saga Software.

7. CONCLUSIONS

As a conclusion after this study of planning the resources of an enterprise for a big order, Saga Software can cover the need for planning the human resources, financial resources and a part of stock resources.

If we talk about planning the production and the capacity, here the right tool for doing this in the right way is Qlik Sense. The study contains key methods for

planning the human, financial resources and also the production by distributing the capacity required.

A future improvement of the current work is the construction of a computer software that allows the production to request the raw material and the partial auxiliary especially in the case of large orders in order not to have a stock agglomeration in the production hall, respectively for a better flow of raw materials required for each order.

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