SYSTEMS & MANAGEMENT
Electronic magazine

# APPLICABILITY OF THE PRODUCTION EFFORT UNITS METHOD IN A BAKERY: AN EVIDENCE FROM A CASE STUDY

**Marcos Suélio Pedone de Lacerda[1], Charles Albino Schultz[2], Fábio Walter[3]**

**1 Brazil's Navy**
**2 Federal University of Fronteira Sul**
**3 Federal University of Paraíba**

## ABSTRACT

Micro and small enterprises, such as those that typically make up the baking industry, usually lack the resources to invest in complex management tools. A relatively simple alternative to help in cost control and evaluation of productive performance is the Production Effort Units (UEPs - from the Portuguese Unidades de Esforço de Produção) method, which is usually applied to industrial enterprises. This study aims to present consistent evidence that the UEPs method is applicable to a bakery and, to this end, a case study was developed in a small bakery in João Pessoa/PB, using the theoretical basis presented by Bornia (2010) and Kliemann Neto (1994). This work has a descriptive purpose, in which bibliographic research, documentary research and case study were used as methods. The research is classified as qualitative and quantitative, and data collection was based on company documents, timing, unstructured interviews and observation of the production process. The case study demonstrated that the UEPs method was implemented with the use of common spreadsheets, providing the transformation costs and the indicators for the control of productive performance. The results suggest that the UEPs method is applicable to the baking process.

**Keywords:** Cost Management. UEPs Method. Production Efforts Units. Performance Evaluation. Bakery.

## 1. INTRODUCTION

Costs are part of every business organization and are represented by the use of inputs in the manufacture of their products and in the provision of their services. In environments with a high degree of competition, the concern with controlling costs is increasing, becoming a factor of intense monitoring, and controlling costs is part of the actions relevant to good organizational performance. In the "struggle" for the continuity of their activities and in the search for a more secure positioning against the competitors, companies need to mount strategies increasingly efficient for internal and external controls.

In the case of industries, cost control involves the control of expenditures on the necessary inputs - labor, energy, machinery, facilities and various others, depending on the process - to transform raw material into finished product. These inputs are related to "transformation costs" (Bornia, 2010), which should be appropriately allocated to the cost of the final product. Over time, costing methods have been developed to allocate costs to products, among which we can mention simple apportionment methods, the Cost Center method, Activity Based Costing (ABC) and the Production Effort Units method (UEPs - from the Portuguese Unidades de Esforço de Produção).

In the context of small and micro-enterprises, many have limitations in the application of costing methods, however the UEPs method has as one of its main objectives to simplify the allocation of indirect costs to products, allocating them in order to consider the effort to manufacture them, rather than using different apportionment criteria, as in so-called traditional costing methods.

PROPPI / LATEC
DOI: 10.20985/1980-5160.2017.v12n1.1072

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

A number of studies have been published on the applications of the UEPs method, but they are not published in periodical applications in bakery companies, which have very different productive characteristics from the manufacturing context for which this method was developed. To the extent that the bakery sector is composed of a large number of companies, if the UEPs method proves applicable in these companies, then it can be very useful in their management.

Thus, the main objective of this work is, from a case study developed in a bakery in João Pessoa/PB, demonstrate that the UEP method is applicable in a bakery micro-enterprise and can contribute to the evaluation of its productive performance by the availability i ndicators.

## 2. FOUNDATION

### 2.1 The Bakery Industry in Brazil and its Costs

The theme "costs" has always been focused on identifying and allocating products to the determination of business results. However, with the increase in complexity and competition in the markets, the focus has also expanded on its control and management, as a way of maximizing results and the use of resources. According to Bornia (2010, p. 15), "cost is the value of the inputs used in the production of the company's products" and, as in many business sectors, the proportion of costs on a baker's total revenue is very relevant, and can reach 68%, according to the Food, Confectionery and Bakery Development Program (PROPAN - from the Portuguese Programa de Desenvolvimento da Alimentação, Confeitaria e Panificação) (2009).

According to the Brazilian Association of the Bakery and Confectionery Industry (ABIP - from the Portuguese Associação Brasileira da Indústria de Panificação e Confeitaria) (apud Confectioners in Motion, 2008), "the management of a baking company is as complex as or more complex than many businesses in the market. Managing a bakery professionally requires the competence of the management of an industry and the breadth of control over the operation of a trade". Thus, knowledge of the costs of the company and of the characteristics of the sector, as well as the control of its operational performance, are relevant aspects for the success of a baking enterprise.

According to the Technological Institute of Bakery and Confectionery (ITPC - from the Portuguese Instituto Tecnológico de Panificação e Confeitaria) and ABIP, in 2014, the size of the Brazilian bakery and confectionery sector remained stable, with 63.2 thousand companies, which received around 41.5 million customers daily, representing a reduction of 3.48% over the previous year. This sector maintained around 850 thousand direct jobs (and 1.85 million indirect jobs), representing an increase of 5.7% compared to 2013 (ABIP, 2015).

The growth rate of the Bakery and Confectionery companies in 2014 was 8.02%, with revenues reaching R$ 82.5 billion. It was the second consecutive year that the sector presents an increase of less than 10%, the lowest rate of the last eight years. (...) In the last year, the main factors for the reduction in the growth rate of the sector were the increase in costs that increased by an average of 11.5% (ABIP, 2015).

Regarding the composition of operational costs (except raw materials) in bakeries and confectionery, the highest in 2014 were those with staff (42%), energy (11%), taxes (15%) and packaging (7%), with other costs accounting for 25% (ABIP, 2015).

From the data presented, it can be seen that costs represent a significant part of the revenues, with special attention being paid to management. However, only information on costs and revenues is not sufficient to efficiently manage the production process, but also operational performance data, such as human productivity: For example, in 2014, "recorded percentages indicate lower productivity In companies, with a fall of 5.4% per employee "(ABIP, 2015). Other indicators can also be evaluated, such as those of average productivity for the bakery sector made available by PROPAN (2013 apud Everything Baked, 2015):

- Average production volume of the bread sector per employee: 2 tons/month
- Average production volume of confectionery per employee: 500 kg/month
- Average salary production volume per employee: 450 kg/month in non-automated companies and 1,500 kg/month in automated companies
- Average sales per employee in industry: 750 kg/month
- Average minimum production per month in artisanal production companies: 500 kg.

These sectoral indicators can be monitored within each company to control production, as well as many other possible uses, which should be chosen according to the specific peculiarities of their operational processes.

Electronic Journal of Management & System
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

### 2.2 The Method of Production Effort Units (UEPs)

The Production Effort Units (PEUs) method originated in France during World War II when the French engineer Georges Perrin created the GP method. Unlike other methods, GP was established in the "equivalence of machines and not of products, achieving their unity through the process steps of each product" (GantzeL et Allora, 1996, p.50). Brought to Brazil by consultant Franz Allora, the GP was adapted and renamed as UEPs (or UP's) method and in "1986, a team of UFSC researchers was in charge of studying, disseminating and improving the method "(Bornia , 2010, p.137).

The main advantage of the method is in its practical use, from spreadsheets that only need to update production data and total costs for each period of analysis. Among the main limitations of the method are (1) its focus only on manufacturing environments with standardized production and (2) its restriction on processing costs, ie costs required to convert raw material into finished product. Insofar as it is restricted to the treatment of processing costs, the UEPs method should then be complemented by other methods (Bornia, 1995; Coronetti *et al.*, 2012), as the Standard Cost and/or ABC, to form a complete costing system for a company.

Production Engineering uses several indicators to evaluate the performance of the factory (efficiency, effectiveness, productivity, idleness, etc.), but are general measures that do not express the actual situation of each manufactured product: "in short, production generally does not have its own measure unit, whatever the products manufactured"(Gantzel et Allora, 1996, p.52). When it comes to a single-processor company, cost calculations and performance measures are easily related to the product, which is not the case in multi-producer companies. In these, "this situation is no longer so banal, because the production of the period can not be determined, because the products can not be simply summed up" (Bornia, 2010, p.138).

The implementation process of the UEPs method is divided into five stages. The first is to divide the company into operational posts. An **operational station** (OS) is composed of homogeneous transformation operations, formed by one or more elementary productive operations, which have the characteristic of being similar for all the products that pass through the OS, differing only in the time of passage. OS can be considered as the transformation steps to which the raw material is submitted until its final form (Bornia, 2010).

The second step is the determination of the cost/hour ($/h) of each operational post, called **photo-index**. Photo--indices are calculated from the efforts consumed in each OS, considering the unit of time chosen, usually cost-hours. The **photo-cost** corresponds to the total cost required to manufacture the **base product**. To fulfill this step, it is essential to choose a base-product that represents the production system as a whole. The base product can be a product that ideally goes through all or most of the operational stations, can be a fictitious product or even a combination of products (Kliemann Neto, 1994). At this point, it can be highlighted that "the characteristic of the UEP method is the effective use of the time used to obtain the cost of production. Everything is based on the time spent "(Zonatto et al., 2012, page 237).

The calculation of productive potentials is the simplest step of the UEPs method and requires only the photo--indexes of the operational posts and the photo-cost. The productive potentials of each OS are found by dividing the respective photo-index by the photo-cost, calculated in previous steps. The productive potential shows the processing capacity, in UEP, that a OS has for a chosen unit of time, such as hours or minutes, for example.

Once the **productive potential** of each of the OS is reached, it is left to calculate the consumption in Production Effort Units (UEPs) equivalent to the other products. When passing through OS, the raw material absorbs the production efforts and, in order to know how much effort has been made on the raw material in each OS, it is necessary to know the processing time spent in the OS.After the survey of all the times consumed by the products in each OS, the equivalents in UEP of each product can be obtained, multiplying the times spent by the respective productive potentials of the OS. This procedure is repeated for all products, being the last step of **implantation** of the UEPs method (Bornia, 2010) (Figure 1).

It should be noted that a facility of the UEPs method is that the value in UEPs of each product does not change as long as the productive structure remains: "The methodology offers a powerful product comparability instrument in a non-monetary unit, i.e. it's not influenced by monetary issues, such as inflation, etc."(Morozini et al., 2006, p.146).

The method **operationalization** starts with the measurement of the level of production and the calculation of the costs of transformation, but its application can also extend, for example, to the calculation of the productive capacities of the company, the production scheduling and the adoption of physical measures of performance (Bornia, 2010; Kliemann Neto, 1994).

In spite of the relative simplicity of costing the transformation of products and being disclosed in Brazilian cost management books (eg Bornia, 2010; Souza, Diehl, 2009; Martins, 2010; Ribeiro, 2011; Wernke, 2008), in the area of Accounting, the UEPs method is little used.

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

| | Step | Step Description |
|---|---|---|
| Implementation | Division of the factory in Operational Stations | Divide the production environment into Operational Posts, grouping jobs according to the similarity observed in operations. |
| | Calculation of photo-indices | Determine the costs/hour of the Operational Posts. |
| | Choice of base-product | Choose (or create) a "homogeneous" product that serves as a comparison of the productive potential of each Operational Post and then calculate the cost of the base product (photo-cost-base). |
| | Calculation of productive potential | Divide the photo-indexes of each Operating Post by the photo-base-cost. |
| | Determination of the equivalents of the products | Obtain, from the production efforts absorbed in each operational post, the total effort (in UEPs) equivalent to each product. |
| Operationali-zation | Measurement of quantity produced (in UEPs) | From the sum of the efforts made for the transformation of the products, to obtain the total production (in UEPs). |
| | Calculation of Transformation Costs | Measure the cost of transformation (cost of UEP) for the period and then the cost of each product. |
| | Performance Measures | Monitor production performance from physical measures related to UEP. |

**Figure 1.** Procedures for the *implantation and operationalization* of the UEPs method.
Source: Elaborated from Bornia (2010, pp. 143-147).

The accounting, in general, does not use the method of the UEPs, since it considers a variation of the absorption. In addition, the few works in the accounting area that recognize it understand that its use is almost exclusively for the industrial area. However, the UEPs method is very similar to the absorption cost method, having the same virtues and the same problems. However, for multiproducer companies with diversified product lines, the UEPs method, although more difficult to implement, may offer a more accurate cost because it better recognizes the complexity of the processes (Souza et Diehl, 2009, p.191).

The provision of indicators for the performance evaluation is the differential of the UEPs method in relation to other costing methods, which usually can only offer information on the cost of processing of the products (Antunes Júnior, 1988; Bornia, 2010; Kliemann Neto, 1994). In addition, it is worth highlighting its potential contribution to production management, not only to managerial accounting, which is the most publicized method in the areas of Production Engineering and Administration.

Another limitation of the method refers to the fact that "industrial companies with production to order and whose products are not repetitive can not establish a unit of measurement of common production and are unable to use the UEP" (Sousa et Figueiredo Júnior, 2012, p. 150).

A number of researches have been published on the method, applying it in different industrial sectors, such as those related to the production of cosmetics (Luiz et al., 2014), clothing (Wernke et al., 2013), refrigerators (Wernke et al.2015), dairy products (Cambruzzi et al., 2009), metalworking (Filomena et al., 2011), furniture makers (Rodrigues et Brady, 1992), meat processing (Milanese *et al*., 2012; Kunh *et al*., 2011), fabrics (Sousa *et* Figueiredo Júnior; 2012), curved glasses (Zonatto et al., 2012), and others (Walter et al., 2016).

## 3. METHODOLOGICAL PROCEDURES

This research is classified as descriptive, since it seeks to describe the application of the method in a bakery. As for the ways of investigation, this study uses bibliographical, documentary and case study research (Vergara, 2014).

As variables of the research, we present the implantation of the UEP method and the contribution to the management, having as observation unit a baking company of the city of João Pessoa/PB. As for the company, this was born from the professional experience of its manager, who accumulates the functions of administrator and chief baker of the business, characteristic typical of family businesses. The chief baker accumulates 25-year experience in the function, but in administrative terms he has no training and therefore has little specific knowledge of managerial functions.

Regarding the approach, this research is characterized as qualitative, involving analyzes on the case studied, and quantitative, since it uses statistical instruments (Raupp et Beuren, 2013) for the elaboration of several worksheets related to the implantation and operationalization of the UEPs method.

The bibliographical research was mainly based on books and articles. For the localization of articles on the topic, we used the online search tools Google Academic and the Portal of Periodicals of CAPES with the following search parameters: "UEP", "UEPs", "Production Effort Unit" and "Production Effort Units".

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

Data collection and analysis followed the theoretical model of the UEPs method described by Kliemann Neto (1994) and Bornia (2010). As data collection techniques in the company, we used time timing, unstructured interviews and systematic observation of the processes. In order to analyze the results obtained with the operation of the UEPs method for the management of production and its effects, non-statistical content analysis procedures were used. We also used basic procedures for comparing, through the Excel software from Microsoft Office.

## 4. CASE STUDY

### 4.1 The Implantatio step of the UEPs Method

The implementation of the UEPs method in the bakery complied with the five steps foreseen in the theoretical model presented in Figure 1.

*Division of the factory into operative stations*

The first step of the implantation consisted of defining the production operations, which include all the tasks involved in manufacturing. The operating stations should be defined based on the Layout and the production flows, shown in Figure 2.

In Figure 3, the defined operational stations and their main physical resources are presented.

The production area of the bakery has 8 simple cabinets, 160 screens, 3 double cabinets and 120 baking trays. In this way, it has 8 operating stations PO5 and 3 operating stations PO6 of double capacity. The sequence of bakery product processing in the operative stations follows its numerical order (Figure 3). The only exceptions are at the operating stations PO3 and PO4, and PO5 and PO6, which perform the same activities but with different configurations.

*Calculation of Photo-Indexes*

The second stage of the deployment consisted in the determination of the Photo-Indexes, which determines the cost-hour of all the operational stations. For the determination of the photo-indexes, it is necessary to identify all the cost items of the operating stations. To obtain the cost--hour, the monthly amount of effective operation hours was used, since all the stations have periods of idleness. These procedures followed the principle of full absorption (Bornia, 2010), according to which all idle costs are allocated to the operating stations. In order to obtain the time of use of each operative station, the various steps of the processes were timed three times each and then multiplied by the number of times the process was repeated during the month, thus determining the quantity of hours in which each item of cost was used during one month in the operative stations.

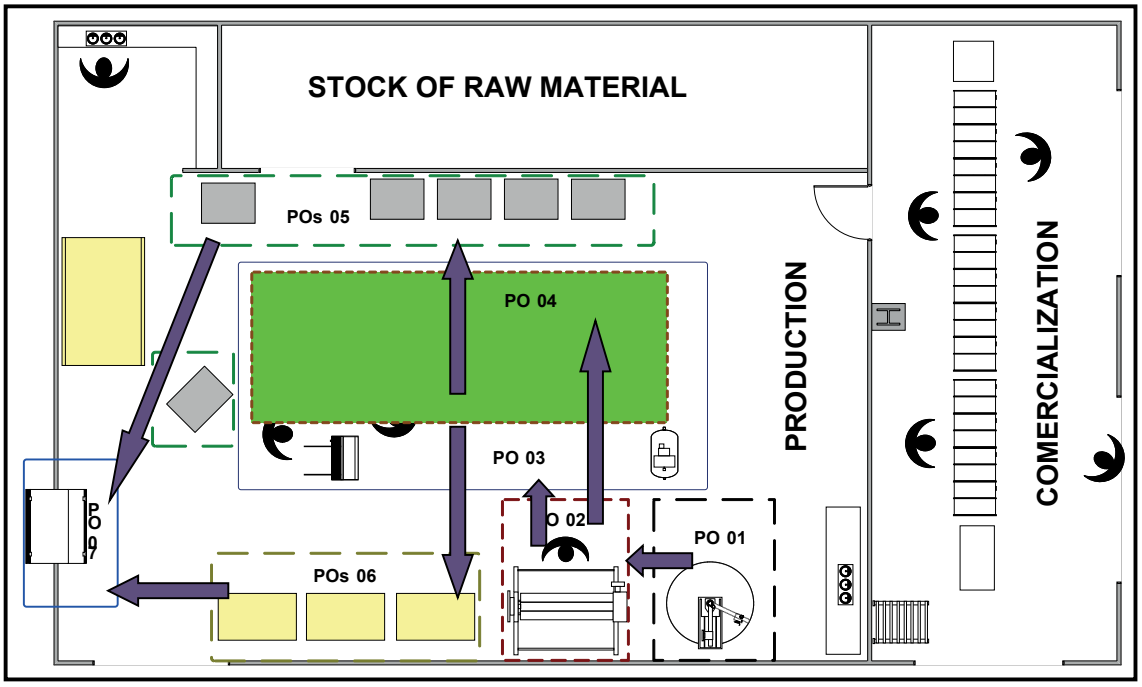


**Figure 2.** Approximate Disposition of Operational Stations in Bakery Layout
Source: Own elaboration

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

| OPERATIONAL STATIONS | COMPOSITION |
|---|---|
| 01: Kneader | 1 kneader / 1 scale / 1 worker |
| 02: Cylinder | 1 kneader / 1 scale / 1 worker |
| 03: Cutting and accommodation with machine | 1 divider / 1 modeler / 1 workbench / 3 workers |
| 04: Cutting and accommodation without machine | 1 counter / 2 manual cutters / 3 men |
| 05: Storage with simple cabinets | 1 single cabinet / 20 screens |
| 06: Storage with Double cabinets | 1 double cabinet / 40 baking trays |
| 07: Oven | 1 oven / 1 worker |

**Figure 3**. Operational stations and it's composition

Source: Own elaboration

The cost of manpower was found by dividing the amount of wages and charges paid by the sum of the number of hours worked per month of all employees. This procedure was adopted because the bakery does not have defined functions and all employees can perform all the processes.

Considering the costs of the cost items of depreciation and maintenance of machinery and equipment, maintenance and depreciation of the bakery structure, direct manpower, electrical energy of the machines and respective equipment to each of the operative stations, the total value were obtained for each operational position, presented in Table 1.

**Table 1:** Values of Photo-Index

| Operative Station | Photo-Index (R$/h) |
|---|---|
| PO 01 | 4,6708 |
| PO 02 | 5,5407 |
| PO 03 | 9,9876 |
| PO 04 | 6,5640 |
| PO 05 | 0,0602 |
| PO 06 | 0,0814 |
| PO 07 | 4,6707 |

Source: Own elaboration

*Photo-cost calculation*

For the calculation of the photo-cost, the base product that would serve as the reference for the calculations was first determined. As none of the bakery products went through all the operative stations, the French bread batch (30 kg) was determined as the product base, taking as justification the fact that it is the most commercialized product. Table 2 shows the calculation of the photo-cost, obtained by the sum of the multiplication of the processing time by the photo-index of each operative station.

*Calculation of productive potential*

The productive potentials represent the capacity of processing, in UEPs, of the operative stations by a unit of time. In this stage, the productive potentials of each operational station are determined by dividing the photo-indices by the photo-cost of the product-base, as shown in Table 3.

**Table 2:** Demonstration of photo cost of ptoduct base

| Operative Station | Processing Time (h/un) | Photo-index (R$/h) | Photo-cost (R$/un) |
|---|---|---|---|
| PO 01 | 0,1833 | 4,6708 | 0,8563 |
| PO 02 | 0,2500 | 5,5407 | 1,3852 |
| PO 03 | 0,3750 | 9,9876 | 3,7454 |
| PO 04 | 0,0000 | 6,5640 | 0,0000 |
| PO 05 | 14,0000 | 0,0602 | 0,8421 |
| PO 06 | 0,0000 | 0,0814 | 0,0000 |
| PO 07 | 0,2583 | 4,6707 | 1,2066 |
| Total | | | 8,0356 |

Source: Own elaboration

*Determination of equivalents in UEPs of products*

The determination of the equivalents in UEPs of the products is to determine the amount of production effort consumed by each of the products. To do so, it is necessary that the time that the product takes to be processed in each operative station is multiplied by the productive potential of the respective operative stations. As an example, the calculation of the UEP equivalent of the product base is presented in Table 4. This procedure was processed for each of the company's products.

**Table 3:** Calculation of Productive Potentials

| Operative Post | Photo-index (R$/h) | Photo Cost (R$/UEP) | Productive Potencials (UEP/h) |
|---|---|---|---|
| PO 01 | 4,6708 | 8,0356 | 0,5813 |
| PO 02 | 5,5407 | 8,0356 | 0,6895 |
| PO 03 | 9,9876 | 8,0356 | 1,2429 |
| PO 04 | 6,5640 | 8,0356 | 0,8169 |
| PO 05 | 0,0602 | 8,0356 | 0,0075 |
| PO 06 | 0,0814 | 8,0356 | 0,0101 |
| PO 07 | 4,6707 | 8,0356 | 0,5813 |

Source: Own elaboration

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

**Table 4:** Calculation of the UEP equivalent of the base product

| Operative Post | Processing Time (h) | Productive Potencial (UEP/h) | Equivalent in UEPs |
|---|---|---|---|
| PO 01 | 0,1833 | 0,5813 | 0,1066 |
| PO 02 | 0,2500 | 0,6895 | 0,1724 |
| PO 03 | 0,3750 | 1,2429 | 0,4661 |
| PO 04 | ----- | 0,8169 | ----- |
| PO 05 | 14,0000 | 0,0075 | 0,1048 |
| PO 06 | ----- | 0,0101 | ----- |
| PO 07 | 0,2583 | 0,5813 | 0,1502 |
| Total | | | 1,0000 |

Source: Own elaboration

The bakery manufactured 13 types of breads, and the equivalent in UEP of each are shown in Table 5.

**Table 5:** Equivalent in Product UEPs

| Product Lots | Equivalent in UEPs |
|---|---|
| French Bread | 1,00 |
| French Bread II | 0,95 |
| Sweet Bread | 0,63 |
| Sweet Bread II | 0,56 |
| Sweet Bread with Coconut | 0,72 |
| Sweet Bread with Coconut II | 0,65 |
| Sweet Bread with Cream | 0,66 |
| Sweet Bread with Cream II | 0,59 |
| Bread Brota | 1,56 |
| Bread Carteira | 0,49 |
| Bread Criolo | 0,47 |
| Bread Sedinha | 0,58 |
| Bread Ball | 0,60 |

Source: Own elaboration

As can be seen in Table 5, there are differences in equivalents in UEP of similar products, such as French Bread and French Bread II, which results from different processing times. In addition, it may be noted that while a batch of the French Bread product consumes 1 UEP to be manufactured, a batch of Bread Brota, for example, consumes 1.56 UEPs, which is to be interpreted as 56% more work carried out for this last one.

### 4.2. Operacionalization of UEPs Method in the bakery

Among the advantages of using the UEPs method, one can cite the possibility of measuring the level of production, calculating processing costs, calculating productive capacities, scheduling production and physical measures of performance. Some of these possibilities will be presented in this subchapter.

*Measuring the level of production*

The UEPs method turns a multiproducing company into a mono-producer, facilitating the calculation to obtain total production for the period, as well as simplifying the comparison between quantities produced from different periods. For the measurement of the total production of the period, the quantity of items produced by their respective equivalents in UEPs was multiplied. Adding these results, we have the total production of the period in UEPs, as presented in Table 6.

**Table 6:** Production of UEPs in a given month

| Products | Quantity Produced (Lote/ Month) | Equivalent in UEPs (UEP/lot) | Production (UEP/ Month) |
|---|---|---|---|
| French Bread | 112 | 1,00 | 112,00 |
| French Bread II | 112 | 0,95 | 106,13 |
| Sweet Bread | 5 | 0,63 | 3,15 |
| Sweet Bread II | 5 | 0,56 | 2,79 |
| Sweet Bread with Coconut | 11 | 0,72 | 7,95 |
| Sweet Bread with Coconut II | 11 | 0,65 | 7,17 |
| Sweet Bread with Cream | 12 | 0,66 | 7,96 |
| Sweet Bread with Cream II | 12 | 0,59 | 7,11 |
| Bread Brota | 30 | 1,56 | 46,68 |
| Bread Carteira | 26 | 0,49 | 12,83 |
| Bread Criolo | 26 | 0,47 | 12,12 |
| Bread Sedinha | 26 | 0,58 | 15,03 |
| Bread Ball | 26 | 0,60 | 15,63 |
| TOTAL | ---- | ---- | 356,56 |

Source: Own elaboration

As the total UEPs produced in previous months were available, the total production (in UEPs) would be compared, being this an application of UEP method to aid control of production.

*Calculation of processing costs*

The calculation for determining the cost of a UEP is simple. It consists of determining the total of processing costs, which are indirect costs, divided by the total UEPs produced in the period, according to Equation 1. In the month considered in this case study, the bakery had processing costs of R$3,153,35.

$$\frac{\text{Cost}}{\text{UEP}} = \frac{\text{Processing Cost of the month}}{\text{Produced UEPs in the month}} = \frac{\text{R\$3153,35}}{\text{356,56 UEPs}} = \frac{\text{R\$}}{\text{UEP}} 8,8439 \quad (1)$$

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

The determination of the unit costs is made by multiplying this cost by the equivalent in UEP of each product. Table 7 shows the application of this procedure for the costing of a lot and, subsequently, of one kilogram of each product, according to the weighing of the lot of each product.

The variations observed in the processing costs of the products are mainly associated with the variations of the costs in the operative stations where they are processed, since some have higher costs than others, due to the inputs used in each one and the processing time of each product in the respective stations. This difference in the costs of the operative stations and in the timing causes that the costs of the kilograms of the products are different.

*Productive capabilities of the company*

The UEPs method allowed us to calculate the productive capacity of the bakery. The theoretical, practical and real capacities will be demonstrated considering: a normal day of work and the operational post. It is understood in this company as a normal working day, every day of the week, except Sundays and holidays, when capacity is reduced by 50% of normal capacity.

It is worth noting that theoretical capacity is the total capacity that a company can achieve with its available resources, considering the fully efficient use of resources. In the determination of the practical capacity, a normal working day is considered, with 10 hours of effective work at the PO1, PO2, PO3, PO4 and PO7 operating stations, and 7 and 21 working hours at PO5 and PO6, respectively, once subtracted the involuntary stops. In addition, PO5 and PO6 stations should be considered to have 8 and 3 units, respectively, with PO6 having double capacity.

Actual capacity (or "actual production") is calculated post-production because it considers only the perfectly manufactured products, ie, subtracts the defective items. For this calculation, production was considered as a basis on a specific business day. Calculations of theoretical, practical and actual capacities are presented in Table 8.

From the productive capacities, different product mixes can be designed to be manufactured, allowing production scheduling to be done daily, if necessary.

*Physical measures of performance*

With the productive capacities, the UEPs method also allows the company's production to be accompanied by three physical measures of performance: theoretical efficiency, practical efficiency and hourly productivity. It should be remembered that these measures are applicable to each of the operational posts, as well as to a few of them, and even to the factory as a whole.

For the calculation of efficiency, it was based on the actual production of a given day. In this study, were used data from the same day as previously considered. Theoretical efficiency, practical efficiency and productivity were obtained by Equations 2, 3 and 4, respectively.

$$\text{Theoretical Efficiency} = \frac{\text{Real Production (in UEPs)}}{\text{Theoretical Capacity (in UEPs)}} \quad (2)$$

$$\text{Practical Efficiency} = \frac{\text{Real Production (in UEPs)}}{\text{Nível de Atividade Real (in UEPs)}} \quad (3)$$

$$\text{Productivity} = \frac{\text{Real Production (in UEPs)}}{\text{Worked Hours}} \quad (4)$$

**Table 7**: Cost of processing of products

| Products | Equivalent in UEPs (UEP/lote) | Cost UEP (R$/UEP) | Processing Cost (R$/lote) | Processing Cost (R$/Kg) |
|---|---|---|---|---|
| French Bread | 1,00 | 8,84 | 8,84 | 0,29 |
| French Bread II | 0,95 | 8,84 | 8,38 | 0,28 |
| Sweet Bread | 0,63 | 8,84 | 5,57 | 0,37 |
| Sweet Bread II | 0,56 | 8,84 | 4,94 | 0,33 |
| Sweet Bread with Coconut | 0,72 | 8,84 | 6,39 | 0,43 |
| Sweet Bread with Coconut II | 0,65 | 8,84 | 5,77 | 0,38 |
| Sweet Bread with Cream | 0,66 | 8,84 | 5,87 | 0,39 |
| Sweet Bread with Cream II | 0,59 | 8,84 | 5,24 | 0,35 |
| Bread Brota | 1,56 | 8,84 | 13,76 | 0,31 |
| Bread Carteira | 0,49 | 8,84 | 4,36 | 0,44 |
| Bread Criolo | 0,47 | 8,84 | 4,12 | 0,41 |
| Bread Sedinha | 0,58 | 8,84 | 5,11 | 0,43 |
| Bread Ball | 0,60 | 8,84 | 5,32 | 0,44 |

Source: Own elaboration

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

It is necessary that the unit of time observed be the same for real production, for real and practical capacities, and for productivity. These measures are presented in Table 9.

The efficiency of the operating stations varied according to the quantity of UEPs produced in a unit of time, which could be verified by the differences in productivity indexes. In addition, the efficiency of the bakery operative stations also varied according to the production mix used. Thus, with this information, it was possible to determine the most efficient operating stations, such as PO6, which reached a theoretical efficiency level of 70.14% and 80.16% of practical efficiency. For the operating station PO4, which showed only 9.35% and 22.44% of theoretical and practical efficiency, respectively, it will be necessary to verify if it presents productivity problems or if there are problems of idleness due to the production mix used.

## 5. FINAL CONSIDERATIONS

This work demonstrated the applicability of the Production Effort Units (UEPs) method to assist production management in a bakery in João Pessoa/PB. The implementation of the UEPs method, based on the fundamentals presented by Kliemann Neto (1994) and Bornia (2010), demonstrated how the costs of processing the different products (breads) could be obtained, as well as some indicators for the control of production, related to capacity, efficiency and productivity.

The results suggest that the method is adequate for the costing of the traditional breadmaking process, although it is quite different from those in industrial companies that apply the UEPs method to the manufacturing area (chapter 2.2).

It is understood that here is the main academic contribution of the study. In addition, the case study confirmed the practicality of implementing the UEPs method, which was developed with the use of simple spreadsheets and production data and costs of the analyzed period. The simplicity of application of the UEPs method seems to be an accessible alternative for micro and small bakeries, which usually do not have the conditions or resources to invest in more complex and expensive management systems.

As limitations of the study, analyzes could have been carried out regarding operational station idleness, production bottlenecks and contribution margin studies, for example. Such analyzes were not possible, however, due to the unavailability of information at the time of data collection.

As suggestions for future work are the replication of this work in bakeries with a more diversified list of products and

**Table 8:** Theoretical, practical and real productive capacities

| Operative Post | Productive Potential (UEP/h) | Theoretical Capacity | | Practical Capacity | | Real Capacity (UEPs) |
|---|---|---|---|---|---|---|
| | | Hours available (h/day) | Theoretical Capacity (UEPs/day) | Normal Hours (h/day) | Practical Capacity (UEPs/day) | |
| PO 01 | 0,5813 | 24,00 | 13,95 | 10,00 | 5,81 | 1,34 |
| PO 02 | 0,6895 | 24,00 | 16,55 | 10,00 | 6,90 | 2,55 |
| PO 03 | 1,2429 | 24,00 | 29,83 | 10,00 | 12,43 | 4,97 |
| PO 04 | 0,8169 | 24,00 | 19,61 | 10,00 | 8,17 | 1,83 |
| PO 05 | 0,0075 | 24,00 | 1,44 | 21,00 | 1,26 | 0,63 |
| PO 06 | 0,0101 | 24,00 | 1,46 | 21,00 | 1,28 | 1,02 |
| PO 07 | 0,5813 | 24,00 | 13,95 | 10,00 | 5,81 | 2,96 |

Source: Own elaboration

Table 9: Physical measures of performance

| Operative Post | Real Production (UEP) | Theoretical Capacity (UEP/Day) | Theoretical Efficiency (%) | Practical Capacity (UEP/Day) | Practical Efficiency (%) | Productivity (UEP/h) |
|---|---|---|---|---|---|---|
| **PO 01** | **1,3369** | **13,9503** | **9,58** | **5,8126** | **23,00** | **0,1337** |
| **PO 02** | **2,5474** | **16,5486** | **15,39** | **6,8953** | **36,94** | **0,2547** |
| **PO 03** | **4,9696** | **29,8303** | **16,66** | **12,4293** | **39,98** | **0,4970** |
| **PO 04** | **1,8334** | **19,6050** | **9,35** | **8,1688** | **22,44** | **0,1833** |
| **PO 05** | **0,6288** | **1,4372** | **43,75** | **1,2576** | **50,00** | **0,0299** |
| **PO 06** | **1,0232** | **1,4588** | **70,14** | **1,2765** | **80,16** | **0,0487** |
| **PO 07** | **2,9644** | **13,9502** | **21,25** | **5,8126** | **51,00** | **0,2964** |

Source: Own elaboration

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

the exploration of production indicators that were not developed in this work. In addition, it is suggested to implement the method in other similar food sectors, such as pizzerias and confectionery, to verify eventual difficulties of implantation of the UEPs method in these productive contexts.

## REFERENCES

Associação Brasileira da Indústria de Panificação e Confeitaria – ABIP (2015) "Indicadores 2014", disponível em: http://leitura.com.br/wordpress/indicadores-2014/ABIP (Acesso em 05 de agosto de 2015).

Antunes Júnior, J. A. V. (1988) Fundamentação do Método das Unidades de Esforço de Produção, Dissertação de Mestrado em Engenharia de Produção, Universidade Federal de Santa Catarina, Florianópolis, SC.

Bornia, A. C. (1995) Mensuração das Perdas dos Processos Produtivos: Uma Abordagem Metodológica de Controle Interno, Tese de Doutorado em Engenharia de Produção, Universidade Federal de Santa Catarina, Florianópolis, SC.

Bornia, A. C. (2010), Análise Gerencial de Custos: Aplicação em Empresas Modernas, 3 ed., Atlas, São Paulo.

Cambruzzi, D. et al. (2009) "Unidade de Esforço de Produção (UEP) como Método de Custeio: Implantação de Modelo em uma Indústria de Laticínios", ABCustos, Vol. 4 No. 1, disponível em http://abcustos.emnuvens.com.br/abcustos/article/view/66/100 (Acesso em 12 de agosto de 2015)

Confeiteiros em Movimento (2008), "Setor de panificação e confeitaria cria mais de 20.000 novos empregos em 2007", disponível em: http://ativista.wordpress.com/2008/03/11/15/ (Acesso em 05 de agosto de 2015).

Coronetti, J. et al. (2012), "Os Métodos de Custeio utilizados nas maiores Indústrias de Santa Catarina", GESTÃO.Org, Vol.10 No. 2, disponível em http://www.revista.ufpe.br/gestaoorg/index.php/gestao/article/view/299/236 (Acesso em 11 de agosto de 2015).

Filomena, T. P. et al. (2011), "Manufacturing feature-based cost management system: a case study in Brazil", Production Planning & Control, Vol. 22 No. 4, disponível em http://dx.doi.org/10.1080/09537287.2010.497505 (Acesso em 11 de agosto de 2015).

Gantzel, G. et Allora, V. (1996), Revolução nos Custos: Os Métodos ABC e UP e a Gestão Estratégica de Custos como ferramenta para a Competitividade, 2 ed., Casa da Qualidade, Salvador, BA.

Kliemann Neto, F. J. (1994) "Gerenciamento e Controle da Produção pelo Método das Unidades de Esforço da Produção", artigo apresentado no Congresso Brasileiro de Gestão Estratégica de Custos, São Leopoldo, RS, 20-23 de novembro, 1994, disponível em http://www.abcustos.org.br/texto/viewpublic?ID_TEXTO=1501 (Acesso em 11 de agosto de 2015).

Kuhn, P. D. et al. (2011) "Aplicação e Utilização do Método Unidade de Esforço de Produção (UEP) para Análise Gerencial e como Ferramenta para o aumento da competitividade", Produção Online, Vol. 11, n. 3, disponível em http://dx.doi.org/10.14488/1676-1901.v11i3.664 (Acesso em 10 de março de 2016).

Luiz, G.; Gasparetto, V.; Lunkes, R. J.; SCHNORRENBERGER, D. Utilização do Método da Unidade de Esforço de Produção (UEP): estudo em uma empresa de cosméticos. ABCustos – Associação Brasileira de Custos, vol. IX, n.1, jan./abr. 2014.

Martins, E. (2010). Contabilidade de Custos. 10ª Ed. Atlas, São Paulo, SP.

Milanese, S. et al. (2012) "Método de Custeio UEP: uma Proposta para uma Agroindústria Avícola", Revista Catarinense da Ciência Contábil, Vol. 11, n. 32, disponível em http://dx.doi.org/10.16930/2237-7662/rccc.v11n32p43-56 (Acesso em 10 de março de 2016).

Morozini, J. F. et al. (2006), "Aplicação da Abordagem UEP em uma Empresa do Setor Fabril: um Estudo de Caso", Sistemas & Gestão, Vol. 1 No. 2, disponível em http://www.revistasg.uff.br/index.php/sg/article/view/SGV1N2A4/17 (Acesso em 11 de Agosto de 2015).

Programa de Desenvolvimento da Alimentação, Confeitaria e Panificação (2009), "Indicadores de 2008", disponível em: http://www.propan.com.br/print.php?id=350 (Acesso em 11 de agosto de 2015).

Raupp, F. M. et Beuren, I. M. (2013), "Metodologia da Pesquisa Aplicável às Ciências Sociais", em Beuren, I. M. (Ed.), Como elaborar trabalhos Monográficos em Contabilidade. Teoria e Prática, 3 ed., Atlas, São Paulo, SP, pp. 76-97.

Ribeiro, O. M. (2011). Contabilidade de Custos, 2ª Ed, São Paulo, Saraiva, SP.

Rodrigues, L. R. et Brady, G. (1992) "Cost Accounting and Production Control in a Multiproduct Environment – The Unit of Production Effort Method", International Journal of Operations & Production Management, Vol. 12 No. 10, disponível em http://dx.doi.org/10.1108/01443579210017277 (Acesso em 11 de Agosto de 2015).

Sousa, L. A. et Figueiredo Júnior, H. S. (2012), "Determinantes da Difusão do Método de Custeio 'Unidade de Esforço de Produção' (UEP) na Indústria Têxtil Cearense", Revista Gestão Industrial, Vol. 8 No. 1, disponível em https://periodicos.utfpr.edu.br/revistagi/article/view/878/783 (Acesso em 11 de agosto de 2015).

Souza, M. A. et Diehl, C. A. (2009) Gestão de Custos: uma Abordagem Integrada entre Contabilidade, Engenharia e Administração. 1 Ed. Atlas, São Paulo, SP.

**Electronic Journal of Management & System**
Volume 12, Number 1, 2017, pp. 38-48
DOI: 10.20985/1980-5160.2017.v12n1.1072

Tudo Panificado (2013), "Perfil do Setor no Brasil - PROPAN", disponível em: http://tudopanificado.blogspot.com.br/p/indicadores.html (Acesso em 05 de agosto de 2015).

Vergara, S. C. (2014) Métodos de Pesquisa em Administração, 1 ed., Atlas, São Paulo, SP.

Walter, F. et al. (2016) "Método das Unidades de Esforço de Produção: Um Perfil dos Estudos de Caso", Espacios, Vol. 37, n. 3, disponível em http://revistaespacios.com/a16v37n03/16370304.html (Acesso em 10 de março de 2016).

Wernke, R. (2008). Gestão de Custos: uma abordagem prática, 2ª ed., Atlas, São Paulo, SP.

Wernke, R. et al. (2013) "Método UEP: Estudo de Caso sobre a Aplicabilidade em Pequena Fábrica de Confecções Femininas", Iberoamerican Journal of Industrial Engineering, Vol. 5 No. 9, disponível em http://incubadora.periodicos.ufsc.br/index.php/IJIE/article/view/2107/pdf (Acesso em 12 de agosto de 2015)

Wernke et al. (2015) "Determinação do Custo Fabril pelo Método UEP: Estudo de Caso no Setor de Salsicharia de Frigorífico", GEPROS, Vol. 10 No. 1, disponível em http://revista.feb.unesp.br/index.php/gepros/article/viewFile/1227/636 (Acesso em 12 de agosto de 2015)

Zonatto, V. C. S. et al. (2012) "Utilização do Método de Unidade de Esforço de Produção (UEP) para Determinação dos Custos de Transformação de uma Indústria de Vidros curvados para Refrigeradores comerciais", Revista Gestão Industrial, Vol. 8 No. 1, disponível em https://periodicos.utfpr.edu.br/revistagi/article/view/804/787 (Acesso em 11 de agosto de 2015).