How to make sugar production more effective: A case of Ukraine*

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The article is devoted to the analysis of efficiency of sugar companies of Ukraine and the ways of its improving. The decreasing return to scale and scale inefficiency for the majority of sugar companies are determined. The main factors of sugar plants inefficiency are defined. Developed benchmarking has revealed significant reserves of reduction of the basic inputs and potential growth of efficiency. In comparison with foreign companies the Ukrainian sugar plants have smaller material capacity of production and stuff cost, considerably lower labour and capital productivities. The recommendations for proprietors and managers of sugar companies for making of decisions on improving of efficiency are made.

Dieser Artikel befasst sich mit der Analyse der Effizienz der Zuckerindustrie in der Ukraine und wie diese verbessert werden kann. Unter positiven Feedback – Effekten verstehen sich in der Ökonomie drei Effekte, welche die Bildung von temporären Monopolen begünstigen. Die Hauptfaktoren der Ineffizienz der Zuckerindustrie sind definiert. Der fortgeschrittene Leistungsvergleich hat erhebliche Reserven bei der Reduktion von grundlegendem Einsatz und ein potentielles Effizienzwachstum zum Vorschein angezeigt. Im vergleich zu ausländischen Unternehmen haben die ukrainischen Zuckerfabriken kleinere materielle Kapazität der Produktion und Materialkosten, wesentlich niedrigere Arbeitskosten und eine niedrigere Kapitalproduktivität. Die Vorschläge für die Eigentümer und Führungskräfte der Zuckerindustrie zu Entscheidungsfindung bei der Verbesserung der Effizienz wurden unterbreitet.

Key words: Sugar production, Efficiency, International benchmarking, Motivation, Ukraine

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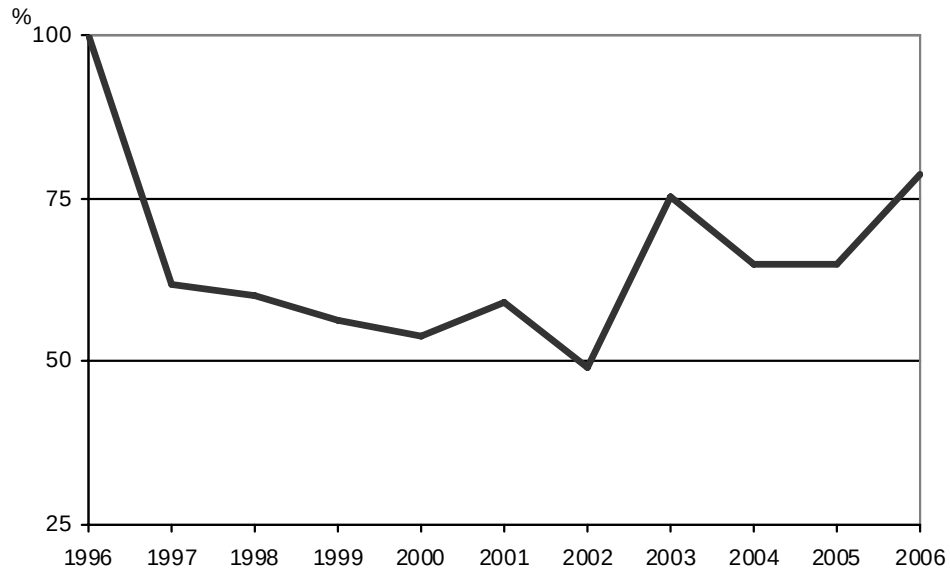
1.Introduction

Entering of Ukraine in the World Trade Organization (WTO) makes us think about the perspectives of those industries, which activity was traditionally limited to various tools of a state regulation, including external economic. Sugar production industry is one of such industries. The research presented below is devoted to the estimation of current efficiency of sugar production in Ukraine, its major factors and to the determination of the ways of efficiency improvement of sugar plants with use of various analytical tools, including benchmarking.

Sugar production concerns to the continuous-line mechanized manufacture with a high level of automation of basic processes. The distinctive feature of territorial allocation of sugar plants in Ukraine is their rigid binding to the areas under crops of sugar beet, as beet transportation on great distances is economically inefficient. Vinnitsa, Poltava, Kyiv and Cherkasy areas are the basic regions of beet sowing. In some cases, sugar plants have own areas under crops located directly near the enterprise. By-products of sugar industry (beet pulp, molasses) are used as fertilizers and animal feed.

Figure 1. Indexes of sugar production in Ukraine for 1997-2006 (1996=100 %)



According to the National Association of Ukrainian Sugar Manufacturers "UkrTsukor" in 2006 119 sugar plants produced sugar in Ukraine. Last decade dynamics of sugar production in the country had no steady tendency and changed within the limits of 1,6-2,6 million tons a year (Figure 1), at established capacities near 5 million tons. The major part of sugar produced is consumed in domestic market, two thirds of which is people consumption and one third includes the various branches of food-processing industry: confectionery (24%); beverages – beer, wine, vodka and non-alcoholic (5%); dairy (2%), bakery (1%), etc.

50% non-utilized capacity is explained by the following reasons:

- surplus of capacities, which have remained since days of socialism when the industry sold production through all the USSR and produced more than 6 million tons a year (in 1990); for this reason 37 sugar plants have been cut on scrap metal for the last years;
- stable low internal consumption of sugar at a level of 1,8-2,1 million tons a year;
- shortage of own raw materials (sugar beet) for production, hence the plants have been compelled to import raw cane sugar on quotas (from Brazil, USA, Cuba, etc.) till 2004, and from 2005 – sugar beet (from Belarus, Poland and Lithuania);
- absence of export sugar trade because of closeness (quotas, customs barriers) or unprofitability (low prices) of export to the majority of countries.

However, the new opportunities of sugar usage in manufacture of bioethanol appeared during the last years can provide good prospects for the domestic sugar industry. Nevertheless, the industry demands technological reequipment for its reanimation as a fixed capital deterioration of Ukrainian sugar plants is about 60% in average and for some of them exceeds 90%.

The author of this article tries to answer the following questions:

- Are the Ukrainian sugar companies effective today?
- What are the defining factors of their efficiency and its potential growth?
- How to raise efficiency of sugar companies up to the world level?

2. Methodology

We offer to examine an efficiency of sugar plants and industry as the whole under the following scheme:

- an estimation of technical and scale efficiency with a ranking of sugar plants;
- establishing of influence of the major factors on sugar plants' activity;
- revealing of reserves of input reduction and potential growth of efficiency of sugar plants;
- working out of recommendations for using of internal reserves as well as external posibilities that allow the company's management to improve efficiency of sugar production.

For the estimation of efficiency of sugar plants it is offered to use the widely known method of Data Envelopment Analysis (DEA) first offered by Charnes et al. (1978).

In order to provide the needs of internal consumers and to prevent seasonal prices fluctuations and overproduction, the sugar market in Ukraine, as well as the markets in other countries, is actively regulated by the government by means of establishment of boundary minimal prices and quotas on manufacture: a quota "A" (a quota of deliveries to the domestic market – a maximum quantity of sugar for supplying to the domestic market); a quota "B" (a quota of deliveries under the international contracts – quantity of sugar for export supplying and updating of quotas "A", if necessary); a quota "C" (sugar supplied above both quotas "A" and "B" and intended for sales exclusively outside the country). The production quotas are defined by the Order of the Ministry of an agrarian policy of Ukraine in a cut of areas both for cultivation of sugar beet and for sugar production. These regulators significantly limit the influence of sugar plants' top-management on volumes of sugar production and sales. In such situation the basic source of improvement of sugar plants' efficiency is decreasing of their own expenses (inputs). Therefore in order to study the efficiency of sugar plants it is expedient to use input-oriented DEA models.

With a view to purpose of this study four input-oriented DEA models are used here:

- DEA model with a constant return of scale (CRS) (Charnes et al. 1978);
- DEA model with a constant return of scale (CRS) (Banker et al. 1984);
- DEA model with non-increasing return of scale (NIRS) (Fare et al. 1994);
- Slack-based DEA model offered by Ali et al. (1995) and Thrall (1996) and advanced by Tone (2001).

To estimate an influence of a production scale on a company's technical efficiency the measure of scale efficiency will be defined on the following ratio:

$$SE = \frac{TE_{CRS}}{TE_{VRS}}, \qquad (1)$$

where TE_{CRS} is technical efficiency score for CRS model and TE_{VRS} is technical efficiency score for VRS model.

The shortcoming of scale efficiency measure is that its value does not indicate whether the firm is operating in area of increasing or decreasing returns to scale. This problem can be solved by seeing whether technical efficiency score for NIRS model (TE_{NIRS}) is equal to TE_{VRS}. If they are equal then sugar plant works under decreasing returns to scale. If they are unequal then increasing returns to scale exist for that plant. And if $TE_{CRS} = TE_{VRS}$ then plant is operating under constant return of scale and its scale efficiency equals 1.

For the establishment of a cumulative return to the scale for a sample and valuation of the elasticities of output with respect to major factors (labour, materials and capital), three-factor multiplicative production function (Goncharuk 2006) and widely known method of Ordinary least square (OLS) are used here.

In terms of division of impact of external and internal factors on efficiency of the companies, the efficiency-profitability matrix (EPM) first offered by Dyson et al. (1990) is used. The basic idea of the given method is the placement of the firms of a sample in bi-directional co-ordinate. The horizontal axis shows their efficiency scores and the vertical one shows values of profitability. There is grouping by 4 quadrants: "sleeping", "stars ","dogs" and "duds". On the disposition of the firm in this or that quadrant it is possible to judge the general character of influence of exogenous factors, such as government regulation, an environment, a level of business activity and public income, regional features etc., on its activity. The EPM allows not only to look at efficiency in two aspects and to present it in two-dimensional view, but also enables to receive the expanded notion about efficiency of analyzed sample of the companies, about their relative performance and potential development.

For the estimation of input reduction reserves, the slack-based model (SBM) will be used:

$$\begin{aligned} &\max \sum_{i=1}^{m} w_i^- s_i^- + \sum_{r=1}^{s} w_r^+ s_r^+, \\ &subject\_to: \\ &\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{i0}, i = 1,2,...,m \\ &\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = y_{ro}, r = 1,2,...,s \\ &\lambda_j, s_i^-, s_r^+ \geq 0, \end{aligned} \qquad (2)$$

where λ_j is a weight of DMUj, x_{ij}, y_{ij} are inputs and outputs of DMUj, s_i^-, s_i^+ are input and output slacks, w_i^-, w_r^+ are weights of slacks. This model ensures an objective quantitative measure (slacks) for possible reserves of decrease in inputs on each enterprise and industry as the whole.

3. Data collection

The basic sample includes 44 sugar companies, which total volume of output comprised more than 53% of all sugar production in Ukraine in 2006. Additional sample for implementation of an international benchmarking includes 34 sugar companies of India (9), Russia (7), Pakistan (3), USA (2), Australia, Canada, Brazil, Germany, France, Spain, Denmark, Austria, Holland, Poland, Croatia, Serbia and SAR.

Raw materials, depreciation and a number of employees are used as inputs. The given variables most adequately reflect the using of major factors of production – materials, fixed capital and labour. A sugar production in tons is used here as output. This parameter reflects a result of production activity of sugar company.

Considering the results of DEA are sensitive to errors in initial data, the annual reports (10-K, 20-F and other forms) of the companies, reliability of which is confirmed by the auditor conclusions, were used as a source of information. The descriptive statistics of companies' samples is framed in Table 1.

Table 1. Descriptive statistics for sugar companies' samples

Variables	Ukrainian sugar companies			Foreign sugar companies		
	Mean	Median	Stand. dev.	Mean	Median	Stand. dev.
Raw materials, 000' SDR	5011	4498	3775	148439	38712	194439
Depreciation, 000' SDR	307	192	312	10349	1987	15746
Number of employees	427	361	294	2780	850	6129
Production, tonnes	30928	23781	24251	530377	198846	619818

4. The results of analysis

4.1. Estimation of the efficiency

Defining the degree of influence of major factors – materials M (Cost of materials), plant and equipment K (Depreciation), and labour L (Staff cost) on output and the general character of return to scale for sugar industry, three-factors production function has been constructed:

$$Y = 7{,}274 \cdot L^{0{,}185} K^{0{,}163} M^{0{,}610}. \qquad (3)$$

Model (3) is reliable (see Table 2) and specifies that the volume of output at the Ukrainian sugar plants more than 73% is defined by three factors: the personnel, a fixed capital and raw material inputs. Moreover material inputs play defining role in formation of the end-product that is appropriate for all industrial activity.

The sum of elasticities of output to all factors in model (3) is below one (0,957) that specifies presence of decreasing return to scale in Ukrainian sugar industry, i.e. with increase in size of sugar plant and volumes of spent resources an output grows slow and efficiency decreases. 9 of 44 plants of a sample have a constant return to scale, i.e. optimal scale of production, five - an increasing return to scale and the overwhelming majority (30) has a decreasing return to scale. It means that an integration of production for the majority of plants is a negative factor of efficiency growth, and reduction of scale of production should be reflected positively on the level of efficiency of industry.

Table 2. Estimates of regression model parameters for Model (3)

Multiple correlation coefficient	R = 0.8581
Coefficient of determination	R^2 = 0.7364
F-statistics	F = 37.247
Number of Observations	N = 44
t-statistics	5.124; 2.825; 2,411

Source: Own calculations.

Value of residual (7,274) in model (3) specifies an average current level of production efficiency (output-input ratio) in sugar industry (sample) of Ukraine.

The estimation of efficiency of plants of a sample by means of input-oriented DEA model with a variable return to scale (VRS) has allowed to allocate 11 companies laying on the efficiency frontier (Table 3).

There are eleven companies on the industry efficiency frontier: all of them are located in the central-northern part and the western part of Ukraine. In the majority they have optimal (constant) scale of production, high technical efficiency and belong to the large corporations. Their significant number is an important element of the vertically-integrated or branch holdings (Sugar Union "UkrRos", Astarta Holding N.V, Sumyagrocukor LLC, UVS LLC). The given circumstances specify the presence of the effective proprietor in the companies from the top part of a rating of efficiency. The high increasing return to scale for APO Tsukrovyk Poltavschyny LLC specifies perspectives of extension of manufacture in the given company. Highly decreasing return to scale for Sumy Sugar Refinery Plant and Nyzivka Sugar Plant testifies to necessity of reduction of production volumes to provide an efficiency growth.

The worst in a rating of efficiency [0...0,5] are 15 sugar plants located mainly in the eastern (Kharkiv, Dnipropetrovsk), southern (Odessa, Vinnitsa) and central areas of the country. With rare exception all of them have a decreasing return to scale, low technical efficiency and belong to medium-sized investors, nonspecialized companies or to one or several persons. In most cases (at 9 plants) there is no major proprietor of a controlling interest. Exception is the worst plant of a sample - Gubinsk Sugar Plant owned by Sugar Union "UkrRos".

The plants owned by the largest domestic manufacturer of sugar - Ukrainian Food Company LLC, which includes 12 sugar plants, have appeared in the middle of a rating of technical efficiency. The majority of these plants have a decreasing return to scale. At the same time the factories located in Poltava area have an increasing return to scale that in combination with the similar effect specified above at APO Tsukrovyk Poltavschyny LLC makes the companies of the given region the most attractive and perspective from the point of view of development of sugar production and efficiency growth.

Table 3. Technical and scale efficiency scores for Ukrainian sugar companies

Company name	No.in Rating	Technical efficiency	Scale efficiency	Return to scale
APO Tsukrovyk Poltavschyny LLC	1	1,000	0,382	↑
Chortkiv Sugar Plant	2	1,000	1,000	→
Sumy Sugar Refinery Plant	3	1,000	0,388	↓
UVS LLC	4	1,000	1,000	→
Radekhiv Sugar Plant	5	1,000	1,000	→
Gorodische-Pustovarivske Sugar Plant	6	1,000	1,000	→
Kremenetscukor	7	1,000	1,000	→
Sumy-Stepanivka Sugar Complex	8	1,000	1,000	→
Nyzivka Sugar Plant	9	1,000	0,395	↓
Palmiracukor	10	1,000	1,000	→
Kornin Sugar Plant	11	1,000	1,000	→
Juzefo-Mykolaivska Agroindustrial Company	30	0,499	0,695	↓
Teofipol Sugar Plant	31	0,497	0,992	↑
Parafiyivka Sugar Plant	32	0,466	0,949	↓
Volodymyrcukor	33	0,465	0,927	↓
Novoivanivka Sugar Plant	34	0,464	0,580	↓
Pervukhinsky Sugar Plant	35	0,459	0,836	↓
Savincy Sugar Plant	36	0,443	0,887	↓
Novomyrgorodsky Cukor	37	0,439	0,749	↓
Tsurupa Sugar Plant	38	0,429	0,682	↓
Shamraivka Sugar Plant	39	0,413	0,914	↓
Firm “Sokolivsky Cukor”	40	0,406	0,894	↓
Kotovsk Sugar Plant	41	0,383	0,941	↓
Zaplazy Sugar Plant	42	0,364	0,908	↓
Smilyansk Sugar Complex	43	0,309	0,921	↓
Gubinsk Sugar Plant	44	0,304	0,734	↓
Average on sample		*0,619*	*0,835*	*0,957*

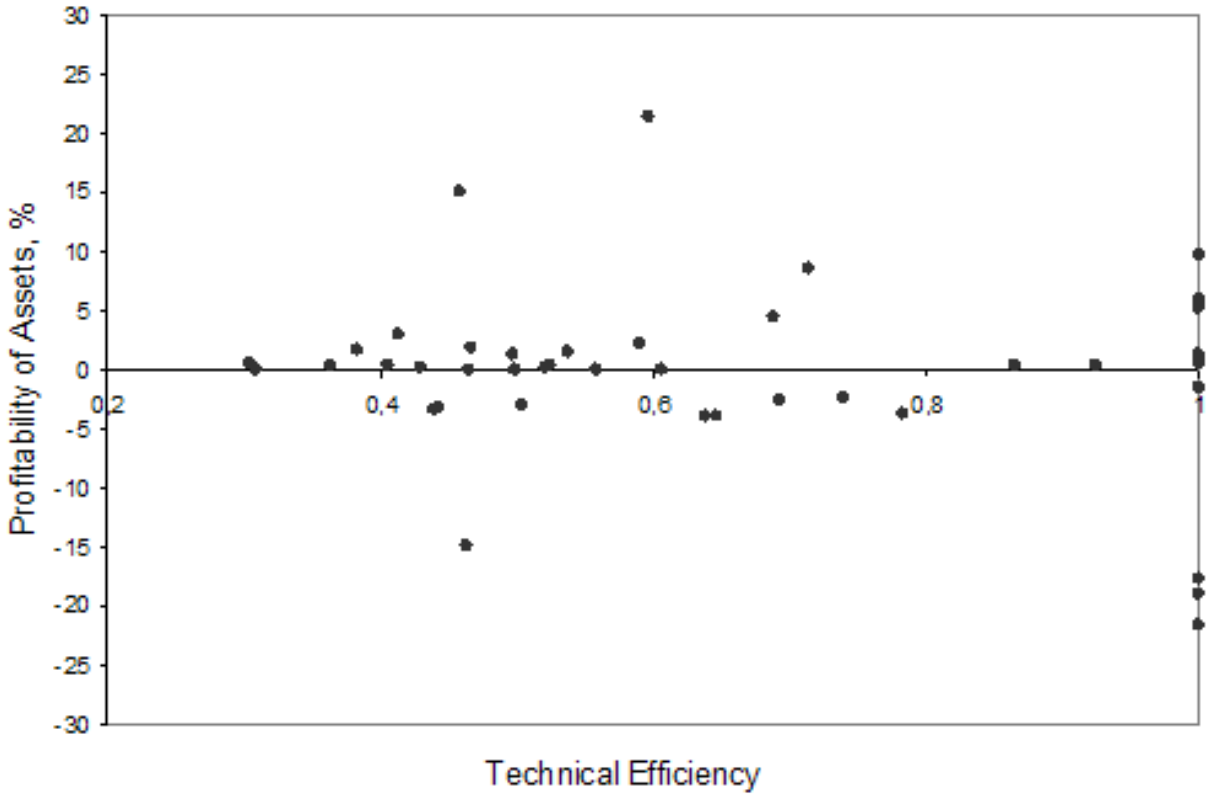
4.2. Two-criteria analysis and factors of efficiency

For two-criteria estimation of efficiency of companies of a sample the matrix of efficiency-profitability has been constructed, in which the levels of technical efficiency have been compared to profitability of total assets (Figure 2).

As shown, the greatest number of enterprises (20) of a sample is in the first quadrant "sleeping". Except for Alexandria and Pervukhinsky Sugar Plants, all of them are low-profitable (0-3 %) and are close to transition to the quadrant "duds". The given enterprises have low relative efficiency, but because of high prices for their production (sugar prices in 2006 were higher than in 2005 and 2007) and other positive factors of internal and external environment, they have an opportunity to receive positive financial results and to “shut eyes” to low efficiency in short-term prospect. However any adverse market change or

strengthening of other negative factors in the long term can shake their position and shift them to the quadrant "duds", therefore they should invest their earned profit in manufacture development and in innovation capable to raise a current level of their efficiency. An important factor of low efficiency of companies of the given quadrant is the decreasing return to scale that specifies an opportunity of increase of efficiency and profitability due to reduction of production volumes and inputs.

Figure 2. The efficiency-profitability matrix for Ukrainian sugar companies for 2006



In the second quadrant "stars" there are 10 companies, 4 of which are low-profitable (0,3-1,2 %). High profitability of other plants of this quadrant is provided by both market factors – high prices and high efficiency. Besides all of them have an effective proprietor and qualitative management. The companies of this quadrant in 2006 have increased their output more than in two times and reduce material capacity of production on 1,5 % (from 39% to 37,5%) that was promoted by the growth of crop of sugar beet in Ukraine on 44,4 % and updating of capacities of the given companies on the average on 18 %.

In the third quadrant "duds" there are 5 companies: Gileya, Novomyrgorodsky Cukor, Novoivanivka Sugar Plant, Chervonsky Cukrovik and Savincy Sugar Plant. They are located in the east, south and in the centre of the country. In spite of the fact that total output of companies of this quadrant in 2006 has grown

almost on 40%, and a relative deterioration of a fixed capital here is below than in average for industry, material capacity of production has increased on 13,5% up to 77,5%. The reasons of low efficiency and unprofitability of the "duds" can be separated to the following basic groups.

1. *Financial difficulties and poor-quality management*. Novoivanivka Sugar Plant and Savincy Sugar Plant are not recognized bankrupts, the sum of their current liabilities is accordingly 3 and 1,8 times higher than working capital and amounts more than two thirds of the total liabilities. Such condition is explained by the regional allocation of the given plants (the Kharkiv area) remoted from the main sources of raw materials and also by inefficiency of management and proprietors. The former raises delivery cost and material inputs, the later increases various charges and losses of the companies connected with nonoptimality of management actions (X-inefficiency) and insufficiency of own capital. An obvious example of inefficiency of management of the capital is unreasonable expansion of short-term credit borrowings by Chervonsky Cukrovik in 2005 up to the half of the total liabilities with the purpose of updating of a fixed capital, and as a result the company has appeared to be insolvent and was passed to the property of bank in 2006 that was extremely negatively reflected on its economic results (falling of production volumes on 43 %, growth of net loss on 13%).

2. *Shortage and poor quality of raw material (sugar beet)*. Lack of local raw material for loading and a quota performance forces Gileya and Novomyrgorodsky Cukor to buy beet in the remote regions, that under a rise in prices on fuel and transportation increases material inputs of plants. Besides because of poor quality of raw material (low content of sugar in beet) waste grow and a coefficient of extraction, i.e. sugar output percent of unit of raw material, decreases. As a result, under growing output and decreasing return to scale material capacity of production in 2006 has considerably grown (accordingly up to 78% and 94%) and a production efficiency and profitability have decreased.

Thus, it is possible to emphasize the following major factors of the inefficiency and unprofitability of sugar companies:

- low credit capacity and an inability of proprietors to solve financial problems of the enterprises;
- poor-quality management making the decisions that lead to excessive expenses and losses of the companies;
- territorial remoteness of some plants from the basic sources of raw material, because of absence of strategic contractual and partner relations with agrarian enterprises;
- a weak raw-material base (in quality and quantity) because of low productivity of cultivation of sugar beet and lack of modern technologies in Ukrainian agriculture;

- non-optimal distribution of quotas to sugar production, an inefficiency of state regulation on a market of sugar and raw materials.

In the fourth quadrant "dogs" there are 5 companies located in four areas of the country: Sumy, Vinnitsa, Khmelnitskiy and Lviv. While having high relative efficiency, the given plants have faced subjective and objective problems, which does not allow them to receive a profit. It is possible to refer to the former an unwillingness of a proprietor to realize the given business in existing conditions that has led to saling (writing-off) of industrial equipment by Nyzivka Sugar Plant and Sumy-Stepanivka Sugar Complex, and stopping of industrial activity of the given plants included to the group of industry leaders by technical efficiency. Another reason of subjective character is modernization of equipment carried out by two companies of the quadrant that led to delaying of capital turnover and decreasing in material capacity of production, but in the future should be positively reflected in financial results. Other companies of this quadrant are undergone to the general problems of the majority of sugar plants: shortage of turnaround through the low credit capacity and an inability of proprietors; an obsolete equipment (moral and physical); shortage and poor quality of raw materials; poor-quality management and lack of qualified personnel.

Summing up the analysis of efficiency-profitability we can draw the following general conclusion: in conditions of rigid state regulation and limitation of a raw-material base the major factor of success of sugar companies is presence of effective proprietors and the management capable to carry out technological reequipment of manufacture, to involve qualified personnel, to provide a sufficient and qualitative raw-material base and to minimize expenses of the company.

4.3. Defining of reserves and potential

SBM and computer program DEAFrontier™ have been applied with the purpose of revealing of potential growth of technical efficiency and output of Ukrainian sugar industry. Therefore the reserves of inputs reduction for each company have been estimated. The total results are presented in Table 4.

Calculations specify the existence of significant reserves of input reduction at constant volumes of output and potential growth of output at constant inputs.

Table 4. Potential growth of efficiency and reserves of inputs reduction of Ukrainian sugar industry

Reserves of inputs reduction, %			Potential growth, %	
Material cost	Depreciation	Employees	Output	Efficiency
24,0	32,0	30,0	28,5	48,1

The greatest reserve on depreciation specifies presence of surpluses of a fixed capital or a share of their unproductive part (32%), which the plants can escape at achievement of the highest capital productivity level in industry. A high reserve of reduction in a number of employees (30% - more than 5,6 thousand workers) testifies to significant gap in a labour productivity level of efficient and inefficient sugar plants. Relatively smaller reserve of material inputs reduction testifies to existence of gap in a level of material capacity of production between efficient and inefficient companies of industry.

To study the opportunities of greater growth of efficiency of sugar industry we performed an international benchmarking where 34 sugar companies of India (9), Russia (7), Pakistan (3), the USA (2), Australia, Canada, Brazil, Germany, France, Spain, Denmark, Austria, Holland, Poland, Croatia, Serbia and South Africa were analyzed along with Ukrainian companies.

By the results it has been established, that on the efficiency frontier there are 5 companies: two Russian (Nikiforovsky and Labinsky sugar plants), American Imperial Sugar Company, Australian The Maryborough Sugar Factory and Indian Gobind Sugar Mills Ltd. Defining the degree of influence of major factors (raw materials, fixed capital and labour) on output and a general character of a scale effect on an international sample (78 companies), three-factors production function has been constructed:

$$Y = 6{,}324 \cdot L^{0{,}079} K^{0{,}201} M^{0{,}669} \qquad (4)$$

Model (4) is reliable (see Table 5) and specifies that the volume of output at sugar plants in the world is defined by three factors more than on 96%: personnel, fixed capital and material inputs.

Table 5. Estimates of regression model parameters for Model (4)

Multiple correlation coefficient	R = 0.9827
Coefficient of determination	$R^2 = 0.9658$
F-statistics	F = 696.014
Number of Observations	N = 78
t-statistics	10.329; 3.722; 2.827

Source: Own calculations.

In comparison with model (3) a role of materials and fixed capital in formation of the end-product has noticeably increased and a role of labour has decreased. It specifies a higher output-staff cost ratio and smaller material capacity of production of Ukrainian sugar plants. But a labour productivity level in foreign companies is almost 4 times higher, that along with high capital productivity specifies a higher technological level of manufacturing (automation) and better motivation of personnel. The highest labour productivity level is characteristic for American (Imperial Sugar Company and American Crystal Sugar Company) and European companies (Societe Vermandoise de Sucreries and Nordzucker).

The sum of elasticities of output with respect to all factors in model (4) is below one (0,949) that specifies a presence of decreasing return to scale that is close to the Ukrainian sugar plants level. Value of residual (6,324) in model (4) as well as in model (3) is high enough that specifies a level of efficiency of joint use of three considered production factors.

International benchmarking has allowed to expand reserves of possible inputs reduction for capital input from 32% to 44,3% while reserves on labour and material inputs have slightly decreased that is explained by relatively low wages and salary and material capacity of Ukrainian sugar plants. The potential of output growth (from 28,5% up to 153,9%) and a growth of efficiency of Ukrainian sugar plants (from 48,1% up to 50,4%) has significantly increased. While considering the rigid state restrictions of output for a home market (quota A), the basic useful direction of international cooperation for the Ukrainian sugar companies is the study of experience in decreasing of a capital cost per unit and growth of capital productivity (increase in productivity and loading of equipment) and also expanding of export activity.

However, taking into account the technological differences in sugar manufacture from sugar beet and sugar cane, there are only two foreign benchmarks of the efficient companies of an international sample – the Russian plants: Nikiforovsky sugar plant and Labinsky sugar plant. Among the factors that allowed the given companies to compete successfully with the other sugar plants not only in Russia, but also with the plants in the other countries, it is possible to name the following:

- an opportunity to work both with beet and raw cane sugar, thus repurposing of equipment is carried out in minimally short terms;
- presence of warehouses and capacities for unpacked storage of sugar that allow to store sugar for a long time;
- an allocation of plants in the centre of the chernozem zone that allow constantly to expand raw base;
- active participation of large foreign investors in management of companies - agroindustrial, trading and sugar holdings (Cargil 25%, Imperial Sugar Company 19,7%, AV Maximus 19,7%, Armoreal Trading 19,7%, etc.) capable to provide an additional raw-material base for the full loading of equipment, modern equipment and export of product.
- high quality of production and discharge their liabilities to partners.

5. Managerial decisions for efficiency improvement

The results of analysis give important information for the sugar company's owners and management for making of decisions on improve of efficiency. Owners of a few enterprises, namely APO Tsukrovyk Poltavschyny LLC, Gnidavsky Sugar Plant, Teofipol Sugar Plant and Kryzhopil Sugar Plant, having

an increasing return to scale, should get a positive synergetic effect from consolidation of production due to the own investing, acquisition or merger of companies. But since the owners of majority of the listed companies do not have possibilities of investing, only the last two variants of consolidation are possible.

It is possible to offer such variants of making of strategic decisions by the owners of the noted companies:

- Friendly acquisition of inefficient companies, for example, Gubinsk Sugar Plant or Smilyansk Sugar Complex, by perspective domestic sugar group, for example, Astarta (APO Tsukrovyk Poltavschyny LLC) or an international sugar group with the subsequent provision with own raw materials, implementation of internal performance benchmarking and adaptation of the best practices of efficient divisions of group on them.
- Merger between Teofipol Sugar Plant, Gnidavsky Sugar Plant, Orzhitsky Sugar Plant and Kryzhopil Sugar Plant with the subsequent implementation of internal benchmarking and adaptations at the plants of new company (association) of operational experience of the most efficient division – Orzhitsky Sugar Plant.

For efficient companies from the top of rating (see Table 2), having a constant return to scale, an important step on the way of perfection can be close co-operation with the purpose of studying and use by Ukrainian companies of the best practice (operations, technologies, a control system, etc.) of foreign benchmarks and its adaptation during the operational activity. Thus Russian Nikiforovsky sugar plant and Australian Maryborough Sugar Factory are the optimal benchmarks for Chortkiv Sugar Plant, UVS LLC, Palmiracukor and Kornin Sugar Plant; Indian Gobind Sugar Mills Ltd – for Radekhiv Sugar Plant; Russian Nikiforovsky and Labinsky sugar plants – for Gorodische-Pustovarivske Sugar Plant, Kremenetscukor and Sumy-Stepanivka Sugar Complex.

For improving of efficiency of the companies with decreasing return to scale (the majority of the Ukrainian sugar plants) it is necessary to realize a complete modernization of production. However, taking into account low credit capacity and investment possibilities of present owners, for such companies an optimal variant can be an attraction of the large foreign investors having high-efficiency technologies, own raw-material base (beet, raw sugar) and distribution channels abroad, for example, American Imperial Sugar Company or European British Sugar, Danisco and Nordzucker.

Moreover, there is internal potential of growth of efficiency of the Ukrainian sugar companies, which realization depends on managers and quality of their work. On many backward plants problems of poor-quality management and low motivation of personnel take place. Thus the former frequently is sequent of the latter: attracting of high-quality manager and providing of his effective work is

impossible without the appropriate motivation. These problems can be solved by introduction on the sugar companies of model of personnel motivation directed on the growth of efficiency of production (Goncharuk 2008). This model should be based on the systems of personnel stimulation and of internal competitiveness.

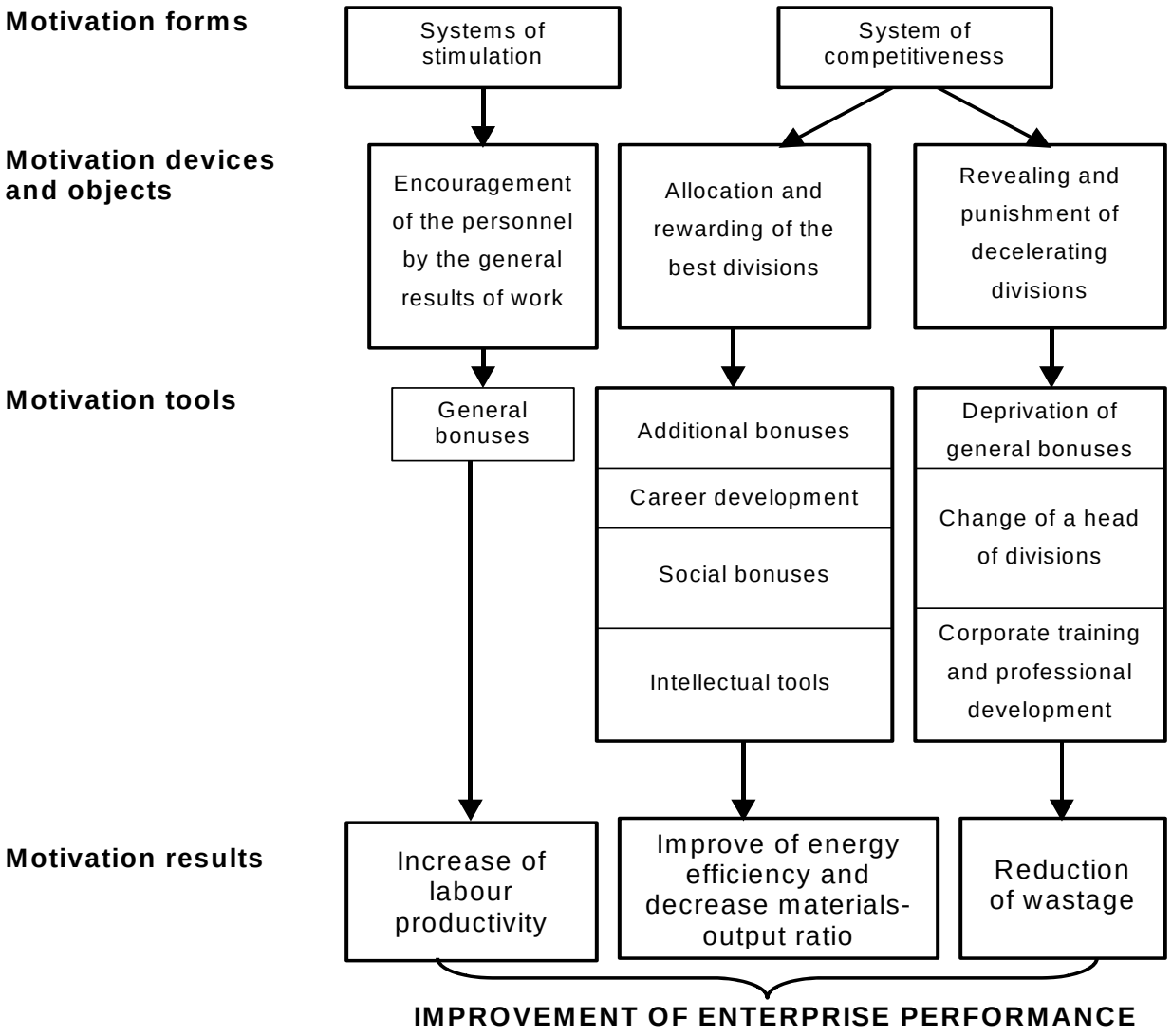
The basic goals of the system of personnel stimulation in a context of performance management are the following: increasing of labour productivity, reduction of wastage, improving of energy efficiency and decreasing of materials-output ratio. Such system can be based on the multi-factor group incentive scheme offered by Prasada Rao (2006), with addition of missing, but very important factors of overall enterprise performance – energy efficiency and reduction of wastage. Optimal way of use of the offered system of stimulation is its application for all enterprise in the whole, i.e. employee benefits for growth of indicators of production efficiency are appointed to all workers of the enterprise by results of the last month. In this case each worker will understand that from quantitative and qualitative results of his work depend not only the size of his wage, but also the general wages fund of the personnel of enterprise. At the same time, single introduction of the offered system of stimulation can lead to the situation when decelerating divisions (workers) parasitize on leaders, and leaders cannot receive adequate compensation for the effective work. Hence it is necessary to support it with other motivational tools, which, on the one hand, can provide a spirit of competitiveness in organization (personnel), and, on the other hand, give the help to the decelerating divisions not capable singly to improve results of the work.

The system of internal competitiveness will allow to provide additional selective encouragement and rewarding of the best divisions (leaders) of the enterprise, and also punishment of heads and deprivation of bonus of the most decelerating divisions (outsiders). Moreover such sanctions should not be individual as they can suppress incentives of decelerating groups to effective work. Therefore they should be to combine with an opportunity of correction of mistakes by training, improvement of professional skill and studying of an operational experience of the best divisions (leaders) both inside of the enterprise and outside.

Thus the motivational model will develop various complementary tools (Figure 3). The offered model of motivation creates incentives to effective work for all employees of the enterprise. Moreover, as practice shown the additional incentives are necessary sometimes for increasing of productivity and personnel performance with a view of formation of aspiration of perspective workers to career development (to be a manager) and prevention of abuses by enterprise heads. As those a tool of participation of managers in the profits of company, an inclusion of the most effective and perspective of them into enterprise proprietors (Baldoni 2005) and other methods of motivation of the heads for

improving of quality of sugar company's management can be used (Kindermann 2004; Protsyk 2007).

Figure 3. Model of motivation for performance management system



Introduction of this model of motivation in management system at one of the inefficient sugar plants of Ukraine (Kotovsk Sugar Plant) already has given positive results: in 2007 growth of the labour productivity was 88,6%, output-materials ratio grew in 2,8 times, energy efficiency rose on 82%, wastage reduced almost in 2 times under the growth of average wage on 12,8%. Hence the model helps this plant to improve its productivity and to raise its efficiency rating from 41 up to 12 point (see Table 3). It means that model works and it is possible to improve an efficiency without large expenses.

Therefore using of internal reserves as well as external posibilities (benchmarking) allows the company's management to improve efficiency of sugar production on tens of percents.

6. Conclusions and recommendations

Thus, efficiency of sugar companies under current conditions is defined in many respects by the following factors:

- shortage and poor quality of domestic raw material (sugar beet) that doesn't allow to provide high loading capacities and raise a coefficient of extraction;
- a rigid state regulation that doesn't allow to provide full loading capacities due to raw material import;
- obsolete technologies and high deterioration of equipment that demands significant labour inputs and repair costs;
- an inefficiency of management and low motivation of personnel that doesn't create effective incentives to growth of labour productivity and quality of production;
- absence of effective proprietors capable to provide with necessary resources (financial, raw material, labour) at the majority of plants;
- low credit capacity and investment appeal of the majority of sugar plants.

These problems have two sides: external and internal. The solving of external problems is not connected with actions of companies and depends on the government and its further policy in the field of regulation of agriculture and sugar production. From the point of view of efficiency of sugar business the policy focuses on gradual liberalization of foreign trade of both the raw material and end-product in the process of modernization of technologies. It could be the serious impulse for development of sugar industry to stimulate expansion of the areas under crops and growth of productivity of beet in regions where sugar factories are located, and also to re-profile the part of not used production capacities of bioethanol (diversification). Besides, the government could cancel the VAT and the customs duties on import of modern equipment for sugar plants and in that way promote sugar industry.

The solving of internal problems of sugar companies depends on desire and abilities of their proprietors and management to manage a business performance. Recommendations for the improvement of efficiency of sugar companies and industry on the whole are the following:

- Attraction of large foreign investors having high-efficiency technologies, own raw-material base (beet, raw sugar) and distribution channels abroad, for example, Imperial Sugar Company, British Sugar, Danisco or Nordzucker.
- Friendly acquisition of inefficient companies, for example, Gubinsk Sugar Plant or Smilyansk Sugar Complex, by perspective domestic sugar group, for example, Astarta (APO Tsukrovyk Poltavschyny LLC) or an international sugar group with the subsequent provision with own raw

materials, implementation of internal performance benchmarking and adaptation of the best practices of efficient divisions of group on them.

- Merger between not numerous players of domestic market which have an increasing return to scale – Teofipol Sugar Plant, Gnidavsky Sugar Plant, Orzhitsky Sugar Plant and Kryzhopil Sugar Plant with the subsequent implementation of internal benchmarking and adaptations at the plants of new company (association) of operational experience of the most efficient division – Orzhitsky Sugar Plant.
- Merger or close co-operation with the purpose of studying and use by Ukrainian companies of the best practice (operations, technologies, a control system, etc.) of foreign benchmarks, for example, Nikiforovsky sugar plant included into Russian holding "Russian sugar ", and its adaptation during the operational activity.
- Use of internal potential due to introduction in the enterprise management system of model of personnel motivation based on the systems of personnel stimulation and of internal competitiveness, and directed to increasing of labour productivity, reduction of wastage, improving of energy efficiency and decreasing of materials-output ratio.

Realization of the given recommendations can provide improvement of quality and volumes of output, a decrease in costs and growth of a level of production efficiency by 50% and more.

In case of unwillingness of the government to create necessary conditions for the solving of the problems noted above and unwillingness of foreign and domestic benchmarks to invest and co-operate with inefficient sugar plants, the most accessible way to increase efficiency for the majority of sugar companies is reduction of scale of production to an optimal level, that in conditions of the entering of Ukraine into the WTO and gradual growth of internal consumption of sugar (industrial) will mean inflowing of foreign sugar producers on a domestic market.

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