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HIGHER SCHOOL OF ECONOMICS

Irina O. Volkova

APPLICATION OF DATA ENVELOPMENT ANALYSIS IN MANAGEMENT RESEARCH (CASE OF RUSSIAN DOMESTIC ENERGY SECTOR)

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Irina O. Volkova [1]

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The idea that different firms can be classified into relatively homogeneous groups has been popular for many years, and many typologies have been developed and tested using a variety of classification tools. It has become apparent, however, that most clustering tools are somewhat limited, because they create groups of companies based on similar characteristics, without taking into account company performance. The objective of the current study was to address the limitations of previous research by creating a typology of companies based on financial efficiency, using data envelopment analysis as a clustering tool.

JEL Classification: M00.

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[1] National Research University Higher School of Economics. Department of General and Strategic Management, Professor; E-mail: iovolkova@hse.ru

1. Introduction

The idea that companies may be separated into groups based on a variety of characteristics has been popular for many years, with a variety of variables used to create such groups. From industry clusters to geographical clusters (e.g., Bell, 2005) to clusters based on competitive performance (e.g., Harrigan, 1995) and rapid best practice improvement (e.g., Poter, 2000), researchers have been looking for ways to create typologies that could predict company performance. The tool of choice has been some variant of cluster analysis, which has received some criticism due to inconsistent application which yields cluster solutions of different quality, and the resulting questionable results (Ketchen & Shook, 1996).

At the same time, for the purposes of management effectiveness benchmarking, one of the tools that has been used previously is the Data Envelopment Analysis (DEA) (e.g., Chiang & Lin, 2009). Though not widely used in management, DEA is a linear programming method (Charnes, Cooper, & Rhodes, 1978), which allows decision-making units (DMUs) to be assessed on a basis of multiple inputs and outputs, even when the production function is unknown (Adler, Friedman, & Sinuany-Stern, 2002). It is thought by some as superior to other methods (such as cluster analysis) because it does not only separate companies by certain characteristics, but also evaluates their output measures relative to each other on a number of different parameters. The main benefit of using DEA is its ability to use several performance metrics as outcomes simultaneously. As company performance is not one-dimensional, and different companies may achieve a relatively superior efficiency level by using different means, using DEA as an analysis tool allows us to remove the subjectivity when weighting various performance metrics for company evaluation, and use the composite measure of performance efficiency to separate the companies. There are several methods of post-hoc DMU classification (such as the level of efficiency, e.g., Norman & Barry, 1991), all of which allow comparing companies relative to their efficiency peers. For further review of DEA please see, e.g., Adler et al., 2002.

2. Illustrative example

The notion that certain management practices at all levels create substantial competitive advantages for the company in the market received a lot of attention in the academic community over the years. The idea that there is a relationship between the actions of managers and company effectiveness was first introduced in early 1950s (Carlson, 1951), when researchers first noticed that there is a link between managerial actions and effectiveness and productivity of the

units and companies as a whole (e.g., Guest, 1951; Jasinski, 1956; Strong, 1956; Dubin & Spray, 1964). Since then, a number of studies have looked at various individual management practices and their impact on all productivity metrics (e.g., Huselid, 1995). A large body of empirical and theoretical work was accumulated as a result, though it appears that a comprehensive theory of the relationship between the management practices and firm performance is still lacking.

The interest in the relationship between the management practices and company performance has been revived recently, with the work of Bloom and colleagues (Bloom & Van Reenen, 2010). Bloom and Van Reenen (2006, 2010) and Bloom, Kretschmer, and Van Reenen (2009) have looked at management practices in medium-sized manufacturing firms in the US and several European countries. They have found significant cross-country differences in the management practices and their impact on firm-level productivity, profitability, sales growth, and other measures of performance. A large number of studies[2] have already extended this work, looking at competition policy (e.g., Buccirossi, Ciari, Duso, Spagnolo, & Vitale, 2009), corporate culture (e.g. Cronqvist, Low, & Nilson, 2007), compensation (Falato, Li, & Milbourn, 2011), as well as individual management practices and their clusters (e.g., Fu, Eisingerich, & de Hoyos, 2009).

Moreover, recent studies generated by an interest in emerging economies have revealed that, to a large extent, management practices in firms operating in emerging vs. developed economies are often quite different. As Hoskisson, Eden, Lau, and Wright (2000) have indicated, emerging economies are often heterogeneous, sometimes even within the same geographic market. For example, a study comparing performance of Japanese subsidiaries in Asian market (Chung & Beamish, 2005), which is traditionally thought of as emerging market, found differential effects in performance between subsidiaries operating in different countries (Thailand, Philippines, Malaysia, Indonesia, and Korea). It is reasonable to expect that differential performance may be due not only to the region in which the company operates, but also to managerial practices employed at each subsidiary, even though no clear link was ever made between the two. A study of Chinese joint ventures (Chen, Park & Newburry, 2009) has found significant differences in control practices between the joint venture partners by comparing survey results. In a multi-country study of US International Joint Ventures, a study by Tong, Reur, and Peng (2008) analyzed the differences between firm performance in developed and emerging markets, and found that the development market location was both significant and positive of IJV performance. Even from these few examples, it is reasonable to expect pronounced differences between managerial practices in emerging vs. developed

[2]According to Google Scholar, as of December 21, 2013, work of Bloom and colleagues has been cited almost 1000 times.

economies, and there are many more examples in the rich body of work accumulated in the area of emerging vs. developed comparative market research.

Current research agenda, however, appears to be missing a very important aspect of knowledge creation: the long-term monitoring of these practices for the establishment of causal relationship with firm performance. To date, a large number of studies have examined the relationship between management practices and firm performance. However, they are limited in scope to individual practices, such as human resource management (e.g., Huselid, 1995; Fey, Björkman, & Pavlovskaya , 2000; Delaney & Huselid, 1996) or total quality management (e.g., Kaynak, 2003; Nair, 2006). While some are conducted in emerging markets such as Russia (e.g., Fey et al., 2000), very few are comparative in nature. More importantly, to the best of our knowledge, none are longitudinal, looking at the progression of management practices over the years and relating them to firm performance metrics.

At this time, the objective of the project is to create a typology of companies and classify them as more or less efficient based on a number of theoretically-driven, objective criteria that can be observed from the "outside" of the company – that is, from publicly available information. Data Envelopment Analysis appears to be the perfect tool for it, as it takes all these criteria into account simultaneously and relates them to performance. No other clustering tool can do so – at best, groups of companies can be formed based on their similarity or difference on the same criteria, not a comparison with performance.

There are several reasons for choosing this research setting. First, because collecting publicly available information does not require company involvement, and can be done in an efficient manner by researchers without expanding sufficient time and resources on data collection. Second, in the monitoring process we need to include different companies, with various degrees of efficiency. Finding which companies are efficient *before* entering the company for data collection can only be done by analyzing publically available data. Third, if our method of company analysis by using external data proves to be an efficient way to evaluate companies, other researchers will be able to use our methodology in their analysis.

Prior attempt at creating company typologies have taken many different approaches. The best well-known are typologies of Miles and Snow (1978), strategic typologies based on industry characteristics (e.g., Kearns, 2005), or typologies based on management characteristics (e.g., Hass, 1996). However, these typologies are somewhat limited, because they cannot be easily applied to every industry, and may not offer as much insight into the company as the typologies based on performance. Therefore, the main goal of this study is to create such typology based on the objective performance metrics, and then classify and describe the companies that fit different typological profiles.

The overall study is based on a rich theoretical foundation formed on the intersection of several classical managerial theories. We use the theory of the allocation of time (Guest, 1956) and Vroom's (1964) expectancy theory to explain the mechanisms of formation of individual management practices and practice clusters within companies; industrial organization approach for looking at resource allocation within management domain; and resource-based view of the firm (Wernerfelt, 1984) to explain the relationship between managerial practices and firm performance. As this particular study is a only a part of the larger project, theoretical foundation at the roots of the relationship between managerial practices and firm performance is not presented here.

Theoretical foundation for this part of the project was based on the prior work in operations management area. To develop a typology of companies based on efficiency, we needed to identify potential performance indicators that could be used to compare companies with each other. As management performance measurement is a rather complex process (Chiang & Lin, 2009), a large number of inputs and outputs are expected to be involved in the process. One of the methods for identifying individual inputs and outputs suggested previously (Chiang & Lin, 2009) is the Balanced Scorecard (BSC) approach, which has been shown to provide a realistic framework for the relationship between performance measurement and strategic objectives (Hasan & Tibbits, 2000).

The BSC approach is a formal measurement system, first offered by Kaplan and Norton (1992) to address the issues of agency issues between stakeholders and the company management. Per Kaplan and Norton (1992), there are four balanced perspectives to company management: financial, customer, internal business processes, and learning & growth, integrating a large number of both financial and non-financial indicators of company performance. These perspectives are connected through complex cause-effect relationships (Rusjan, 2005). Out of the four, financial and customer indicators are the dimensions that can be assessed from the "outside," without getting access to the inside information, aligning well with the goals of this study. While what constitutes financial performance is relatively clear, performance measures from the customer perspective are usually the subjective attributes such as customer satisfaction, loyalty, retention, and acquisition of customers (Kaplan & Norton, 1996), usually measured through behavioral summated rating instruments. Therefore, through the BSC approach has been thought of as a top-down approach to organizational management with heavy management input (e.g., Kanji & Moura, 2001; Malina & Selto, 2001), it is apparent that some BSC dimensions can be obtained and evaluated from the information not limited to the insiders, and through their causal interrelationships with other BSC factors, could serve as indirect indicators of the overall company effectiveness.

3. Method

3.1. Sample and Measures

As it is evident that different countries (Bloom and Van Reenen, 2010) and industries may have not only different managerial practices, but different performance indicators as well, we have started our exploratory work with the Russian domestic energy distribution sector (total sample size n = 38). Russian economy is unique, with both the elements of the developed and the emerging market economies present. Findings obtained in the Russian market may become useful for companies operating in either market, or for comparative cross-cultural research. We have focused on the energy sector as a starting point for a number of reasons. First, energy companies are relatively similar in their approach to management and business modeling. Therefore, it is less likely that the observed differences in management practices would be due to drastic differences in strategic orientation. Second, energy distribution business is relatively robust to fluctuations in BSC customer perspective. This is because energy distribution companies divide the market on a regional basis, with little to no competition, and customer demand, loyalty, and retention remain relatively stable compared to other industries, eliminating the need for introducing subjective summated rating indicators into the efficiency evaluation process. With a rare exception, companies are named for the region in which they operate, and that is how they are identified throughout the study.

Because financial performance indicators vary by industry (Braker, Keates, & Pearson, 2006), we have identified a number of performance metrics relevant to the energy distribution sector (e.g., Gutermuth, 1998). These indicators serve as the performance measurement inputs (current and long-term investments, company ownership status, costs, composite financial indicator -a simple average of large number of such indicators as financial liquidity, debt ratio, etc.) and outcomes (economic value added, labor productivity, costs, number of employees, and a number of calculated metrics based on the available outputs) for the DEA. Company size was measured in the number of employees and used as a control: all financial inputs and outputs were divided by the number of employees. We have also accounted for the fact that energy industry may be regulated, and some companies have guaranteed supplier contracts. Data was analyzed with Frontier software using denominator minimization approach.

3.2. Results

DEA results are presented in Table 1. Using input/output contribution and availability of peers, we have further classified the companies into three distinct clusters. All but four companies were assigned a cluster based on their relative performance. First cluster was grouped together based on their lack of contribution on the long-term investment indicator; second – EVA indicator, and third – labor productivity indicator. Last four companies did not appear to belong in any of the first three categories.

3.3. Advantages of using data envelopment analysis

As was apparent from the presented results, the companies were clearly different in their level of efficiency. The more interesting question was whether there was anything in common between the companies belonging to a particular cluster that first, could be identified without obtaining additional company data; and second, was not accounted for with all the previous indicators. Upon careful analysis of the data, it was determined that indeed, the companies did have something in common – namely, the investment attractiveness of the region in which they operated. Regional investment attractiveness[3] (RIA) is a complex composite index calculated by the "RA Expert" Russian rating agency, based on a large number of indicators (financial, social, management, economic, ecological, and criminal). Based on a complex formula, a region is assigned one of ten possible grades, starting with 1A (most attractive) to 3D (the least attractive). This rating is show in column 4 of Table 1. Because the resulting scale is obviously ordinal, we have assigned a number 1-10 to each rating category in a descending order (1A = 10, 1B = 9, etc.) for further analysis.

Based on the RIA, we have determined that the companies belonging to the first cluster, united by their lack of output contribution to long-term investment, belong to the regions with very high levels of risk. The three exceptions are companies that are established for providing energy to specific large companies, and are, therefore, not subject to the same operating conditions as their peers in the cluster. For clusters 2 and 3, united by the lack of contribution to EVA and labor productivity, there was a clear relationship between effectiveness level and RIA. To further test the strength of this relationship, we have regressed the efficiency level on the RIA, and obtained the R-square (variance explained) of 0.68 for the second cluster and 0.43 for the second cluster. Considering that these clusters were formed using financial input and output measures without taking the regions into account, this is a very high percentage of variance

[3] Detailed information about the rating agency, as well as RIA calculation and composition, can be obtained at: http://raexpert.ru/ratings/regions/2011/tab8/

TABLE 1: Results of Data Envelopment Analysis

						Input/Output Contributions					Peers[m]												
Cluster	*Company*[4]	*EL*[a]	*RIA*[b]	*RIAN*[c]	*CI*[d]	*Costs*	*LTI*[e]	*EVA*[f]	*LP*[g]	*CFM*[h]	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*CS*[i]	*PT*[j]	*GSC*[k]
1	C1	*99.14%*	*3B1*	*5*	96.75%	3.25%	0.00%	68.33%	25.35%	6.32%	+		+	+						+	2	*1*	-
1	C2	*73.67%*	*3B2*	*4*	89.70%	10.30%	0.00%	20.48%	30.01%	49.51%			+	+	+					+	2	*1*	-
1	C3	*71.34%*	*1A*	*10*	99.15%	0.85%	0.00%	70.53%	29.47%	0.00%		+	+							+	4	*1*	+
1	C4	*58.71%*	*3B1*	*5*	87.99%	12.01%	0.00%	29.92%	30.43%	39.65%			+	+	+					+	1	*1*	+
1	C5	*43.11%*	*1B*	*9*	96.98%	3.02%	0.00%	54.03%	39.00%	6.97%		+	+	+						+	4	*1*	+
1	C6	*41.49%*	*3B1*	*5*	97.59%	2.41%	0.00%	48.84%	38.30%	12.86%		+	+	+						+	3	*0*	+
1	C7	*41.45%*	*3B2*	*4*	95.52%	4.48%	0.00%	51.52%	25.36%	23.12%			+	+	+					+	2	*1*	-
1	C8	*38.22%*	*3B1*	*5*	97.13%	2.87%	0.00%	48.88%	44.00%	7.12%	+		+	+						+	2	*1*	-
1	C9	*28.21%*	*3B1*	*5*	98.31%	1.69%	0.00%	48.78%	39.67%	11.55%	+		+	+						+	3	*1*	+
1	C10	*23.81%*	*1B*	*9*	96.90%	3.10%	0.00%	43.80%	56.20%	0.00%	+								+	+	1	*1*	-
1	C11	*16.49%*	*3B1*	*5*	100.00%	0.00%	0.00%	46.14%	5.89%	47.97%			+	+	+						2	*1*	+
2	C12	*100.00%*	*1A*	*10*	2.27%	89.83%	7.91%	0.00%	100.00%	0.00%		+									1	*1*	-
2	C13	*100.00%*	*1A*	*10*	75.66%	24.34%	0.00%	0.00%	100.00%	0.00%									+		4	*1*	-
2	C14	*100.00%*	*2B*	*7*	112.75%	-12.75%	0.00%	0.00%	100.00%	0.00%										+	4	*1*	+
2	C15	*100.00%*	*2A*	*8*	100.00%	0.00%	0.00%	0.00%	71.96%	28.04%				+							2	*1*	+
2	C16	*74.56%*	*3B1*	*5*	7.15%	39.81%	53.04%	0.26%	99.74%	0.00%		+				+		+		+	3	*1*	+
2	C17	*67.93%*	*3C1*	*3*	86.57%	13.43%	0.00%	0.00%	88.34%	11.66%					+				+	+	2	*1*	+
2	C18	*61.60%*	*3B1*	*5*	11.24%	24.64%	64.12%	0.00%	66.68%	33.32%		+		+		+				+	3	*1*	+
2	C19	*34.36%*	*3B1*	*5*	86.04%	13.96%	0.00%	0.00%	81.88%	18.12%				+	+				+		3	*1*	+
2	C20	*31.74%*	*3C2*	*2*	4.90%	3.73%	91.36%	0.00%	100.00%	0.00%		+						+		+	2	*1*	-
3	C21	*100.00%*	*3B1*	*5*	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%			+								2	*1*	-
3	C22	*100.00%*	*3B1*	*5*	36.85%	0.00%	63.15%	100.00%	0.00%	0.00%							+				2	*1*	-
3	C23	*100.00%*	*3C1*	*3*	90.99%	1.68%	7.33%	78.86%	0.00%	21.14%						+					3	*0*	+
3	C24	*91.68%*	*3C2*	*2*	88.43%	11.57%	0.00%	77.16%	0.00%	22.84%			+		+					+	2	*1*	-
3	C25	*74.45%*	*3A1*	*6*	100.00%	0.00%	0.00%	66.75%	0.00%	33.25%			+		+						2	*1*	-
3	C26	*60.73%*	*3B1*	*5*	69.96%	14.55%	15.49%	80.11%	0.00%	19.89%			+		+	+	+				3	*1*	+
3	C27	*57.75%*	*2A*	*8*	67.77%	0.00%	32.23%	65.59%	0.00%	34.41%				+		+	+				4	*1*	+

[4] All companies have "Energy Distribution" in their names. In order listed, from C1 to C38:
Archangelsk, Atom (Atomic Energy), Belgorod, Dagestan, Kalmychia, Karachaevo-Cherkesovo, Kirov, Kostroma, Lipetsk, Mordova, Moscow, Moscow region, Krasnodar, Novgorod, Orel, Perm, Ryazan', Samara, Saratov, Sverdlovsk, Novosibirsk, Sibur, Smolensk, Stavropol, Tula, Tumen', Udmirtia, Ulyanovsk, Chelyabinsk, Chita, Chuvashia, Rostov, Moscow (second), Vladimir, Volgograd, Vologda, Voronezh

3	C28	*35.26%*	*3B1*	*5*	60.55%	3.81%	35.64%	60.45%	0.00%	39.55%		+	+	+		+			2	*1*	-
3	C29	*32.87%*	*3B2*	*4*	76.74%	23.26%	0.00%	74.44%	0.00%	25.56%		+		+				+	2	*1*	-
3	C30	*27.86%*	*3B1*	*5*	60.02%	11.89%	28.10%	61.81%	0.00%	38.19%		+		+	+	+			3	*1*	+
3	C31	*19.92%*	*1B*	*9*	102.60%	-2.60%	0.00%	100.00%	0.00%	0.00%		+						+	1	*1*	+
3	C32	*18.41%*	*2B*	*7*	100.00%	0.00%	0.00%	57.21%	0.00%	42.79%		+		+					3	*1*	+
3	C33	*12.16%*	*2B*	*7*	100.00%	0.00%	0.00%	34.93%	0.00%	65.07%		+		+					4	*1*	-
3	C34	*6.00%*	*1A*	*10*	96.00%	4.00%	0.00%	100.00%	0.00%	0.00%		+						+	1	*1*	-
	C35	*100.00%*	*2B*	*7*	53.47%	8.57%	37.96%	42.64%	15.76%	41.60%	+								2	*1*	-
	C36	*100.00%*	*3B1*	*5*	50.31%	49.69%	0.00%	0.00%	0.00%	100.00%				+					3	*1*	+
	C37	*100.00%*	*3C2*	*2*	10.52%	15.46%	74.02%	0.00%	100.00%	0.00%							+		2	*1*	-
	C38	*97.32%*	*3B1*	*5*	47.63%	0.00%	52.37%	35.69%	0.00%	64.31%			+		+	+			1	*1*	-

Note: [a]EL – Efficiency Level, [b]RIA – Regional Investment Attractiveness, [c]RIAN – Regional Investment Atractiveness, Numeric, [d]CI – Current Investments, [e]LTI – Long-Term Investments, [f]EVA – Economic Value Added, [g]LP – Labor Productivity, [h]CFM – Composite Financial Measure, [i]CS – Company Size. 1 – up to 100 employees; 2 – 100-500 employees; 3 – 500-1000 employees; 4 – 1000-2000 employees, [j]PT – Pricing Type (0 – regulated, 1 - not regulated / market), [k]GSC – Guaranteed Supplier Contract, [m]Peers: Some of the same companies as above; in order listed, from A to J. Novosibirsk, Siberia, Ryazan', Belgorod, Buryatya, Dagestan, Chuvashia, Kalmykia, Moscow, Perm'

explained by just one variable. In order to verify that the region did not play any role for the overall sample, the same regression was performed for all companies simultaneously, with resulting R-square very close to zero. In other words, knowing the investment attractiveness of a region in which the company operates could help determine which of the financial indicators would not contribute to the output, and therefore should not be used for evaluating the company's efficiency.

3.4. Typology

As the goal of the project was to develop a typology of companies for further analysis, we have developed the following classification based on the obtained DEA results.

Short-term investment group. Companies belonging to this group are characterized by the lack of contribution of long-term investments, and relatively high contribution of short-term investments to their overall efficiency. The importance of costs and labor productivity in calculating company efficiency is also relatively low. A closer examination (as described in the post-hoc analysis section above) revealed that these companies belong to regions with low investment attractiveness indicator. In other words, they operate in regions that do not attract outside capital, with lower competitive pressure and lower economic indices. Separating these companies into their own group is very important: compared to their peers, they may appear to be less than exemplary as measured by efficiency indicators. However, such performance is most likely not due to management practices employed, but rather the regional operating conditions.

As the overall correlation between the measures of performance and investment attractiveness of the region is nearly zero (as indicated above), without a more complex look at the results provided by the DEA, these companies would have been likely dismissed from further analysis as inefficient. However, as indicated by contribution of the EVA indicator, within this group, there are companies that operate at relatively high EVA levels, meaning they do generate income that sufficiently covers all operating expenses. Furthermore, this is the only indicator where there appear to be dramatic differences between companies, and it also correlates negatively with the composite financial measure ($r = -0.73$). So the EVA indicator (or alternatively, the composite financial measure) is the indicator that should be used for separating companies within this group, and selecting several companies for further analysis.

Labor efficient group. Companies within this group are characterized by near-zero contribution of economic value added (as well as composite financial measure) to their overall efficiency. That is, company efficiency is determined, in large part, by relatively high contribution of labor productivity. The labor productivity indicator and the composite financial measure for this group are almost perfectly negatively related ($r = -0.999$), meaning that if labor

productivity contribution to efficiency is high, financial contribution is nearly absent. In other words, in this cluster, we expect to find the most impactful relationship between human resource management practices and company efficiency.

The importance of separating these companies into a separate cluster is obvious. As indicated above, a large number of studies have looked at the relationship between human resource management practices and firm performance. To the best of our knowledge, none of the studies have separated companies by contribution of various factors to overall efficiency as we've done here. From the results obtained so far, it is apparent that in this particular cluster, there will be a highly pronounced relationship between the HR management practices and firm performance; such may not be true for the other companies in the sample. As a result, the effect of HR management practices may not have been very pronounced at best. But this is due not to the fact that there is no relationship between HR management practices and performance, but rather to the fact that the sample itself is heterogeneous, with at least three different explanatory variables accounting differentially for firm performance within individual clusters. It is important to emphasize that such relationship may not have been obvious without implementing DEA in the sample first.

Within the cluster, there is an apparently a differential effect of long-term investment on company efficiency. As was mentioned above, the relationship between the efficiency indicator and the investment attractiveness of the region is not only relatively strong (r=0.68), but it is also curvilinear, with the shape of inverted U. In other words, the most efficient companies operate in regions with about medium rating of investment attractiveness. In regions with low and high investment attractiveness, the company efficiency is lower than could be expected given the regional conditions. Again, this is a good indicator of potential differences in managerial techniques applied at the company level, and apparently, they are due to HR management practices specifically. Therefore, for the purpose of selecting several companies within this group, the long-term investments indicator may be proven useful for distinguishing HR-efficient companies from each other.

Financial performance group. Companies within this group are characterized by near-zero (in fact, zero in all cases) contribution of labor productivity indicator to the company efficiency. In this group, long-term investments play a large role in determining the company efficiency. As expected, there is also a high level of correlation between long-term and short-term investments, but this group is fundamentally different from the first because of contribution of other indicators. 0% correlation between the labor productivity and company efficiency may indicate that for this group, HR management practices may play no practical role, so apparently, other managerial techniques account for the company efficiency. It is also worth noting that there

is a strong positive correlation between the economic attractiveness of the region and company efficiency, so apparently, within this cluster, region plays a relatively strong part in determining the company investment policy. All companies perform well as indicated by the EVA, which means all of them generate income that is higher than the operating expenses. Potential separating variable for selecting companies from this cluster is the costs, s they vary rather dramatically between the companies.

4. Conclusion

The objective of this study was to create a typology of companies and classify them as more or less efficient based on a number of theoretically-driven, objective criteria observed from the from publicly available information. Using an inductive approach based on DEA, we have determined that such classification was indeed possible. Results of the analysis indicate that once the inputs and outputs are selected and the DMUs' relative efficiency is obtained it is possible to further find the patterns not accounted for previously.

Contribution to Theory, Practice, and International Community. Results of this study have clear implications for research and practice. First, we have shown how the DEA could be used to evaluate relative efficiency of a company based on a large number of indicators, potentially aiding managers in the corporate performance review and evaluation. Second, we have clearly demonstrated that it is possible, by using public information only, to separate the companies based on their levels of efficiency and further describe them using patterns and regularities not accounted for previously. Third, by conducting the analysis on a sample of companies in Russia, we have opened the door for further research in comparative developed-emerging market research.

Limitations and Directions for Further Research. This study, clearly, has several limitations. First, it was conducted on a very narrow sample – that of an energy distribution industry. Because this industry is relatively homogeneous, there is less of a chance of third variable interference when evaluating a new method of efficiency analysis. On the other hand, it is too early to talk about the generalizability of the results, and the method has to be tested on a variety of different samples. Second, only the financial indicators were used, though the BSC approach, among many others, calls for a more complex evaluation of the company's efficiency. While it is not uncommon for BSC evaluation to be reduced to financial analysis only, including other indicators, especially the customer perspective observed from the outside, could substantially enrich the analysis process and the resulting outcomes. Future studies could address these limitations, and find other uses for the classification process described in this paper.

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Contact author:

Irina O. Volkova
National Research University Higher School of Economics, Moscow, Russia, Department of General and Strategic Management, Professor;
E-mail: iovolkova@hse.ru, Tel. +7 (495) 772-95-90*55185

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