MEASURING ROMANIAN DO-IT-YOURSELF RETAIL CHAIN'S EFFICIENCY DURING THE ECONOMIC CRISIS

MJERENJE USPJEŠNOSTI TZV. "URADI SAM" PRODAJNIH LANACA U RUMUNJSKOJ TIJEKOM EKONOMSKE KRIZE

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SAŽETAK

Predmet rada je mjerenje uspješnosti tzv. „uradi sam" prodavaonica u Rumunjskoj u razdoblju od 2007. do 2010. godine. Uzorak obuhvaća svih 10 maloprodajnih lanaca tzv. „uradi sam" prodavaonica prisutnih na rumunjskom tržištu u navedenom razdoblju. Za potrebe istraživanja korištena je metoda *Data Envelopment Analysis (DEA)*. DEA model uključuje tri varijable, odnosno dva inputa (dugotrajnu imovinu i prosječan broj zaposlenika) i jedan output (prihod). Rezultati DEA analize pokazuju visoku razinu učinkovitosti ovih prodavaonica na rumunjskom tržištu za vrijeme ekonomske krize. Srednja vrijednost tehničke

ABSTRACT

The purpose of this study is to measure Romanian do-it-yourself retailers' efficiency during the period of 2007-2010. The sample encompassed all do-it-yourself retail chains in Romania present in the market during the given period, that is 10 chains in all. For the purpose of the analysis, the Data Envelopment Analysis (DEA) method was used. The DEA model includes three variables, namely, two inputs (fixed assets and the average number of employees) and one output (turnover). The results of the DEA analysis show a high level of efficiency in the Romanian do-it-yourself market during the period of the economic cri-

učinkovitosti kreće se od 0,829 do 0,904. Prema rezultatima istraživanja, domaći tzv. "uradi sam" maloprodajni lanac Dedeman nadmašuje inozemnu konkurenciju u analiziranom vremenskom razdoblju. To je ujedno bio jedan od najuspješnijih lanaca tzv. „uradi sam" prodavaonica na tržištu u 2010. godini. U radu su ukratko prikazane strategije ulaska na tržište i razvoja učinkovitih poduzeća. Prema saznanjima autora, u radu je prvi puta primijenjena DEA metoda u mjerenju uspješnosti na tržištu tzv. „uradi sam" prodavaonica u Rumunjskoj.

sis. The mean score of technical efficiency varied between 0.829 and 0.904. According to the results, the domestic do-it-yourself retailer Dedeman outperformed the international competition during the analyzed period. Dedeman was also one of the best performers in the market in 2010. The well-performing companies' market penetration and development strategies are discussed briefly. The study seems to have been the first to apply performance measurement by means of the DEA in the Romanian do-it-yourself market.

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1. INTRODUCTION

"A crisis can be a real blessing to any person, to any nation. For all crises bring progress."
Albert Einstein

The economic crisis which began in the late 2008 and early 2009 has influenced all economic activities and many companies faced losing a large portion of their value. From the marketing point of view, the economic crisis is an uncontrollable phenomenon which managers have to deal with, and which could represent a threat or an opportunity for them. Following Albert Einstein's[1] theory, the economic crisis is more of an opportunity than a threat. He believes that: "It's in crisis that invention is born, as well as discoveries, and big strategies. Who overcomes crisis, overcomes himself, without getting overcome. Who blames his failure on a crisis neglects his own talent, and is more respectful to problems than to solutions."

The main objective of the paper is to measure Romanian do-it-yourself retailers' efficiency during the period of the economic crisis. According to Neely, Gregory and Platts,[2] performance measurement is the process of quantifying action by using the two possible dimensions: efficiency and effectiveness. Efficiency is a measure of how economically the firm's resources are utilized when providing a given level of customer satisfaction while effectiveness refers to the extent to which customer requirements are met. In this paper, only one dimension of the performance concept was measured, i.e. the efficiency of Romanian do-it-yourself retail chains.

During the recession, companies face several problems because of a decrease in sales. Within this general context, the focus on the efficiency becomes more important. Therefore, this study tackles the following questions: "Which companies were efficient/inefficient in the Romanian do-it-yourself retail sector during the economic crisis?", "Which were the possible efficiency/inefficiency factors for these companies?" and "Which market penetration and development strategies were employed by the companies that turned out to be efficient during the economic crisis?"

The study is relevant due the fact that, in 2011, the Romanian market is still facing the economic crisis. Furthermore, the do-it-yourself retail sector was and still is affected by the economic crisis since it is strongly connected to the construction industry. Finally, there is a lack of more detailed analysis of the Romanian do-it-yourself retail sector in general. Overviews available in the press provide very limited insights (e.g. in terms of sales in a given period). Scientific approach to the topics such as efficiency measurement is needed to provide managerial implications.

The efficiency studies conducted before 1950 were mainly based on the average productivity indicator, and later on the productivity index. The simplicity of the productivity concept, i.e. measuring efficiency as a ratio between total outputs and total inputs, explains the popularity of the method. Despite its popularity, the concept of productivity failed to provide on overall view of efficiency of the whole company. The concept of efficiency frontier solved this limitation and initiated the modern approach to efficiency measurement by utilizing multiple inputs and outputs and comparing the results with the best performer.[3]

The modern efficiency measurement methods are based on Farrell's[4] article, entitled "The measurement of productive efficiency", which was published in 1957. In 1978, based on Farrell's paper, Charnes, Cooper and Rhodes[5] developed a linear programming method for efficiency measurement, called the Data Envelopment Analysis (DEA). DEA is widely used in different sectors and in different countries. Seiford[6] has produced data on more than 800 published articles and dissertations related to the DEA during the period 1978-1996. This article shows that there were 16 studies based on the DEA in the retail sector, conducted mainly in the USA, Chile, Portugal, Spain and the UK. These studies analyzed the efficiency of hypermarkets, supermarkets, outlets and departments stores.

This article aims at supplementing the efficiency studies in the retail sector using the DEA by applying it to the Romanian do-it-yourself retail sector. The paper provides managerial implications by emphasizing particular cases in the Romanian do-it-yourself retail sector. The study seems to have been the first to apply performance measurement by means of the DEA in the Romanian do-it-yourself market.

The paper is organized in six sections, as follows. The first section describes the DEA and its usage in the retail sector research. The DEA model used in this study and a contextual setting of the do-it-yourself market in Romania are presented in the second and third section of the paper. The next section contains the results of the research, followed by a discussion and managerial implications. Finally, the last section contains a conclusion.

2. DATA ENVELOPMENT ANALYSIS

This section describes the Date Envelopment Analysis method and presents a literature review of its usage in the retail sector research.

2.1. Data Envelopment Analysis Method

The Data Envelopment Analysis (DEA) method is a linear programming technique that can be used to measure the relative performance of a homogenous group of firms that produce multiple outputs with multiple inputs. The relative performance means comparing each firm to the best performer (not to the average). Although DEA is a method used nowadays, it is based on the theory which originated in 1950s.

Førsund and Sarafoglou[7] explored the origins of the DEA model. The concept of DEA was developed by Charnes, Cooper and Rhodes (CCR) in 1978 based on Farrell's paper "The measurement of productive efficiency" which dates back to 1957. The authors emphasize Farrell's contribution to modern efficiency and productivity studies, which were ignored until Charnes, Cooper and Rhodes published their article. In his paper, Farrell makes references to Debreu and Koopmans article published in 1951.

According to Farrell,[8] productive efficiency (named also economic efficiency or overall efficiency) has two components: technical efficiency (TE) and allocative efficiency (AE, also named price efficiency - PE). Technical efficiency reflects the ability of firms to obtain the maximum output to a given set of inputs. Allocative efficiency or price efficiency refers to the ability of firms to use inputs in optimal proportion, given their respective input prices. The concept of TE could be applied not only at the micro level but to an entire industry, and then it is called structural efficiency. Structural efficiency shows how the entire sector has the ability to obtain outputs as close as possible to the company's best outputs among the entire sector. Structural efficiency has the same meaning for the entire sector as does technical efficiency for a single company.

Farrell's theory on the efficiency analysis was developed in the literature in two strands: first, it gave birth to the development of estimation methods for a parametric frontier production function (econometric approach), and second, it provided the basis for the theoretical underpinnings of the Farrell efficiency measures (linear programming approach). The second approach represents the basis of the Data Envelopment Analysis developed by Charnes, Cooper and Rhodes in 1978.[9]

Charnes, Cooper and Rhodes[10] proposed that "the efficiency of any Decision Making Units (DMU) is obtained as the maximum of a ratio of weighted outputs to weighted inputs subject to the condition that the similar ratios for every DMU be less than or equal to unity". This could be transposed in a linear programming technique as follows.

There is a sample of *N* firms (DMU_l, l = 1,... N) producing *M* outputs (Y_{1n}, Y_{2n},...,Y_{Mn}) with *K* inputs (X_{1n}, X_{2n} ,... X_{Kn}). The used variables have to be non-negative. For each DMU *l*, *l* = 1,..., N, a measure of a ratio of all outputs over all inputs can be obtained, such as $u' Y_l / v' X_l$, where u is an Mx1 vector of outputs weights and v is a Kx1 vector of inputs. This involves such findings values for u and v that the efficiency measure of the i-th DMU is maximized.

The efficiency of one DMU_l is calculated as follows: $\frac{\mathbf{u}' * \mathbf{Y}_l}{v' * \mathbf{X}_l}$

The maximum efficiency for DMU_l is calculated as follows:

$$\max \frac{\sum_{r=1}^{s} u_r y_{rl_1}}{\sum_{i=1}^{k} v_i X_{il_1}} = H;$$

None of the DMU could be more efficient that 100%, subject to:

$$\frac{\sum_{r=1}^{s} u_r y_{rl}}{\sum_{i=1}^{k} v_i X_{il_1}} \leq 1,\ l = 1,\ldots,N; \quad u_r, v_i \geq 0;\ r = 1..s;\ i = 1...k;$$

The optimal weights are obtained by resolving the linear programming equation. One DMU is efficient if h = 1 and is inefficient if h<1.

In other words, one DMU is efficient when no other DMU is capable of producing a higher output from the same input (output oriented), or alternatively, of producing the same output from less input (input oriented).[11]

Each DMU is evaluated with regard to the efficient frontiers and will get an efficient score relative to the best performance. All the DMUs which are situated on the efficient frontier are efficient in terms of DEA, the others are inefficient and they get an inefficient score.

The first DEA models had assumed a constant return to scale (CRS), which means that producers are able to linearly scale the inputs. In later studies, Banker et al.[12] introduced the assumption of variable returns-to-scale (VRS).

In 1981, Charnes, Cooper and Rhodes[13] improved the definition of DMU's efficiency by taking into consideration the slack issues:

a) In case of the input orientation: a DMU is inefficient if there is any possibility to cut down the input quantity without raising the quantity of any other input variables and maintaining the same output quantity.
b) In case of the output orientation: a DMU is inefficient if there is any possibility to raise any output quantity without raising the input quantity or to cut down other output quantity.

An inefficient outlet may become efficient by increasing all outputs/decreasing all inputs by an amount equal to its corresponding slack. In that case, DMU is efficient if h = 1 and there is no occurrence of a), b) situations.

Wang and Wu[14] argue that the most important advantage of the DEA model is the simplicity of technical efficiency calculation, without specifying the input and output price. The model identifies the possible causes of inefficiency and the DMUs which use their inputs efficiently. At the same time, the authors give some practical advice regarding the studied sample. First, it is important to exclude from the sample any data with the output-to-input ratios exceeding the sample mean by 2.5 standard deviations, in order to avoid the frontier distortion. Second, the DEA approach is highly dependent on the number of inputs and outputs, as well as on the sample size. It is recommended that the number of DMUs in the sample be at least three times greater than the sum of the number of outputs and inputs included in the study. Third, the results obtained by the DEA are confined only to the studied sample only, and they can not be generalized or used for comparison with another sample.

During three decades of the DEA development, DEA techniques included a lot of variants/models. DEA models are used in numerous empiri-

cal efficiency analyses. Marinescu[15] in her Ph.D. thesis presents a synthesis of DEA models from the traditional forms to extended variants which use: allocative efficiency, environmental variables, non-discretionary variables, slacks, efficiency in agglomeration and negative value of some variables. In 1990s, the DEA model was applied to a number of activities, not necessary only economic ones. This establishes new forms of DEA models which: incorporate Pareto-Koopmans efficiency, evidence input/output deviation, include qualitative variables, calculate scale trade-off, use simultaneous date modification, study dynamic efficiency, modify the DEA model (MDEA), which introduces new concepts: super-efficiency and high super-efficiency and distance function direction.

2.2. Data Envelopment Analysis usage in retailing research

In the literature there is a wide variety of studies in different fields which used the Data Envelopment Analysis. Seiford[16] made a bibliography of DEA-related articles, which covered the period from 1978 to 1996. He counted more than 800 published articles and dissertations related to the DEA.

The following section presents the most important studies in the field of retailing, based on the DEA (Table 1). The DEA method has been widely used in retailing since 1995 in the USA, Chile, Portugal, Spain, UK and Romania. Almost all of these countries are well-developed, with a modern retail sector (Romania is a developing one) and strong competition. Therefore, the efficiency measurement is recognized as necessary.

In performance measurement studies, researchers also have been using marketing (promotion, customer satisfaction, marketing expenses, distribution services, sales) and financial (labor, capital, assets, costs, shareholders' funds, profits, operational result, value added, revenue, market value, earning per share) indicators. Donthu et. al.[17] distinguished controllable (retail, managerial and labor personal factors) and uncontrollable variables (environment factor and customer factor) by the management, depending on whether the retail firm includes the factor in its management action plan. These authors suggest that the ones to choose for research are input/output variables that reflect the firm's goals, objectives and sales situation. The most widely used variables in the previous studies are: the number of employees, for the input (retailing is a labor intensive activity), and sales, for the output.

The most widely used DEA model is output oriented with variable returns to scale. Transversal and longitudinal studies are also present. The dynamic model of DEA is used in two studies: Baros and Alves, (2004) and Sellers-Rubio and Mas-Ruiz (2007). In comparison with the static model, the dynamic DEA model gives information about the optimal path for the input variables adjustment to the optimal point.

3. METHODOLOGY: DEA MODEL

According to Barros and Alves,[34] in a competitive market, companies are output oriented since the inputs are under the control of managers, who aim to maximize the output, subject to market demand, which is outside their control.

In this study, an output-oriented DEA model is used with variable returns to scale (which is more appropriate from a practical point of view). The input/output variables were obtained from the companies' balance sheets published on the Romanian Ministry of Finance website.[35] One of the reasons for choosing these variables was their availability.

Because of a limited number of do-it-yourself chains in the Romanian market during the re-

Table 1: Data Envelopment Analysis usage in retailing research

AUTHORS/ YEAR	COUNTRY	NO. OF STORES, TYPE, STUDIED PERIOD	INPUTS	OUTPUTS	DEA MODEL
Donthu et. al. (1998)[18]	N.A.*	24 outlets of a fast food restaurant, 1990-1992	store size, store location, store manager experience, promotions	sales, customer satisfaction	DEA vs. regression; IDEAS program
Thomas et. al. (1998)[19]	USA	552 outlets of a multi-store, multi market retailer	labor, experience, location, related costs, internal process	sales, profits	restricted DEA, CRS, output oriented
Keh and Chu (2003)[20]	USA	13 outlets of a chain of grocery stores, 1988-1997	labor, capital	sales, distribution services	DEA
Barros and Alves (2003)[21]	Portugal	47 retail outlets, hypermarket and supermarket, in 2000	employees, cost of labor, cash-out points, stock, other costs	sales and profit	DEA VRS, CRS, output oriented
Rachford (2003)[22]	USA	54, retail food stores, 1959-1995	capital, labor, intermediate services	conventional physical output, breadth of assortment, index of different services	cost efficiency, DEA
Barros and Alves (2004)[23]	Portugal	47 retail outlets of one the leading hypermarket and supermarket chains, 1999-2000	number of full-time equivalent employees, cost of labor, number of cash-out points, stock, other costs	sales, operating results	Malmquist productivity index
Barros (2006)[24]	Portugal	22 hypermarket and supermarket, 1998-2003	labor, capital	sales, operational results, value added	DEA VRS, CRS output oriented and Tobit regression model
Sellers-Rubio et. al. (2006)[25]	Spain	100 supermarkets, 1995-2001	employees, outlets, capital	sales and profits	DEA
Mateo de F. et. al. (2006)[26]	Chile	35 department stores, 2000-2001	sales person labor, cashier labor, sales general expense, marketing expense, store location	gross sales	dynamic DEA model
Sellers-Rubio and Mas-Ruiz (2007)[27]	Spain	96 supermarket chains, 1995-2003	capital	sales revenue, operating results	DEA, Malmquist productivity index
Moreno (2008)[28]	Spain	234 hypermarket stores, 2003	employees, square meters	sales	DEA stochastic (order-m) and bootstrapping Malmquist index
Yu and Ramanathan (2008)[29]	UK	41 retail stores, between 2000-2005	number of employees, total assets, shareholders funds	turnover, profit before taxation	DEA CRS, VRS, Malmquist productivity index (MPI), a bootstrapped Tobit regression model
Mostafa (2009)[30]	USA	45 specialty retailers and food consumer stores	employees, assets	revenue, market value, earnings per share	DEA CRS, VRS
Alt and Dabija (2010)[31]	Romania	10 hypermarket chains, 2006-2007	average number of employees, total assets	sales	DEA VRS, input-orientated
Moreno and Sanz-Triguero (2011)[32]	Spain	12 different non-specialized retail sectors, 1997-2007	personnel costs, fixes assets, intermediate consumption	sales	DEA stochastic (order-m) and bootstrapping Malmquist index
Sellers-Rubio and Mas-Ruiz (2007)[33]	Spain	96 supermarket chains, 1995-2003	capital	sales revenue, operational results	DEA, Malmquist productivity index

* N.A. – not available
Source: literature review done by the author

searched period (10), efficiency analysis in this study is based on only three variables. The input variables used are fixed assets and average number of employees. Fixed assets and employees are essential in the retail activities. The output variable is represented by turnover.

Do-it-yourself chains' efficiency was analyzed for the 2007-2010 period. Unfortunately, longitudinal analysis could not be conducted due to the fact that the sample had changed in the given period and some of the data was not available for all firms each year.

DEAP software was used for the efficiency measurement in this study. DEAP software, specialized for measuring product efficiency, was developed by Professor Tim Coelli of the University of New England, Australia.[36] An output-orientated VRS DEA model was used.

4. CONTEXTUAL SETTING: DO-IT-YOURSELF MARKET IN ROMANIA

Unlike the Romanian modern grocery retailing sector, where international chains, such as Metro with Metro Cash & Carry and Real, Carrefour with Carrefour Hypermarket, Carrefour Express and Carrefour market or Rewe with Billa supermarket as well as Penny and Penny XXL discount stores dominate the market,[37] the do-it-yourself sector has been dominated by the Romanian company named Dedeman since 2010.[38]

Given the reluctance of foreign investors to enter the Romanian market before 2002, Romanian building materials distributors had time to develop their businesses. Arabesque, Ambient Sibiu and Dedeman are the most important building materials distributors and they all started their businesses at the beginning of 1990's. Meanwhile, Ambient Sibiu and Dedeman developed a modern do-it-yourself retail business too.

The Romanian do-it-yourself market has a 10-year history. In 2002, a new retail format was introduced by domestic (Ambient Sibiu) and foreign investors (Praktiker and Bricostore) at the same time. Foreign investors were encouraged by Romania's accession negotiations with the EU which began in 2000.[39] The competition in the do-it-yourself market increased after 2005, when the resolution regarding the country's EU accession in 2007 was accepted. New do-it-yourself chains opened their stores in 2005 (Interhome), 2006 (bauMax), 2007 (Hornbach, Tekzen Rom, Mr. Bricolage) and 2008 (OBI). In this period, the Romanian economy was the fastest developing one in Central and Eastern Europe. Do-it-yourself companies expanded their retail chains throughout the country: 11 new stores were opened in 2006, 12 in 2007, with the largest number of new stores – 18 – opened in 2008.[40]

Until the recession period, Praktiker was the market leader, followed by Bricostore and Dedeman. In 2009, the do-it-yourself retail market shrank 25%.[41] While small retailers could not survive the crisis period (Interhome become insolvent in 2010),[42] large retailers took advantage of the new economic environment (Dedeman, the Romanian do-it-yourself retail chain became the market leader in 2010). Despite the unfavorable economic environment, do-it-yourself companies pressed on with their expansion strategy: 11 new stores were opened in 2009, 14 in 2010 and 8 in 2011.[43] Besides the existing do-it-yourself companies, Leroy Merlin entered the Romanian market in order to test it in 2011.[44]

By 2011, the do-it-yourself market had reached more than 100 large stores, so the pace of business expansion has slowed down in recent years, with the construction market showing no signs of recovery yet. Despite the large number of stores, there are 10 Romanian counties uncovered by do-it-yourself chains.

Table 2 presents the number of stores for each do-it-yourself chain in the 2007-2011 period. The data for 2011 was collected from retailers' web-

sites and that for previous years was collected through newspapers articles. In the given period, Praktiker was the largest retail chain in the do-it-yourself market. It was followed by Dedeman, Bricostore and Ambient Sibiu. Since 2010, bauMax has become an important player too.

5. RESEARCH RESULTS

The performance measurement of the do-it-yourself market was run separately for each year, from 2007 to 2010. The studied sample included

Table 2: Number of stores for each do-it-yourself chain in the 2007-2011 period

		FIRST STORE	2007	2008	2009	2010	2011
1	Ambient Sibiu[45]	2002	11	12	12	12	12
2	Dedeman[46]	2003	11	13	17	22	27
6	Bricostore[47]	2002	8	13	14	14	15
3	Praktiker[48]	2002	20	25	26	27	27
4	Interhome Décor[49]	2005	2	2	5	5	-
5	bauMax[50]	2006	5	7	9	13	14
7	Mr. Bricolage[51]	2007	1	2	2	3	3
8	Hornbach[52]	2007	1	2	3	4	4
9	Tekzen Rom[53]	2007	1	2	5	5	N.A.*
10	OBI[54]	2008	0	2	4	7	7
11	Leroy Merlin[55]	2011	0	0	0	0	0
	TOTAL		49	79	96	111	108

The Romanian do-it-yourself market is beginning to show signs of crowding. Seven foreign chains (Germany's Praktiker, Hornbach and OBI, French Bricostore and Leroy Merlin, Austrian bauMax and Turkish Tekzen) compete with three local investors (Dedeman, Ambient Sibiu and Mr. Bricolage – a franchise). Do-it-yourself market specialists expect some mergers or acquisitions to take place in the do-it-yourself market in the country in the near future.

all do-it-yourself retailers present in the Romanian market during the studied period (10 chains), with data collected on the Romanian Ministry of Finance website. Unfortunately, there were three cases of missing data (for Hornbach in 2007 and 2008, and for Interhome Décor in 2009) whereas one company (OBI) did not enter the market until 2008. Therefore, the number of studied companies varied from 8 to 10 during the period covered by this research. Descriptive statistics of the studied variables are presented in Table 3.

Table 3: Summary of descriptive statistics

	NUMBER OF EMPLOYES	FIXED ASSETS (EUR)	TURNOVER (EUR)	STUDIED COMPANIES
2007				8 chains: Ambient, Dedeman, Bricostore, Praktiker, Interhome Décor, bauMax, Mr. Bricolage, Tekzen Rom (Hornbach N.A.*)
MIN	86	1,508,854	856,335	
MAX	423	40,384,983	137,264,449	
MEAN	255	20,946,918	69,060,392	
SD	238	27,489,575	96,455,103	
2008				9 chains: Ambient, Dedeman, Bricostore, Praktiker, Interhome Décor, bauMax, Mr. Bricolage, Tekzen Rom, OBI (Hornbach N.A.*)
MIN	88	1,074,127	2,230,496	
MAX	2,576	95,002,148	255,832,247	
MEAN	1,154	38,788,659	110,954,803	
SD	1,078	41,043,093	104,674,837	
2009				9 chains: Ambient, Dedeman, Bricostore, Praktiker, Interhome Décor, bauMax, Mr. Bricolage, Tekzen Rom, OBI, Hornbach (Interhome Décor N.A.*)
MIN	137	2,015,908	2,152,988	
MAX	2,971	129,736,211	248,030,231	
MEAN	1,217	46,827,837	109,858,215	
SD	1,051	48,656,444	92,676,657	
2010				10 chains: Ambient, Dedeman, Bricostore, Praktiker, Interhome Décor, bauMax, Mr. Bricolage, Tekzen Rom, OBI, Hornbach, Interhome Décor
MIN	117	781,843	2,221,965	
MAX	3,752	164,844,373	353,111,578	
MEAN	1,143	45,640,965	104,167,606	
SD	1,163	53,701,344	107,950,337	

* N.A. – not available
Source: research

The efficiency analysis using the DEAP software provides the following data about each DMU: technical efficiency score, types of return to scale, slacks, peers, peers weights and input targets.

Technical efficiency scores are presented in Table 4. Beside the technical efficiency in terms of variable returns to scale (VRS), the efficiency in terms of constant returns to scale (CRS) and scale efficiency (SE) was also calculated.

In 2007, 6 out of 9 studied chains had the score of TE 1, and are located on the efficient frontier. Two of them are efficient in terms of all three TE (VRS, CRS and SE). In 2008, 5 out of 9 studied chains were efficient. Two of them are efficient in terms of all three TE (VRS, CRS and SE). In 2009, 4 out of 10 studied chains were efficient, and only one of them was efficient in terms of all three TE (VRS, CRS and SE). Finally, in 2010, 4 out of 10 studied chains were efficient and only one of them was efficient in terms of all three TE (VRS, CRS and SE).

The efficient company produced the maximum possible outputs (turnover) for the given level of inputs (fixed assets and the number of employees). The companies that were efficient in terms of CRS were operating at the most productive scale size (SE=CRS/VRS).

During the studied period, only one company from the sample, namely Interhome Décor, remained on the efficient frontier every year. Unfortunately, Interhome Décor became insolvent in 2010.

Table 4: DEA analysis results for the 2007-2010 period

	TE, VRS IN 2007	TE, VRS IN 2008	TE, VRS IN 2009	TE, VRS IN 2010
1. Ambient Sibiu	1	0.786	0.594	0.79
2. Dedeman	0.856	0.865	0.978	1
3. Bricostore	1	1, CRS-1, Scale-1	0.978	0.887
4. Praktiker	1	1	1	0.845
5. Interhome Décor	1, CRS-1, Scale-a	1	1	1
6. bauMax	1, CRS-1, Scale-1	1, CRS-1, Scale-1	0.588	1, CRS-1, Scale-1
7. Mr. Bricolage (Brico Expert)	0.38	0.616	1, CRS-1, Scale-1	0.568
8. Hornbach	-	-	1	1
9. Tekzen Rom	1	1	0.511	0.68
10. OBI	-	0.424	-	0.517
MEAN	0.904	0.855	0.85	0.829

Source: research

The least efficient companies were Mr. Bricolage in 2007, OBI in 2008, Tekzen Rom in 2009 and OBI again in 2010.

Data for the inefficient companies can be interpreted as follows:

- a TE score of 0.517 for OBI in 2010 indicates that this company should increase its turnover by 48.3% using the same input;
- to improve its efficiency, OBI had to follow the model of Hornbach input/output combination in 92.4%, and the baumMax model in the remaining 7.6%.
- to improve its efficiency, OBI could reduce the number of employees by 57 people.

The same analysis could be made for each inefficient company.

The DEA analysis shows a high level of efficiency in the do-it-yourself market in Romania. The mean score of technical efficiency was between 0.829 and 0.904.

Because of the changes in the sample size, longitudinal analysis of technical efficiency was not performed. It is not possible to compare the

Table 5: DEA rankings for the 4 periods

YEAR 2007	YEAR 2008	YEAR 2009	YEAR 2010
1. Interhome décor	1. Bricostore	1. Mr. Bricolage	1. bauMax
1. bauMax	1. bauMax	1. Praktiker	1. Dedeman
1. Ambient Sibiu	1. Praktiker	1. Interhome décor	1. Interhome decor
1. Bricostore	1. Interhome décor	1. Hornbach	1. Hornbach
1. Praktiker	1. Tekzen	5. Dedeman	5. Bricostore
1. Tekzen Rom	6. Dedeman	6. Bricostore	6. Praktiker
7. Dedeman	7. Ambient Sibiu	7. Ambient Sibiu	7. Ambient Sibiu
8. Mr. Bricolage	8. Mr. Bricolage	8. bauMax	8. Tekzen Rom
	9. OBI	9. Tekzen Rom	9. Mr. Bricolage
			10. OBI

Source: research

score of TE for Ambient Sibiu in 2007 with the score of TE in 2008, or in 2009 or 2010. The TE score should be interpreted relative to the sample in each year. However, the comparison of the rank order of companies in different years may be meaningful. All efficient companies in terms of DEA having the ranking of one (1.). Inefficient chains are ranked by the consecutive ordinal numbers (presented in Table 5).

The recession period created a turbulent economic environment, in which some companies experienced a drastic drop in their efficiency (like Ambient Sibiu or Tekzen) while others improved their efficiency significantly (like Dedeman). It is interesting how Dedeman's, the Romanian chain's ranking rose from number 8 in 2007 to 6 at 2008, then to 5 at 2009 before it finally became the best performer in 2010. Meanwhile, international do-it-yourself retailers (Praktiker and Bricostore) experienced a moderate efficiency drop.

The efficient companies are referred to as the peers of inefficient companies. Table 6 presents a summary of cases where each firm is a peer to another one. It is evident that Hornbach was in most cases (8) selected as a peer of other companies in the studied period. The second most selected peer (6 cases) was Praktiker.

According to the results, three interesting performance cases should be discussed in detail: Hornbach – a small chain model, Praktiker – a big chain model, and Dedeman – a success model.

6. DICUSSION AND MANAGERIAL IMPLICATIONS

This paper presents the results of a benchmarking study on the do-it-yourself retail market in Romania in the 2007-2010 period using the Data Envelopment Analysis. The concept of performance is very complex. Although a multiple variable model with two inputs (fixed assets, number of average employees) and one output (turnover) has been used in this study, the model reflects a simple representation of the complex reality. For instance, variables such as the elements of the marketing mix have an important role in the companies' performance.

The results of the DEA reveal that the Romanian do-it-yourself retail market had a relatively high technical efficiency score between 0.829 and 0.904 during the recession period. The DEA model generates the efficient frontier and compares

Table 6: Peer count summery for the 2007-2010 period

	PEER IN 2007	PEER IN 2008	PEER IN 2009	PEER IN 2010	TOTAL
1. Ambient Sibiu	1	-	-	-	1
2. Dedeman	-	-	-	3	3
3. Bricostore	1	3	-	-	4
4. Praktiker	1	2	3	-	6
5. Interhome Décor	1	2	-	2	5
6. bauMax	1	-	-	3	4
7. Mr. Bricolage (Brico Expert)	-	-	4	-	4
8. Hornbach		1	2	5	8
9. Tekzen Rom	-	-	-	-	-
10. OBI	-	-	-	-	-

Source: research

each company to the frontier. Furthermore, the model generates the optimal target inputs value for inefficient companies, which is important managerial information.

With the exception of OBI, all of the studied chains reached the efficient frontier at least once during the studied period. In complement to the DEA, the profit/loss indicator was also analyzed. It may be observed that, even if the activities of a company were efficient, some of them experienced a loss: Praktiker (in 2009 and 2010), Interhome Décor (in 2009 and 2010), bauMax (in 2010) and Mr. Bricolage (in 2010). Big retail chains such as Praktiker can afford a loss in two consecutive years but small retail chains like Interhome Décor can not. In 2010, Interhome Décor became insolvent.

Hornbach and Praktiker were the most selected peers for other companies. In the following paragraphs, their market penetration and development strategies are discussed, together with the strategy of Dedeman, as the market leader.

Praktiker is a German retail chain, a part of Metro Group, which entered the Romanian do-it-yourself market in September 2002. Praktiker was preceded by Bricostore, which introduced the do-it-yourself retail format on the Romanian market only six months earlier. Praktiker chose to open the first store in Bucharest, the capital city, which was the most common market entrance approach for a multinational company. In 2003, Praktiker entered Transylvania, a region in the west of Romania, by opening a store in the city of Cluj-Napoca. Although Praktiker opened another store in the Moldova region (eastern part of Romania, in the city of Bacău), it decided to first cover the Transylvanian market, which was considered to be more developed from the economic point of view. By 2005, Praktiker had opened 3-4 stores per year. During the 2006-2008 period, Praktiker's retail chain development intensified through the opening of 4-5 new stores per year.[56] By the time the economic crisis broke out in 2008, Praktiker's retail chain had reached 25 stores, covering almost every part of the country. In 2009 and 2010, it opened one more store per year. During the studied period, Praktiker had the largest retail chain in the Romanian market.

Hornbach is another German retail chain, which entered the Romanian market relatively late, in 2007. Their first store opened in Bucharest. Hornbach applied a limited expansion strategy, opening one store per year until 2010. Two stores are located in Bucharest, one is near Bucharest and the fourth is located in the city of Brasov, situated in the center of the country. Unfortunately, Hornbach did not publish its balance sheet data for 2007 and 2008. Hornbach is considered to be a small retail chain in the Romanian market.

Finally, Dedeman is considered to be a success case, thanks to its performance in the crisis period. Dedeman is a Romanian company which started its building materials retail business in 1992 in city of Bacău (Moldova region, eastern part of Romania). Dedeman opened the first modern do-it-yourself store in 2003 in the city of Suceava, situated in the northern part of the Moldova region in Romania. Dedeman took advantage of the uncovered Moldova region's market, which was ignored by large multinationals (Praktiker, Bricostore). By 2008, Dedeman had opened 13 stores, and 12 of them were in the Moldova region. During the economic crisis period, while all the multinationals reduced their investments in new stores, Dedeman was opening 4-5 stores per year, mostly in Transylvania (western part of Romania) and Muntenia-Oltenia (southern part of Romania). In 2010, Dedeman became the market leader and, according to the DEA analysis, the best performer. Nowadays (in 2012), Dedeman is the largest do-it-yourself retail chain in Romania with 29 stores in total.[57]

7. CONCLUSION

The Data Envelopment Analysis is a widely used method in the performance measurement using multiple variables. The Romanian do-it-yourself

market performance measurement was based on three variables (fixed assets, number of employees and turnover). The results of the DEA reveal that the Romanian do-it-yourself retail market had a relatively high technical efficiency score between 0.829 and 0.904 in the recession period. The market penetration and development strategies of the three best performers were briefly discussed: Hornbach – a small chain model, Praktiker – a big chain model, and Dedeman – a success model.

The availability of accurate and relevant data is a challenge for this kind of research. Some missing data on retail companies in certain years forced the researcher to exclude these companies from the sample. Therefore, the studied sample does not include all do-it-yourself chains in the Romanian market.

Future research of the Romanian do-it-yourself market could include more different input/output variables, especially different marketing variables, such as promotion, customer satisfaction, marketing expenses and distribution services. The application of another DEA model or doing a longitudinal study using Malmquist Productivity will be possible when the data for all retail chains from the sample is available for the whole period of research. The performance measurement could also be detailed at the store level for large retail chains, such as Dedeman and Praktiker. Finally, a detailed marketing mix analysis for retailers (product assortment, service, price strategy, communication strategy, store location and store design) in the case of each company could explain the key success factors better.

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