Experimental research methodology for physical distribution in bakery industry

A D Pop, G Rus and R F Drenta

Technical University of Cluj-Napoca, Faculty of Engineering, Department of Engineering and Technology Management, Baia Mare, Romania

E-mail: a raul.drenta@cunbm.utcluj.ro

Abstract. The research done in the bakery industry worldwide and in special in the Romanian market had their goals on the production and technological process, focusing on the end result products. Bakery industry focused on profits changed and developed their products according to the market need and preferences and very few traditional businesses know how to make the profits continuing the distribution routes and using the old bread recipes. During this study we aim to go through an experimental process in order to observe the influence that different cost factors have on the end result such as performance and profits. A questionnaire was designed to answer questions regarding the existent technology in the bakery industry, transportation vehicles, clients, turnover, invoice overdue, and the structure of the production, costs with workers, transport, maintenance, marketing and raw materials. The questionnaire will be applied only in the North West area of Romania to all the bakery companies that have over 5 employees and deliver bread products to business customers using predefine routs. In a future stage, it would be of a great interest to apply a similar questionnaire in different parts of Europe for further studies in this industry, where management has a deficiency in scientific research and managers have to take decision based most of the time only on their own experience.

1. Management tool for bakery performance

The most complex business model in bakery industry is the sale of the bakery products through the distribution channel by own means on predefined distribution routes. For this business model we continued the elaboration of the algorithms describing the distribution of the bakery products, following that through software based on these algorithms and an intuitive interface, to provide a simple and useful tool to support the improvement of the business performance of bakery enterprises.

Through this study, we aim to improve managerial performance (expressed at company level through profit and profitability) by highlighting factors or groups of factors that contribute the most to performance. To this end, by gathering information from bakery companies, we can validate a generally valid level of costs and expenses that they must fit for each stage of the distribution process, depending on the main factors of influence.

The term performance is used to highlight both individual, group, process, or system capabilities. Due to these aspects, the existence of an all-encompassing definition seems to be almost impossible. However, in the scientific context, for the performance in the managerial area, we came to the definition formulated following a thorough research by Dr. Iulian Vişoiu, in his doctoral thesis. It defined performance through its component elements and proposed a graphical representation of
performance as a vector located in a three-dimensional space. According to the author, performance is defined by three elements: effectiveness, efficiency and adaptability.

Further on, we will present the structure and main characteristics of the software we are developing and how, using our questionnaire we can achieve the answers that will help the bakery managers to optimize their business.

1.1. Software structure for end users in bakery management

The computer program is conceived as a tool available to bakery managers. It is made up of three interactive segments to diagnose the situation and provide solutions to improve the company's distribution process by pointing out missing factors or those that exceed the values identified at the industry level as defining margins for profitable firms.

![Software algorithm](image)

**Figure 1.1. Software algorithm**
The architecture of the software algorithm to be used is described in figure 1.1 “Software algorithm” and describes the steps to be taken by the end user (manager of the bakery production unit). In a first step, the user of the software program will introduce its own variables in the same way as all the respondents did in the questionnaire and the return returned to the first stage will be a relative one, positioning the company described by the user compared to the results obtained from the questionnaire reflects the influence factors and their share in activity for the companies that have profited in the last years of activity.

1.1.1. Step one. On the first step the information provided by the software application will include graphics and graphical user friendly expression as outlined in figure 3.2. Stage 1 information display Staying in step 1 of the questionnaire and software program the same set of questions, the information collected from both sources, highlighted in parallel, can provide the user with an overview of the strategic location of his business in the area which can provide a profit

The application provides the same perspective and concrete information for managers already involved in a business as well as those who are about to start and provide business plan information.

1.1.2. Step two. On the second step, the software application will ask the user to provide new information in order to continue to evaluate the business and to provide information on the improvements it can make to the production and distribution process in order to optimize them.

Starting from the information obtained by applying the questionnaire, at the level of the bakery industry, for each influence factor and for the overall activity, the average values of the industry will be determined, taking into account only the performances of the enterprises that obtained profit during the analysed period.

Step two will begin by comparing the user's profit with the average of the bakery industry. If it is found that the user is currently earning a profit equal to or above the average of the industry, the application will rewrite a greeting message that will mention this and the program will stop.

If by this comparative method, the profit position below the average of the industry is noticed, additional information will be required that will go through a mathematical model that will determine the activities within the company to be tracked, giving the user a set of performance indicators Incorporates profitable businesses from the bakery industry.

A mathematical model based on the described experience can be represented as follows:

Starting from the break-even formula where: Fixed Costs (Value-Cost Variable) = 1 or Amount of All Expenses + Profit = Income from Sales of Products,

=> 40% Gasoline x Price + 1% Marketing x Price + 1% Interest x Price + Z% Raw Material = 100% Price

=> Price (40% + 5% + 3% + 2.5% + 7% + 1% + 1%) + Z% Raw material = 100% Price

=> 59.5% Ch + Z% Raw materials + profit = 100% Price

=> Raw materials = 40.5% Price

We can observe that the approximate method is currently being applied to reach the profitability threshold, whereby the cost of raw materials cannot exceed one third of the sales price of the products.

Starting from this concrete example where we can see an overview of the cost and profit of societies, we aim to develop an application to support bakery managers to improve their production and distribution performance by identifying and addressing punctual the factors that need to be improved so that the end result is to maximize economic performance.

1.1.3. Step three. On the third step of the software application, the information provided by the user will be compared to those obtained from the analysis of the information provided by the participants in the study conducted by us and on the basis of the publicly available financial information.
Factors tracked in stage three: Staff expenditure, Expense Car Fuel, Car park maintenance costs, Maintenance costs, Gas/ power production costs/ wood/ fuels, Marketing costs, Cash Flow/ Investment (Interest) Costs.

2. Methodology and questionnaire
The research will be carried out by applying a questionnaire developed on the basis of the research studies analysed as well as relevant in the first chapters on the theoretical study of the distribution of finished products in the bakery industry studies that each of them analysed the influence of the identified factors on the efficiency, and generating profit.

Out of these studies, relevant factors have been extracted, capable of generating concrete and conclusive data for the present study, factors analysed by formulating and adapting some of the questions identified in the questionnaires identified, thus materializing in a questionnaire which will include questions about the business model, the structure of expenditures and those of the obtained economic results (profit), a questionnaire that will be applied online through specialized media platforms.

Thus, the qualitative and quantitative data extracted will be analysed with the statistical data analysis programs SPSS 20 and EXCEL 2010, thus generating statistical and mathematical testing, concluding that the hypotheses launched or their invalidity are supported, on the existence of the situation at the level of the Northwest Development Region of Romania

2.1. Description and evaluation of control variables
The following factors were selected:

The sector of activity comprises the area of activity of the selected target companies, in order to analyse and highlight the activity of production and distribution of finished bakery products.

Regarding the sector of activity, it was appreciated the introduction as a control variable the companies having the main field of activity and CAEN code 1071 Manufacture of bread and bakery products.

At North Western Region level, according to the information obtained from the Trade Register, CAEN 1071 is authorized for 700 active companies with at least one employee.

The present study aims to analyse and provide a management tool for bakery company managers but the CAEN 1071 activity is also defining the production of cakes and confectionery products or frozen bakery products. By determining the production structure in total revenues we aim to identify firms based on a predominant production in bread and pastries fresh baked products.

The size of the firm will refer to the average number of employees of the sectarian industrial firms in the chosen research area, with the selection of companies from the four categories: micro, small, medium and large micro enterprises.

Regarding the size of the company, it was appreciated the introduction as a control variable the size of the company, because at the level of the NW region of Romania, the activity of the organizations from the smallest to the multinational is starting, for which, by questioning a representative number within them, will lead to shaping a present situation of those categories of organizations that sell their products through distribution based on pre-established routes and their own fleet.

In order to highlight this aspect, only companies with a minimum number of 5 employees will belong to the target group, so that the number of companies that cumulatively meet these criteria is reduced to 331 firms. In order to highlight this aspect, only companies with a minimum number of 5 employees will belong to the target group, so that the number of companies that cumulatively meet these criteria is reduced to 331 firms.

The evaluation of all the above mentioned factors will be done through the SPSS 20 and EXCEL 2010 statistical program, which will generate statistical data based on the chosen mathematical model,
to show the positive / negative correlations between these factors in order to validate / invalidate the hypotheses launched.

Considering that this questionnaire will be sent to all 311 companies in the chosen field of activity having at least 5 employees and operating in the North-West region of Romania, regarding the representativeness of the group, according to the Taro Yamane formula (Israel 2003), a minimum of 171 questionnaires were needed for representativeness.

A probability of 90% and a maximum error of +/- 5% were taken into consideration, for which the following calculation formula was used: (Israel 2003)

\[ n = \frac{N}{1 + N \cdot (e^2)} \]

- \( n \) - sample size;
- \( N \) - the size of the total population;
- \( e \) - the level of accuracy (maximum permissible error);

\[ n = \frac{311}{1 + 311 \cdot (0.01)} = \frac{311}{1 + 311 \cdot 0.01} = \frac{311}{4.11} = 76 \text{ questionnaires} \]

Collecting the data when completing the questionnaire will be done through the Google Forms electronic application, an application that will generate a record of the number of completed questionnaires and statistics on respondents' answers. The questionnaire is available online on [http://www.UniversitatiiRomania.ro/bakeryStudy](http://www.UniversitatiiRomania.ro/bakeryStudy)

2.2. The structure of the questionnaire

The structure of the questionnaire is based on the structure described for the software as long as the main purpose of this interaction with companies in the bakery industry is to identify algorithms that can provide guidance for new bakery managers to plan a profitable business plan or for other bakeries to restructure and increase the profitability of their activity.

The information we aim to identify and structure is related to cost factors that must be kept well under control and the positive experience of bakery companies with higher profits will be able to offer valuable information and guidance to other bakery managers.

First questions are designed to identify and position the company in the market, offering information about their location in urban or rural area, a factor that can influence the strategy of the company and the profitability in different areas.

Very important for our study is to identify the marketing strategy and branding importance for our survey respondents.

Supply chain and production information are valuable and are present in our questionnaire right from beginning, trying to identify the supply strategy, negotiation capacity, cash flow issues due to suppliers rigidity, technology used in production and manipulation of the raw materials, last investment in technology and the capacity of the production and total use of the capacity.

The portfolio of the company and structure of production for each type of products will help us identify the new bakery companies that are not aiming to produce traditional bread and bakery products and are not part of our research.

Packaging is a complex activity for each company and it is reflected in our study but so far we don’t find it very relevant for final profitability compared with investment costs needed in the beginning of a new business.

Distribution channels used, the amount of different routes, sale strategy, transportation vehicles structured on capacity and volume for each type, age of the transportation fleet, mileage are a big concert for our study. Our studies indicate so far that an important role in costs control is played by these factors.

Distribution reflection is carried on with question related to the relation with the retail customer and end consumer.

By defining an average distance route used in the industry, we can provide valuable information for new bakery managers.
Cash flow is a strategic decision and can determine the success or failure in a new business but also can give the new companies a competitive advantage on the market.

Perishable products are a common problem for fresh products and we will study different approach in the bakery industry in the observed area.

Employees are the most valuable asset and an efficient structure of personal that is common on bakery industry level is the kind of information that each manager would like to possess.

Profitability questions in our questionnaire have two roles. To test the correctness of our survey companies because we can check the information from the available financial information we have access too. The second role is to find the profits companies estimate in different product.

Last questions relate to the most important aspect of our study. Percentage and intervals of cost estimated for each department and activity. We are working on five option grill structure, the middle answer being the one identified in our preliminary research on focus groups.

Acknowledgements
Being one of the first students to approach the topic of Business Management and Engineering on Distribution of bakery products in Romania, I am keen to highlight the step by step support, guidance and time offered by professor Nicolae Ungureanu from academic perspective and Andana Pan Baia Mare Bakery for their full cooperation in designing and testing the current research methodology.

In perspective we are looking forward for other researchers with similar interest in order to apply the questionnaire on bakery companies in different regions around the world as long as we can talk about fresh baked products and traditional bakery product, not yet merged into a general approach of food logistics. Feel free to contact us for a full version of the document.

References
[1] Cioca L I, Moraru R I, Băbuţ G B and Ungureanu N S 2015 Integrating risk analysis with safety dyagnostic in complex industrial systems: modeling hazard ACTA Universitatis Cibiniensis 66 (1) pp.17-22
[2] Isachi S E 2015 The competitive advantage of microeconomical level in the context of globalization. Economy and Management
[3] Isaksson L 2010 Corporate Social Responsibility: A Study of Strategic Management and Performance in Swedish Firms Australia Bond University Gold Coast
[4] Israel G D 2003 Determining Sample Size University of Florida Ifas Extension
[5] Ungureanu N, Duval P, Mocan M L and Taucean I M 2010 Logistica Activitatilor de Mentenanta Editura Universitatii de Nord Baia Mare
[6] Ungureanu N, Lung C and Cotetiu R I 2015 E-maintenance-a new trend in industrial maintenance Mechanical Engineering Letters HU ISSN 2060-3789 12 (1) pp.70-77
[7] Ungureanu M, Pop N and Ungureanu N 2016 Innovation and technology transfer for business development Procedia Engineering 149 pp.495-500