

## **Development of KPIs for assessing the internal logistics of UNIVEG's Warehouse**

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### **Abstract**

In the current world, competition between companies in food industry is a frequent challenge. In food industry's supply chain, is known that customer's demand is always changing and it is necessary to change and readapt constantly the strategy of the companies. The companies' logistic activity it's a critical point that allows this capability of each company to readapt more efficiently its competition.

Due to that, it is necessary analyze the UNIVEG Logistics Portugal's warehouse and its operation, because this is a company that works in food industry and cold chains, and it is necessary to evaluate the performance of the different internal logistics' areas inside the company. In this way, it is intended to verify if the current key performance indicators (KPIs) that company applied are appropriate to each area analyzed and if they are applicability. In the end of this paper, it should have a development of new global performance indicators and suggestions to improve the oldest KPIs.

In the end, is developed three global indicators associated to the activities in the warehouse, like the reception of goods, picking and shipping, through Swing Weighting method.

Finally is created a dashboard that will allow a quick view of the indicators associated to the Operations Management.

**Keywords: Warehouses, Key Performance Indicators, Internal Logistics, Supply Chains, Perishable Products, Multicriteria Analysis, Swing Weighting, Dashboards**

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### **1. Introduction**

At the present, logistics activity of the companies is a key factor for their development and ability to reach their costumers faster and more efficiently than their competitors. If they are more efficient, they will have more costumers. It's known that demand of the end customer have a lot of uncertain, and due to that, companies have to readapt quickly to changes in demand and reconfigure their strategy (Beske, Land & Seuring, 2013).

UNIVEG is the second largest distributor of fruits at the business world. Their second biggest activity is the Transportation and

Logistics, and their operations are mainly focus on food products. The company is located at the center of Portugal, in Riachos. Their focus is to provide an excellent operational service, with quality and always focused on long relationships between UNIVEG and costumers.

UNIVEG is always concerned about their clients, so it has been committed in the control of the internal logistics performance. This paper intends to focus on this constraint identified by the company. In that way, the present work will help the UNIVEG Logistics Portugal to improve its measurement activities, and therefore it will be proposed three global

KPIs linked to their warehouse activity: reception, picking and shipping of goods. It will be also created a dashboard that includes the global indicators and the operational management indicators.

This present paper is divided in seven sections: Section 2 presents the literature review; in Section 3 the problem that origins this paper; Section 4 the methodology applied in this work, the KPIs analysis and proposals; in Section 5 the multicriteria analysis that allowed to create the three global indicators is presented; in Section 6 the dashboard created is described and finally in Section 7 some conclusions are taken.

## **2. Literature Review**

### **2.1. Key Performance Indicators (KPIs)**

KPIs are a set of measures which their focus are the performance of critical processes or activities that influences the success of the company (Parmenter, 2007) and allow to recognize which activities are more weak in terms of performance (Illies *et al.*, 2009).

With KPIs, companies have more consolidated information and the decisions are taken more easily (Meier *et al.*, 2013).

### **2.2. Food Supply Chains**

A supply chain is considered an essential part of any business and it requires a concentration of companies' resources for the chain works effectively and efficiently. This is important because the objective is that the product arrives faster to the final consumer (Kurien & Qureshi, 2011). In this global market with constant changes, the ability to put the right products at the right times and places, it's as important as achieving lower costs (Bogataj *et al.*, 2004). A supply chain is characterized as a complex system, where suppliers, producers, distributors and retailers work together to satisfied the final consumer (Costantino *et al.*, 2013).

In recent years, the concern about food supply chains has been increased. The food industry faces constant challenges due to the increased complexity of operations involved in this industry (Aung & Chang, 2013).

Food chain stands out from the others because is extremely dynamic and have a demand variability very strong. The demand of final consume is uncertain and due to that, companies have to readapt quickly to the

changes in demand and reconfigure their strategy (Beske *et al.*, 2013). This type of chain have a lot of costs, with labor, maintenance and electricity (Tassou *et al.*, 2011)

The workers in this type of industry should be qualified and in constant training, because they need to use a lot of equipment in the warehouse and in transportation. Also the interpretation of the temperatures' sensors requires prevention and education of workers (Stragas & Zeimpekis, 2014).

#### **2.2.1. Cold Supply Chains**

There are different types of stores, like warehouses of perishable products and they can store food, fresh flowers, vaccines and other products that require refrigeration. Jol *et al.* (2006) consider perishable food like products with a high risk of developing microbe and they should be in an appropriate refrigeration storage conditions, controlled carefully. These warehouses are very different from other types of warehouses, because the products are typically stored for short periods of time, and space is efficiently used due to the cooling that has a high cost (Bartholdi & Hackman, 2005).

One of the challenges of these warehouses is avoiding contamination of the products, because they are very fragile and susceptible to these situations. Another challenge is the inventory management due to the policies First In, First Out (FIFO) or First Expire, First Out (FEFO) that must be applied depending on the types of products (Bartholdi & Hackman, 2005).

In addition, warehouses are not only a local storage of goods: have activities like reception, storage, picking and shipping of goods.

#### **2.3. Swing Weighting Method**

The multicriteria analysis is based on solving decision problems involving the evaluation of various options on multiple criteria. There are weighting methods for determining which weights are associated with each criteria in analysis.

For swing weighting method is chosen one or more decision makers, who will present their preferences regarding the criterias, with comparative processes. Through these weights, it's possible to understand the importance of each criteria for the decision maker. The method starts its weighting

process putting all criteria in a worst scenario, creating a baseline as worst case scenario. Thus, the decision maker is asked to choose which criteria has more relevance to change the worst scenario to the best scenario, and that criteria will have 100 points, and then it's eliminated from the choices. Consecutively, the decision maker is requested to choose again another criteria that represents great importance to change the worst scenario for the better, comparative to the first criteria choosen, having this second a value less than 100 points, which is determined by the decision maker. This second criteria is removed from the process and so on. At the end, it is obtained in descending order of relevance the set of criteria selected by the decision maker. To complete the process, it is necessary to determine the weights of the criteria that will have to belong to a range where total of the sum is the unit (Goodwin & Wright, 2004).

### 3. Case Study

UNIVEG Logistics Portugal started their activity in Riachos at 1999. It's a worldwide supply chain, which starts a the suppliers, being the current company responsible to do the transportation service and store the products at the warehouse in Riachos. Then, they shipped in their truck fleet to the final costumers.

The most important client is Makro, the larger wholesaler that company has as a client. In their products performs the crossdocking, which is a good advantage for UNIVEG. The company make all the transport of Makro requests to their stores all over the country. UNIVEG works with other companies like Lidl, Intermarché and other companies with smallest dimension.

UNIVEG Logistics Portugal have, actually, three services for their costumers: Tranportation, Ad-Value Services and Logistics' Storage Services.

With 17.000m<sup>2</sup> warehouse at Riachos, UNIVEG can storage 14.000 pallets, in multi-temperature environment.

Their three fundamental activities at warehouse are reception, picking (Picking-by-Line or Picking-by-Store) and shipping, which will be the focus of this paper, at Section 5.

The actual KPIs implemented on UNIVEG Logistics Portugal are a very large list and don't focus on the essencial aspects that company wants to measure. So, the main problem that company faces is that actual KPIs don't suffer a lot of changes since they were created, so it's necessary a big revision of that list, and analyse all the aspects related to that KPIs, like objectives, the way that they were formulated and analyse its historic. Another aspect are the fact that company needs KPIs that allow lower costs, so it's necessary to create indicators that allow the company to understand which activities can reduce costs.

### 4. Methodology

To do this work, the methodology implemented was the following:

- i. Initially, it was requested historical data of the company of all the KPIs already implemented. It has been only possible to collect data for four consecutive years since 2011, was the year that KPIs were implemented;
- ii. The annual objectives of each KPI were also asked, analyzing each of them and if the goals have been achieved annually;
- iii. Through the data collected, graphs for each indicator were generated, that allowed to understand what is the trend over time and the feasibility of them;
- iv. After this analysis, it has been suggested some changes in KPIs already implemented, as well the creation of new ones that prove to be useful in the future for the company;

#### 4.1. Classification of KPIs implemented

UNIVEG implemented several KPIs. The next list presents all the indicators analysed on this work:

- Evaluation of Suppliers;
- Number of Picking Boxes;
- Number of In Pallets;
- Number of Stock Pallets;
- Number of Out Pallets;
- Number of CrossDocking Pallets;
- Productivity of Fresh Picking;
- Productivity of Frozen Picking;
- Productivity of Reception;
- Compliance with Daily Deliveries in Stores;
- Clients & UNIVEG Breaks;
- Volume of Extra Hours;
- Costs of Extra Hours;

- Level of Absenteeism;
- Compliance with Training Plan;
- Number of Work Accidents;
- Service Level;
- Compliance with Maintenance Actions;
- Number of Failures face of Shipped Pallets;
- Number of Projects Developed;
- Number of Interventions Performed;
- Reduction of Energy Consumption;
- Number of Non-Conformities at Warehouse;
- Number of Customer Complaints;
- Effectiveness of Picking Control.

It is possible to understand that there are two groups of indicators: strategic indicators and operational indicators. In this way, strategic indicators are all the indicators associated with the financial perspective (Clients & UNIVEG Breaks, Costs of Extra Hours and Reduction of Energy Consumption). These indicators help the company to understand its operation regarding costs while trying to minimize costs by optimizing its performance. On the other hand, the group of operational indicators (all other that is related to the non-financial indicators) are the ones are used to control activities or company's operations.

The classification used for these indicators was based on SCOR model that presents six phases, such as Planning, Supply, Production, Distribution, Return and Transversals (Rodrigues *et al.*, 2006). Other perspectives have been attached, with Balanced ScoreCard. This perspectives are based on financial perspective, clients, innovation and internal processes (Kaplan, 2010).

With these models, it was possible to understand that most of the indicators implemented have their focus on the production phase. It is considered the most important activity, and the focus of concern by the company;

- The financial indicators classified in this perspective have been well classified and according to current literature, like Costs with Extra Hours, Reduction of Energy Consumption and Clients & UNIVEG Breaks (with the products of their clients);
- The indicators classified as Transversals are presented as embodied indicators across all the supply chain, such as Maintenance Actions, Projects Developed, Clients' Complaints;

• Most of the indicators implemented on UNIVEG are classified as internal processes. However, according to the literature review, it can be classified through more than one perspective, like indicators associated with continuous improvement, which are presented in the category of Transversals, as Number of Non-Conformities at Warehouse, Number of Customer Complaints at warehouse and Effectiveness of Picking Control which can be encompassed (in addition to Internal Processes), as well as from the perspective of innovation / learning since they are used to improve the company's service and to innovate all their business.

#### **4.2. KPIs Analysis**

In this work all KPIs were analysed, but in this paper it will only be presented the most relevant KPIs which should be deeply analysed.

##### *- Number of Interventions Performed*

This indicator refers to interventions performed with workers' requests. This indicator differs from the Maintenance Actions because the maintenance indicator refers to preventive actions and these are corrective actions. These actions may occur in company's facilities, not necessarily just inside the warehouse but it might also include maintenance work in the offices, bar, among others.

Historical data have values that exceed the 100% compliance in several months of 2013 and 2014. This means that there were more interventions performed than requested in the beginning of the month. Peaks are concentrated in the months of more work, during the summer period, when the work is intense and more damages occur, requiring maintenance interventions. Since the objective of complying with this indicator is the 85% threshold or higher, it is suggested that the goal is increased to a value close to 100%. Implementing TPM (Total Productive Maintenance) makes workers more versatile, there is no need to wait for the maintenance team to solve certain situations in which resolution is simple.

##### *- Number of Work Accidents*

This indicator presents a high volatility every quarter. Achieving only one accident per quarter is a goal not reached in most of the

registers. To improve this indicator, it is proposed the following suggestions:

- Check if the current training given to workers at safety level is appropriate;
- Meetings, set and spread safety standards;
- Check if the working conditions in the warehouse are favorable to workers;
- Kaizen improvement: this philosophy implies the practice of activities that continuously improve all functions, and involve all employees. Thus, it is possible to improve the activities and processes to eliminate the "waste", which is, the work poorly performed.

#### - Operations Management

When the indicators related to the Operations Management area were analysed, some problems with the way that indicators were defined emerged. The indicators Number of Picking Boxes, Number of In Pallets, Number of Stock Pallets, Number of Out Pallets and Number of CrossDocking Pallets, were all evaluated on a monthly basis, but only reflect the number of boxes or number of pallets corresponding to the situation which they describe. Although the literature on KPIs allows indicators being defined with absolute values, the company perspective on these indicators relates to a strategic level, and thus the information that UNIVEG wants to absorb of these KPIs, indicates that they are defined in a wrong way. Due to this, new ways to evaluate these indicators have been suggested in a way to keep their real importance. The suggested is registered in the following equation (1):

$$Picking\ Boxes = \frac{Cp_n}{Cp_{n-1}} * 100 \quad (1)$$

Where:

$Cp_n$  represents the month under consideration reflected in the number of cases in the current year  $n$ ;

$Cp_{n-1}$  represents the month under consideration reflected in the number of cases in the previous year.

To define its goal, current data was considered. Thus, the current 2015 objectives have been compared the corresponding 2014 ones. Applying Equation (1), it was found that the average for the year 2015 is 145%. This means that in addition to performing the same number of Picking Boxes of the previous year (it means 100%), the company wants to overcome these values by 45%. The most

satisfactory situation for the company would be to achieve 20% more than expected, which means, to reach 165%.

For the other mentioned indicators, they were reformulated in the same way, presented in next equations (2), (3), (4) and (5):

$$Pallets\ In = \frac{PI_n}{PI_{n-1}} * 100 \quad (2)$$

$$Pallets\ Stock = \frac{PS_n}{PS_{n-1}} * 100 \quad (3)$$

$$Pallets\ Out = \frac{PO_n}{PO_{n-1}} * 100 \quad (4)$$

$$Pallets\ CrossDocking = \frac{PCD_n}{PCD_{n-1}} * 100 \quad (5)$$

Where:

$PI_n, PS_n, PO_n, PCD_n$  represents the month under consideration reflected in the number of pallets in the current year  $n$ ;

$PI_{n-1}, PS_{n-1}, PO_{n-1}, PCD_{n-1}$  represents the month under consideration reflected in the number of pallets in the previous year.

The goals for each indicator have been defined with the same logic as the goal for Picking Boxes indicator and the results are present in Table 1.

**Table 1 – Goals for new indicators**

KPI	Goal	Best Situation
<b>Pallets In</b>	145%	185%
<b>Pallets Stock</b>	130%	<130%
<b>Pallets Out</b>	152%	172%
<b>Pallets CrossDocking</b>	140%	160%

## 5. Global indicators

Since the Reception, the Picking and Shipping are the core activities of a perishable products' warehouse, it became necessary to establish a way to measure the performance of these activities, on a monthly basis. The purpose of its creation is to provide to UNIVEG a tool that allows them to quickly understand if these activities are carried out in accordance with its objectives.

In order to develop these indicators, it was necessary to choose two decision makers from the company. For the creation of global indicators, it was used the multi-criteria analysis since their creation involve multiple criteria. The methodology used was the following:

- Function value*: the creation of this function can transform value in performance, through bisection method. This technique is introduced as a way to identify the most preferred and least preferred scenarios,

and an intermediate point that is equidistant between the borders;

- ii. *Weighting Methodology*: with Swing Weighting method, it is possible to obtain weights for each of the attributes involved;
- iii. *Additive Aggregation Model*: through this model it will be obtained a final formulation for the desired indicators;
- iv. *Sensitivity Analysis*: This will evaluate the sensitivity of each indicator compared to the variations of the obtained weighting coefficients.

### 5.1. Value Functions

For the creation of this global indicator, the currently used KPIs related to this activity were selected.

For Reception Global Indicator it was used:

- $KPI_1$  = Pallets In;
- $KPI_2$  = Reception Productivity.

For Picking Global Indicator was used:

- $KPI_3$  = Picking Boxes;
- $KPI_4$  = Fresh Picking Productivity;
- $KPI_5$  = Frozen Picking Productivity;
- $KPI_6$  = Effectiveness of Picking Control.

For Shipping Global Indicator it was used:

- $KPI_7$  = Pallets Out;
- $KPI_8$  = Shipping Productivity.

The Bisection Method was used where decision makers have identified what is the best and worst case scenario in KPIs in analysis, as well as an intermediate point that is equidistant to the extreme scenarios. This method is presented as a simple way of turning performance of the KPIs in a range equal between of them, in order to be used in the final indicator. This value function becomes valuable because it would not include indicators with different measures. Decision makers decide the values for the best and worst level scenarios, between 100 points and 0 points, for each of the represented indicators. The intermediate point has 50 points, representing the neutral scenario.

The decisions made by decision makers are represented at Table 2.

Tabela 2 – Values of each indicator in analysis

Value (Points)	$KPI_1$ (%)	$KPI_2$ (Pallets)	$KPI_3$ (%)	$KPI_4$ (Boxes)
100	185	40	165	200
75	170	35	155	190
50	145	30	145	180
0	100	10	100	175

Value (Points)	$KPI_5$ (Boxes)	$KPI_6$ (%)	$KPI_7$ (%)	$KPI_8$ (Pallets)
100	190	30	172	32
75	180	25	164	29
50	155	20	152	24
0	130	15	100	18

### 5.2. Swing Weighting Method

This method has three steps:

- Ordering criteria by their importance for decision maker;
- Quantification of weighting coefficients;
- Coefficients' normalization, so the total sum is unit.

#### ➤ Ordering Criteria

For Reception Global Indicator: it was questioned to decision makers which of the criteria (points of view) the "swing" from the worst to the best scenario would result in the greatest improvement in overall attractiveness, representing in what criteria the improvement is more significant for them. The answer was  $KPI_1$ , so it means that the weight of this indicator ( $p_1$ ) is higher than the weight of  $KPI_2$ ,  $p_2$ . It means that  $p_1 > p_2$ .

For Picking Global Indicator the result was  $p_4 > p_5 > p_3 > p_6$  and for Shipping Global Indicator the result was  $p_7 > p_8$ .

#### ➤ Quantification of Weighting Coefficients

In this step, it was asked to decision makers for Reception Global Indicator:

"How much you classified the change from the worst in  $KPI_2$ , for the same change in the worst case scenario to the best scenario  $KPI_1$ ?"

Decision makers answer if that change happens in  $KPI_2$ , it will have a value of 40 compared to  $KPI_1$ . So, it was possible to obtain the weight of  $p_2$  non-normalized,  $p_2 = (\frac{40}{100})p_1$ .

For Picking Global Indicator:

"How much you classified the change from the worst in  $KPI_3$ ,  $KPI_5$ ,  $KPI_6$ , for the same change in the worst case scenario to the best scenario  $KPI_4$ ?"

Through their answers, it was obtained  $p_3 = (\frac{70}{100})P_4$ ;  $p_5 = (\frac{58}{100})P_4$ ;  $p_6 = (\frac{20}{100})P_4$ ;

For Shipping Global Indicator:

"How do you classified the change from the worst in  $KPI_8$ , for the same change in the worst case scenario to the best scenario  $KPI_7$ ?"

The answer revealed that  $p_8 = (\frac{60}{100})P_7$ .

➤ *Coefficients' Normalization*

In this final step, it was necessary to normalize the coefficients, in a way that their total sum be 1. So, through the equation (6):

$$P_i = \frac{p_i}{\sum_{i=1}^n p_i}, \forall i = 1, 2, \dots, n \quad (6)$$

Finally, it was obtained that:  $P_1 = \frac{100}{140} = 0.71$ ;  
 $P_2 = \frac{40}{140} = 0.29$ ,  $P_3 = \frac{70}{248} = 0.28$ ,  $P_4 = \frac{100}{248} = 0.40$ ,  
 $P_5 = \frac{58}{248} = 0.24$ ,  $P_6 = \frac{20}{248} = 0.08$ ,  $P_7 = \frac{100}{160} = 0.62$  and  $P_8 = \frac{60}{160} = 0.38$ .

**5.3. Additive Aggregation Model**

The Additive Aggregation Model allows the desired global indicator, in which it was possible to apply all the results obtained in previous steps. The equation (7) represents this model and it will be applied to obtain the three final global equations desired.

$$V(GI) = \sum_{i=1}^n P_i v_i(GI) \quad (7)$$

Where:

- $V(GI)$  represents the value of the desired global indicator (GI);
- $v_i(GI)$  represents the parcial value of GI of point of view  $i$   
 where  $v_i(\text{best}_i) = 100$  e  $v_i(\text{worst}_i) = 0$ ;
- $P_i$  represents the weighting coefficients of point of view  $i$   
 where  $\sum_{i=1}^n P_i = 1$  and  $P_i > 0 (i=1, 2, \dots, n)$ .

Through equation (7), it was possible to obtain the three global indicators desired:

➤ *Reception Global Indicator*

$$V(RGI) = 0.71 * v_1 + 0.29$$

$$V(PGI) = 0.28 * v_3 + 0.40 * v_4 + 0.24 * v_5 + 0.08 * v_6$$

➤ *Shipping Global Indicator*

$$V(SGI) = 0.62 * v_7 + 0.38 * v_8$$

**5.4. Sensitivity Analysis**

In all of the next sensitivity analysis, it was considered three scenarios for each KPI:

- Worst Scenario, where weight of KPI in analysis is lower than other KPIs;
- Neutral Scenario, where KPIs' weights
- Best Scenario, where weight of KPI in analysis is higher than other KPIs.

➤ *Reception Global Indicator*

To run this analysis, it was used as input  $v_1=60$  and  $v_2=40$ . These values are random, derivated from confidentiality agreement. The values was obtained from the tranformation by value function created at Section 4.1. The sensitivity analysis is presented in Figure 1.

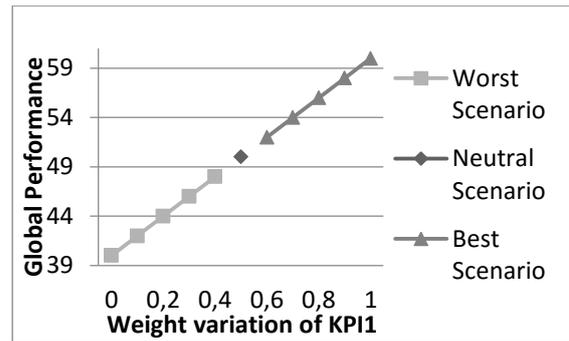


Figure 1 – Weight variation of KPI<sub>1</sub>

Through weight variation of KPI<sub>1</sub>, it's possible see that by increasing the value of  $P_1$ , value of  $P_2$  decreases, progressing to the worst for a better case scenario. If the range of values between criteria weights is bigger, global performance tends to assume the values associated with the criteria with the highest weight. On the other hand, if the interval between the weights of the two criteria is minimal, the overall performance tends to intermediate values between the criteria values. This happens because the weights are negligible, meaning that they are similar and therefore they do not affect the end value performance in a large scale. It is also important to note that these weighting values only influence clearly Global Performance if the input values  $v_1$  and  $v_2$  are more dissimilar, which in this scenario is not what happens, since the values used are similar.

➤ *Picking Global Indicator*

For this analysis, input values are:  $v_3 = 60$ ,  $v_4 = 64.5$ ,  $v_5 = 60$  and  $v_6 = 81$ . Again, these values were get by random values, because the confidentiality agreement. Sensitivity analysis was represented in Figure 2.

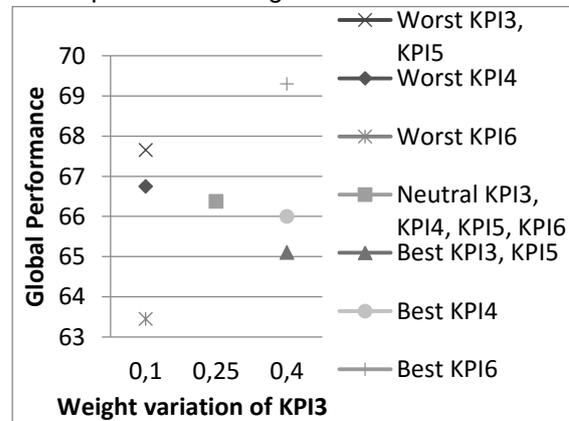


Figure 2 - Weight variations of all KPIs

Since the values of  $v_3 = v_5 = 60$ , they were grouped, as it can be seen in the Figure 2

subtitle, in line of Best and Worst scenarios of both  $KPI_3$  and  $KPI_5$ . It is possible to verify by the graph that in the column of the weight 0.1 all bad scenarios of four indicators are shown. In the column of the the weight 0.25 only one point is showed, which is related to all neutral scenarios (as having the same weight, its performance is equal). Finally, in the column of the weight 0.4, it is demonstrated the best scenarios for each indicator. It is possible to note that the  $KPI_6$  influences more the result of overall performance, because of the higher of input values. If it has a weight lower or higher compared to others, this would influence negatively or positively more than the other indicators. In conclusion,  $KPI_6$  is more robust, dominating the final overall performance of the picking activity.

➤ *Shipping Global Indicator*

In this analysis, it was used as input  $v_7= 52$  and  $v_8= 65$ . Again, these values are random and result from confidentiality with company.

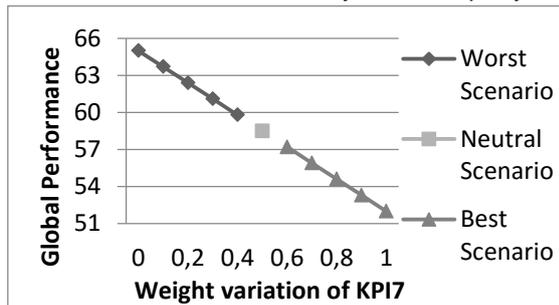


Figure 3 - Weight variation of  $KPI_7$

Again, through Figure 3, can be conclude that the variation of  $P_7$  influences proportionally the variation of  $P_8$ . In this situation, as the input of  $v_7$  is higher than  $v_8$  and this analysis focuses on the variation of the  $P_7$ , then the performance tends to become worse depending on the positive variation of that weight. If the determined weights were more diverse, it would be advisable to reassess the importance of  $KPI_7$  relative to  $KPI_8$ . Since the current weights are similar, it is not necessity to do that review.

**6. Dashboard**

This dashboard was created to facilitate the results' view of KPIs included on Operations Management of the company. The dashboard was created on Excel program, aiming to facilitate its use by UNIVEG workers.

The methodology applied was:

- i. Data collection of Operations Management indicators, like Picking Boxes, Pallets In, Pallets Stock, Pallets Out, Pallets CrossDocking, Productivity of Fresh Picking, Productivity of Frozen Picking and Productivity of Reception;
- ii. Conversion of real data of the indicators through value scales defined in Section 4.1, so they can be used in the Global Indicators created;
- iii. Creation of dashboard design, based on the colors of the company;
- iv. Creation of five pages on dashboard, titled with Reception Global Indicator (“IGR”), Picking Global Indicator (“IGP”), Shipping Global Indicator (“IGE”), “KPIs Paletes\_Caixas” and “KPIs Produtividades”;
- v. Each page needs to match the indicators whose name describes.

**6.1. Visual Dashboard**

Each page of this visual tool is an indicator or a set of indicators important for the company, and due to that, they deserve more attention than the remaining indicators implemented on UNIVEG Logistics Portugal. This set of indicators reflects the logistics company, more specifically, the entire operations management of their warehouse. Thus, it is important to monitor all these data in order to understand if the objectives are being achieved or not, on a monthly and annual basis.

Each page of the Global Indicators includes two types of information:

- On the left side of the page it is possible to find all the information relative to global indicators in analysis, with one table to fill with current values and automatically, the dashboard converts that into values within the defined value function through interpolations created, like it is possible to see in Figure 4.



Figure 4 - Tool to determine the Global Performance

To obtain the desired value of overall performance, it is assigned a "speedometer" that automatically varies with the value obtained in global performance calculated,

which indicates if this is within the desired range (between the neutral and optimal values, designated "Melhor" area) or if that is not in the desired range (between the worst and neutral scenario, called "Pior" area).

- On the right side of the page it's possible to find a tool that is illustrated in Figure 5, where all Global Performances of every month in 2014 were determined. As this indicator did not exist before this work, it was necessary to calculate all Global Performance values to be able to check their trend. With this new information, it is possible to see what was the trend on last year of each global indicator.

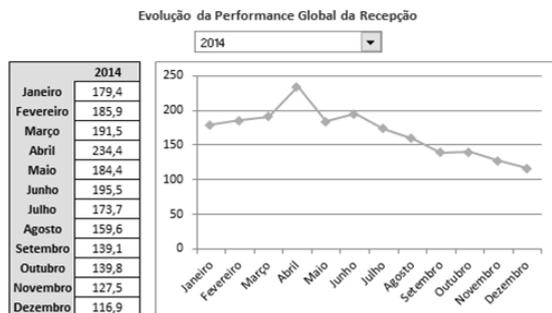


Figure 5 – Tool to see the evolution of Global Indicators

In the other hand, each page of KPIs Caixas\_Picking or KPIs\_Produtividades has two types of information:

- On the left side, a table that it is possible to select the year to see all the values obtained in each month of this year, and returns those results in a graph, presented on Figure 6.

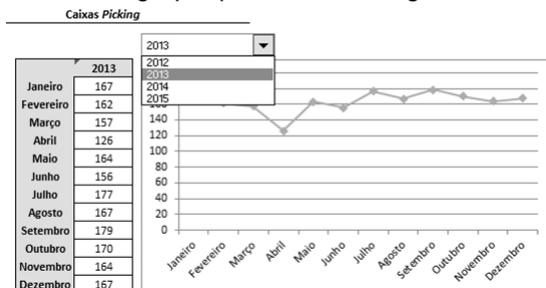


Figure 6 – Table of the trend each year

- On the right side, a chart that allows the user to perform a comparison between the same month values across different years, as it can be seen in Figure 7. By selecting the desired month, the chart returns the values obtained in each year of the selected month. Note that exists a value 0 that is associated to the year of 2015, because database has not those values yet. This tool is useful to see, in a quick view, which year was more productive in month under review.

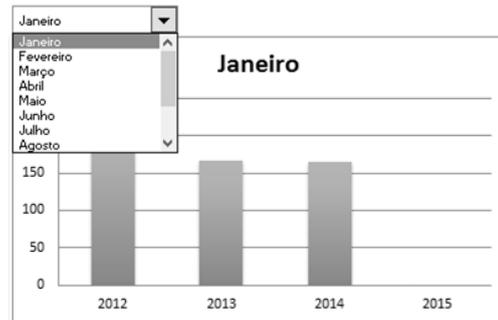


Figure 7 – Chart to compare same month in diferent years

Thus, it is the goal of this dashboard to become useful, a quick view and easy understanding for the company, if they need to change or not the methodologies applied in the activity under review by the company.

## 7. Conclusions

In this paper there were developed tools that will help UNIVEG Logistics Portugal in their control of activities that are their core business.

All indicators used in the company were analysed in a way to improve their results and suggesting what can be modified.

New ways to measure operational management area were created with the goal of transforming their operational indicators in strategic, since that is their view of them.

Finally, global indicators for the most important activities related to UNIVEG's warehouse have been created. These global indicators related to reception, picking and shipping of goods will help company to understand if their efforts have been used correctly and if it needs to change something to performed better.

In the end of this work, it has been developed a dashboard that reveals as a visual tool and useful, allowing UNIVEG to undstand if they are matching their goals.

In the future, to contribute for this work, it can be developed a complete dashboard that links all the database of the company to the all database of the dashboard.

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