USING THE EXPERIMENT METHOD
IN BUSINESS-TO-BUSINESS MARKETING

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ABSTRACT: The concept of industrial marketing is circumscribed around an explosive development which has influenced the specialization and the differentiation of the science of marketing, through extending its applicability to various fields of activities. If on conceptual level, marketing can be used in relation with any type of market – industrial or consumer – the methods of implementing the elements of the marketing process can be very different. The marketing experiment is dwelt upon in this paper both from a theoretic point of view and from the point of view of its practical applicability: the second approach is based on creating and solving a study case using the method of projecting the marketing experiment with the help of random blocks.

KEY WORDS: industrial marketing, marketing experiment, marketing variables, observing units, experimental treatment, experimental factor, random blocks, experimental error

1. THE THEORETIC FRAMEWORK OF THE INDUSTRIAL MARKETING CONCEPT

The word “marketing” comes from the present participle of the Anglo-Saxon verb “to market”, which means “to sell”, “to trade”, “to deal”, “to commercialize”. Later on, the word spread on an international level because it was impossible to capture in translation the whole meaning of the term and the wide range of equivalents associated with it. Originating from the economic field, marketing was the main subject of great theoretic debates during the second half of the past century. According to some authors, more than 1600 definitions have been attributed to marketing so far.

These can fall into two separate categories: classic or “narrow” definitions which focus mainly on commercial activities and on the physical movement of goods and services, neglecting a series of groups strongly influenced by the development of marketing activities (consumers, trade unions, public authorities, governmental...
agencies etc.); modern or “broad” definitions which are related to modern marketing points of view, extending the fields influenced by marketing towards non-profit organizations, relating the company’s activity with the environment, implying social aspects etc.

The starting point in decoding the term marketing is the definition given by the American Marketing Association (A.M.A.): “Marketing is the performance of business activities that direct the flow of goods and services from producers to consumers.” Forwarded in 1948, this definition met serious criticism as it was considered tributary to “the old concept of marketing”, because it referred only to activities which result in the production of goods and they end in selling them. The most recent definition of marketing according to A.M.A. reads: “marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large” (2007) [13]. Included in the “broad definitions” category, this new approach corresponds to the new modern tendency of including the marketing theory and practice into various fields of the economic – social life.

The explosive development of marketing during the second half of the 20th Century was possible in two ways: extensive – implementing marketing in an increasing number of organizations and fields of activity; intensive – consolidating and improving the marketing point of view within enterprises and branches which had implemented it.

Both directions that marked the evolution of contemporary marketing were meant to broaden the field of applicability of this science and resulted in a great process of marketing specialization and differentiation, a process which is still in progress. It is very important that we note the following: if in countries with a developed market economy, marketing has first developed its general methods and practices, and only later has it developed the ones specific to particular fields of activity, then in Romania (just like in other countries that suffered economic changes), the evolution of general marketing and specialized marketing is almost simultaneous.

One of the major criteria that determine the specialization of contemporary marketing is the profile of the economic activity. Thus we can distinguish between: Industrial marketing or B2B Marketing; Consumer Marketing (B2C); Services Marketing.

According to American specialists William Pride and O.C. Ferrell, industrial marketing represents “a set of activities destined to facilitate and encourage the trade implying industrial products and consumers on organizational markets” [12]. Nowadays, the concept industrial marketing is used in a broader sense, meaning that it does not encompass only the sector of industrial products but it also takes into consideration the characteristics of the clients interested in these products and the characteristics of organizational markets. As a concept, marketing can be used in relation with any type of market - industrial or consumer - the methods of implementing the elements of the marketing process can be very different [1].

One of the most frequently used methods in marketing researches to obtain the necessary information required by market researches is the marketing experiment. Further on, we analyze the experiment method and its characteristics when applied to
industrial marketing, starting from the fact that the marketing research has become a necessity due to the unprecedented intensification of the complexity of the decisional process within industrial enterprises.

2. THE ELEMENTS OF THE MARKETING EXPERIMENT

The marketing experiment is a deliberate “induced” simulation on a small scale and under more or less artificial circumstances of a marketing activity which aims to characterize the way this is affected by one or more casual factors. Actually, the variation of one or more explanatory (independent) variables is used by the researcher to quantify the effects of this variation upon some observing units (consumers, users, economic units, etc.) of the result interpretation and of the probable evolution laws enunciation. The main elements of any marketing experiment are [7]:

- **Marketing variables.** An experiment operates with two big categories of variables:
  a) **Independent variables** consisting of influence factors, the activity of which is observed during the experiment. In their turn, these variables fall into other two categories:
    - **explanatory variables** also called experimental factors or marketing stimuli (materialized in products, their characteristics, package, auxiliary services, payment facilities, price, advertisements etc.) the size of which is modifies on purpose by experiment operators in order to reveal the effects of these changes upon the demand, the volume of sales, upon competition, distributors etc.;
    - **random variables (outsiders)** which are not subject to experimental treatment; if we are aware of their effect, we can reject or influence seriously the hypothesis according to which independent variables change dependent variables. Thus, it is important not to eliminate them, but to try to maintain their level as long as possible.
  b) **Dependent variables** (also called explained variables) are variables of effect type, materialized in the volume of sales, demands, time for adopting the purchasing decision, opinions and attitudes, reactions from competition, trademarks, the efficiency of mediators etc. During the experiment, these variables must be kept from possible influences which might be produced by disturbance factors.

- **The observation units** can be represented by shops which sell certain products, batches of products that are to be tested, groups of buyers etc.; their reaction to various experimental factors are closely watched and analyzed. Observation units also fall into two categories:
  - **experimental units** - the experimental treatment is being applied and appropriate measurements are being made;
  - **control units (witness)** - are also placed under observation, but they are kept from stimuli which influence the former; their role is to be a comparison basis for the changes occurred in the case of experimental units.

Aside the results of the experiment, marketing researches also show the importance of other factors, apart from experimental ones. Very often, there are cases in which the effect of a factor is conditioned by the existence or by the influence of
other factors because there is a certain interaction among the effects of factors. In order to outline the effect of the experimental factor as accurately as possible, it is necessary that the marketing experiment be designed and carried out so that it enables the quantification and the elimination of the carrier effect caused by the interaction between factors.

- **Treatments** are a set of actions and procedures through which the performer of the experiment interferes with the independent marketing variables in order to detect the reaction of dependent variables. As a consequence, *treatments are working instruments of the marketing experiment*. They can be represented by changes in pricing (in order to register a variation in the demand), in functional characteristics of the product (in order to analyze the evolution of the sales volume), changes in the behaviour of shop attendants (in order to detect the speed of adopting purchasing decisions) etc. Due to the variation of some external factors (which cannot be entirely controlled), of the inaccuracy of measurements, of the negligence of those who conduct the experiment, of behaviour disturbances caused by stress, we can come across experimental errors.

**Designing the marketing experiment** represents *an anticipated structuring process*, using a model or a chart with *different combinations of factors* which form the treatments chosen to be applied on groups of experimental units. The efficiency of conducting a marketing experiment is, thus, conditioned by the process of *choosing the appropriate design scheme*. Thus, the first category of experiment design schemes implies the existence of one experimental factor and it is based upon the hypothesis of a constant influence from other factors (Solomon’s test or the sign test). Marketing practice requires, however, the use of some more elaborate experiment design methods, which can reflect precisely the complexity of marketing phenomena: random design, random blocks design, \( \chi^2 \) test model, Latin squares, Greek-Latin squares etc.

**3. THE USE OF MONO-FACTORIAL MODEL WITH RANDOM BLOCKS AND GROUPS OF THE SAME SIZE FOR DESIGNING AND CONDUCTING AN INDUSTRIAL MARKETING EXPERIMENT**

This method of elaborating a marketing experiment is based upon the principle of grouping experimental units into blocks, that is to say more homogenous groups. After forming the blocks \((i=1,2,\ldots,n)\), the distribution of experimental units on different levels of the experimental factor \((j=1,2,\ldots,r)\) is done at random. At the same time, in order to reduce errors, the blocks must be of the same size. The experiment design implies a random sample, made of \(n-r\) units.

Consider the case of a company that produces spare parts and subassemblies for Dacia cars, a company which intends to re-analyze its production technologies for some products in order to improve performances and increase sales. A group of technical and economic specialists was formed in this respect, to find solutions that lead to the increase of sales on condition that the technical performances of the products are kept the same and the production costs are reduced. The group of specialists identified the brake cylinder among the products that could be improved through technical – economic measures. The marketing department came up with four
different modernization alternatives of the brake cylinder; they are symbolized by A, B, C, and D.

In order to establish whether the proposed modernization measures can determine a significant increase of sales, a number of eight shops which sell brake cylinders were randomly selected; they are supplied with a stock that covers the market demand for a month for all the four types of the product. Moreover, necessary steps have been taken so that other selling conditions should not be modified and that they would be the same as for the types A, B, C and D of the product. During the marketing experiment, each shop was regarded upon as a block, thus observing the isolation of the studied factor (the improvement of the product) from the influences caused by the characteristics of shops (type, sales behaviour, notoriety etc). The results obtained can be seen in table 1.

Table 1. The volume of sales registered by the eight shops in the cases A, B, C and D of the product

<table>
<thead>
<tr>
<th>Shops (blocks)</th>
<th>Levels of the experimental factor</th>
<th>Total (T_{i...})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>640</td>
<td>645</td>
</tr>
<tr>
<td>2</td>
<td>580</td>
<td>600</td>
</tr>
<tr>
<td>3</td>
<td>600</td>
<td>617</td>
</tr>
<tr>
<td>4</td>
<td>577</td>
<td>580</td>
</tr>
<tr>
<td>5</td>
<td>610</td>
<td>586</td>
</tr>
<tr>
<td>6</td>
<td>565</td>
<td>607</td>
</tr>
<tr>
<td>7</td>
<td>573</td>
<td>665</td>
</tr>
<tr>
<td>8</td>
<td>555</td>
<td>680</td>
</tr>
<tr>
<td><strong>Total (T_{j..})</strong></td>
<td>4700</td>
<td>4980</td>
</tr>
<tr>
<td><strong>Average (\bar{y}_j)</strong></td>
<td>587.5</td>
<td>622.5</td>
</tr>
</tbody>
</table>

The experimental method proposed below implies following several steps:

**A). Submitting the null \( H_0 \) hypothesis.** Taking into consideration the fact that the marketing experiment is a selective research, that is to say that it is conducted on a number of eight shops which sell break cylinders over a limited period of time (a month), the result is obvious to have a relative value. Thus, it is possible that the data does not coincide with the information concerning the entire population (made up of all the shops that sell that certain product); moreover, we cannot know for sure the difference between the two series of data, since the total state of the population is usually unknown.

The mathematical theory of probabilities provides methods to evaluate the results of selective studies, making it possible to estimate, in terms of probability, the maximum error rate which can occur when using the information from the research instead of the real data which characterizes the population. As a consequence, we cannot make statements under certainty; however we can make suppositions called statistic hypotheses. A **null hypothesis** is a statistic hypothesis that is to be verified. In our example, the null hypothesis can be submitted as follows:
- $H_0_{Fr}$ - the modernization measure does not affect heavily the volume of sales (in the case of the experimental factor);
- $H_0_B$ - the experimental blocks do not affect significantly the volume of sales (in the case of shops which are organized as experimental unit blocks).

Verifying a hypothesis means submitting it to some tests, called statistic tests, a procedure after which the supposition is either rejected or accepted. Such a decision is always based on calculations regarding the confidence interval which corresponds to an established level of importance. In order to facilitate practical operations, statistic tests usually indicate the actual working procedure which mainly consists in determining a specific value – noted with $F$ in our example – using the data from the research; this value is then compared with other “critical” values from a table, followed by the decision whether the hypothesis is rejected or not.

**B). Calculating the sum of square deviations $SAP$.** Calculating the sum of square deviations as a total $SAP_T$:

$$SAP_T = \sum_{j=1}^{r} \sum_{i=1}^{n} y_{ij}^2 - C$$

where: $y_{ij}$ – represents the level of the dependent variable for experimental unit $i$ ($i = 1, n$), to which the experimental factor $j$ ($j = 1, r$) is applied; $C$ – represents the correction term obtained from the following equation:

$$C = \frac{T^2}{r \times n}$$

$T$ is the general total of the contingent table while “$r$” and “$n$” are the levels of the experimental factor and of the number of analyzed blocks, respectively.

The first relation of the total of square deviations is being determined as a whole:

$$\sum_{j=1}^{r} \sum_{i=1}^{n} y_{ij}^2 = 640^2 + 580^2 + 600^2 + ... + 668^2 + 732^2 + 647^2 = 13203522$$

The correction relation will be

$$C = \frac{20480^2}{8 \times 4} = 13107200$$

Then $SAP_T = 13203522 - 13107200 = 96322$

- **Determining the total of square deviations due to the experimental factor $SAP_{Fr}$:**

$$SAP_{Fr} = \frac{1}{n} \sum_{i=1}^{n} T_{i}.j^2 - C = \frac{4700^2 + 4980^2 + 5300^2 + 5500^2}{8} - 13107200 = 46600$$

- **Determining the total of square deviations due to experimental blocks $SAP_B$**:

$$SAP_B = \frac{1}{r} \sum_{j=1}^{r} \sum_{i=1}^{n} T_{i}.j^2 - C = \frac{2530^2 + 2433^2 + 2667^2 + 2532^2 + 2626^2 + 2555^2 + 2605^2 + 2532^2}{4} - 13107200 = 9113$$

- **Determining the total of square deviations due to experimental error $SAP_E$**:
SAP_E=SAP_T - SAP_F - SAP_B = 96322 − 46600 − 9113 = 40609

C). Calculating the average of the sums of square deviations MS

- for the experimental factor: MSFr = SAPFr \( \frac{r}{r-1} \) = 15533.33

- for experimental blocks: MSB = SAB \( \frac{n}{n-1} \) = 759.42

- for experimental error: MSE = SME \( \frac{3 \times 7}{(r-1)(n-1)} \) = 1933.76

D). Validating the results of the experiment with the help of Fischer test.

This implies the calculation of some F values:

\[ F_{Fr} = \frac{MSFr}{MSE} \]

\[ F_{B} = \frac{MSB}{MSE} \]

\[ F_{Fr} = \frac{15533.33}{1933.76} = 8.032 \]

\[ F_{B} = \frac{759.42}{1933.76} = 0.392 \]

4. CONCLUSIONS

A determination of the results of the experiment can be possible through comparing the values calculated during the Fisher test with the tabled values for V

\( \frac{1}{1} \) and V

\( \frac{2}{2} \) degrees of liberty and with the value of the degrees of importance \( \alpha \). The number of degrees of liberty as numerator is V

\( \frac{1}{1} = r-1 \); at the same time, the number of degrees of liberty as denominator equals V

\( \frac{2}{2} = (n-1) \cdot (r-1) \).

Based on these facts, we can determine \( F_{theoretic} \) and when comparing it with \( F_{Fr} \) and \( F_{B} \) we find the following:

- H0Fr is rejected if \( F_{Fr} \) calculated > \( F_{theoretic} \) \( (r-1)(n-1)(r-1);\alpha \)

- H0B is rejected if \( F_{B} \) calculated > \( F_{theoretic} \) \( (n-1)(r-1);\alpha \)

The results of calculations and adopting the decision of acceptance or rejection of the null hypothesis H0 (according to which the estimated modernization measures do not affect significantly the volume of sales) are entered in table 2.

The theoretic value of F for V

\( \frac{1}{1} = 3 \) and V

\( \frac{2}{2} = 21 \) degrees of liberty on a level of significance \( \alpha = 0.05 \) is \( F_{theoretic} \) \( 3;21;0.05 = 3.07 \). Considering that \( F_{calculated} \) calculated for the experimental factor is greater than \( F_{theoretic} \), we can reject the hypothesis and the
conclusion is that the volume of sales of the analyzed product is heavily influenced by increasing performances through modernization.

Table 2. The results of the marketing experiment

<table>
<thead>
<tr>
<th>The source of variation</th>
<th>No. of degrees of liberty</th>
<th>Sum of square deviations (variation) SAP</th>
<th>Square average (dispersion) MS</th>
<th>Fisher F test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental factor</td>
<td>(r-1)=3</td>
<td>$S_{Ap}=46600$</td>
<td>$MS_{p}=15533.33$</td>
<td>$F_{Fr}=8.032$</td>
</tr>
<tr>
<td>Blocks</td>
<td>(n-1)=7</td>
<td>$S_{Ap}=9113$</td>
<td>$MS_{p}=759.42$</td>
<td>$F_{B}=0.392$</td>
</tr>
<tr>
<td>Experimental error</td>
<td>(r-1)(n-1)=21</td>
<td>$S_{Ap}=40609$</td>
<td>$MS_{p}=1933.76$</td>
<td>$-$</td>
</tr>
<tr>
<td>Total</td>
<td>r⋅n-1=31</td>
<td>$S_{Ap}=96322$</td>
<td>$-$</td>
<td>$-$</td>
</tr>
</tbody>
</table>

Decision: $H_0$ is rejected because $F_{Fr}(8.032) > F_{theoretical 3;21;0.05}(3.07)$

Moreover, this conclusion is supported due to its high confidential level. Thus, for $\alpha = 0.1\%$, $F_{theoretic 3;21;0.001} = 7.94$ which means that the previous relation is correct and it applies in 99.9\% of the cases.

As far as the variation of blocks (made up of the 8 shops), implementing the Fischer test can lead to $F_{calculated} < F_{theoretic 7;21;0.05} (0.392<3.41)$; in this case it is necessary to adopt a null hypothesis. Hence it appears that the type of shops does not affect significantly the volume of sales.

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