

З отриманих наборів ефективних точок залежно від політики банку, суб'єктивної думки голови правління чи інших факторів вибирають один набір параметрів керування. Визначені кредитні і депозитні ставки дають можливість спланувати діяльність банку у довгостроковому періоді.

**Висновки.** Запропонована модель ґрунтується на симбіозі двох банківських теорій: виробничій теорії, яка стверджує, що банк є підприємством з виробництва грошей, і теорії фінансових інститутів, яка дає змогу застосовувати економічні показники для оцінки банку.

Аналіз графіків (рис. 1, 2) свідчить про те, що значення показників гудвілу і ліквідності відрізняються, тобто є необхідність диференціації стратегій банківської діяльності. Для зменшення рівня ризику банківська установа повинна залучати депозити і фізичних, і юридичних осіб, адже ці вкладники реагують на зміни економічної ситуації по-різному: поки відбувається спад вкладів фізичних осіб, банк може використовувати кошти юридичних.

Розв'язання моделі зводиться до задачі векторної оптимізації. У результаті отримано множини оптимальних точок, яким відповідають значення кредитних і депозитних ставок. Вибір одного набору ставок буде визначати стратегію банківської установи.

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## SUSTAINABILITY INDICATORS – CATEGORISATION, USAGE, TRENDS AND BASIS FOR MULTI-CRITERIA EVALUATION

**Introduction.** A new era of business relations is coming in the beginning of the new millennium – an era of extended corporate social responsibility and open stakeholder dialogue. More and more companies realise that it is time to use more holistic approach in their activities. The accent only on economic growth is not sustainable enough because too many important issues are not considered. Nowadays it becomes crucial to encompass more aspects than before. The stakeholder pressure and economic incentives from responsible environmental and social behaviour are among the main reasons. Therefore, it is important to understand how to measure, evaluate and control this growing multidimensionality. This report tries to offer a possible answer, presenting results from profound studies of the literature and practice, an attempt for categorisation of the most widespread sustainability indicators, conclusions about their usage, and some contemporary trends. To do this, it takes a step forward based on data, which has already been reported but with another focus. This time, the idea is to contribute for better performance measurement, evaluation and control. Using the knowledge, drawn by the leading international reporting schemes and industrial enterprises, is a reasonable way to support these efforts.

**Sustainability indicators – categorisation, usage, trends.** To support the building of a good framework for advanced performance management, a categorisation of the most widespread sustainability indicators is seen as important. The categorisation table (Table 1) concentrates the results from a deep literature study [1] in a single sheet and it is really useful from

theoretical and practical point of view. Using it, a further check of the well-recognised international reporting schemes in the sustainability area {Global Reporting Initiative (GRI) [2; 3], International Organization for Standardization (ISO) [4], World Business Council for Sustainable Development (WBCSD) [5], United Nations Environment Programme (UNEP) [6], World Resource Institute (WRI) [7], United Nations Conference on Trade and Development (UNCTAD) and International Standards of Accounting and Reporting (ISAR) (UN-ISAR) [8; 9], Social Accountability International (SAI) [10], Institution of Chemical Engineers (IChemE) [11], European Commission (EC) [12], Bundesministerium für Umwelt (BMU) [13], UK Department for Environment, Food and Rural Affairs (DEFRA) [14], Ministry of the Environment Government of Japan (JME) [15; 16; 17], Environment Australia (EA) [18], Canada’s National Round Table on the Environment and Economy (NRTEE) [19]} takes place. Another table (Table 2) summarises the results of this coverage check [1] in another single sheet. The data in it are used for drawing up Table 3, showing the categories and subcategories frequency of occurrence. Adding to it the results from the profound empirical research [1; 20] and analysis of some trends [20], few other tables are drawn (Table 4, 5). Thus, step-by-step, the base for the upper-mentioned framework is built, combining theory and practice. An example for such one is shown in Table 6.

Table 1. Main categories, subcategories and examples for sustainability indicators

Environmental	Social	Economic
<p><b>Operational performance indicators</b></p> <p>Materials (consumption – total, by type, source, character; recycling, reuse)</p> <p>Energy (consumption – total, by type, source, character; initiatives to use renewable energy sources and to increase energy efficiency)</p> <p>Services supporting the organization’s operations – cleaning, waste disposal, horticulture, catering, communication, office services, transport, travel, education, administration planning, financial services, etc. (e.g. transport - significant environmental impacts of transportation used for logistical purposes, fuel consumption, emissions from vehicles)</p> <p>Physical facilities and equipment – buildings, machinery, equipment, etc. (emergency events, land owned, leased, or managed for production activities or extractive use, equipment use and maintenance)</p> <p>Supply and delivery (environmental performance of suppliers)</p> <p>Products (significant environmental impacts; characteristics – recyclability, reusability, bio-degradability, environmental influence durability, safety (risk), product durability (lifetime), substances in products, packaging material, energy consumption of appliances)</p> <p>Services provided by the organization (significant environmental impacts)</p> <p>Emissions (greenhouse gas emissions (CO<sub>2</sub>), use and emissions of ozone-depleting substances (CFCs), acidification emissions (NO<sub>x</sub>, SO<sub>x</sub>), VOC, HFCs, PFCs)</p> <p>Effluents (waste water discharges: heavy metals, N, PBOD, COD, nutrients, organic compounds)</p> <p>Wastes (amount – total, by type, source, character)</p> <p><b>Management performance indicators</b></p> <p>Compliance with laws and regulations (number of breaches of environmental legislation per year and the environmental, economic and legal consequences of these breaches)</p> <p>Environmental targets (number of company targets achieved and explanations for why other targets where not achieved)</p> <p>Environmental management practices (management system structure (e.g. responsibilities, procedures) and tools in use (e.g. environmental audits, environmental reviews and life-cycle assessment – number and frequency, environmental</p>	<p><b>Suppliers</b></p> <p>Purchasing criteria (selection of suppliers) (minimum social standards at the workplace)</p> <p>Social performance (supplier auditing and monitoring, concerning social issues)</p> <p><b>Human resources</b></p> <p>Child labour (policies, procedures, programmes... excluding child labour; monitoring systems and results of monitoring; number of children working; contractors screening for use of child labour)</p> <p>Forced labour (policies, procedures, programmes... excluding forced labour; monitoring systems and results of monitoring)</p> <p>Occupational safety and health (policies, procedures, programmes...; standard injury, lost day, and absentee rates, number of work-related fatalities, total number of accidents, illnesses, indoor air quality, water quality at workplaces, noise, number of safety inspections, frequency of accidents, severity of accidents, frequency of occupational diseases, severity of occupational diseases)</p> <p>Freedom of association and collective bargaining (policies, procedures, programmes... addressing this issue; monitoring systems and results of monitoring)</p> <p>Non-discrimination (policies, procedures, programmes... preventing all forms of discrimination; monitoring systems and results of monitoring)</p> <p>Disciplinary practices (appeal practices, non-retaliation policies and confidential employee grievance system)</p> <p>Working hours (policies, procedures, programmes... for avoiding overwork; monitoring systems and results of monitoring; average work week hours, hours overtime work, working intensity (number of working places))</p> <p>Remuneration (employee benefits, top management remuneration, minimum salary paid)</p> <p>Workforce, management systems and diversity (employment, management structure, number of internal audits, gender profile per management level, number of apprentices, employees from minorities, disabled employees)</p> <p>Security (practices and training)</p> <p>Indigenous rights (policies, procedures, programmes... addressing the needs of indigenous people)</p> <p>Training and education (number of employees that have received environmental, social or other training, total hours of training per year, investment in education and training)</p> <p>Satisfaction (results of surveys measuring employee satisfaction; number of strikes, lockouts, complaints)</p> <p><b>Customers</b></p> <p>Product information and labels (product information about ingredients, origin, use, potential dangers and side effects; proper labelling, special labels)</p>	<p><b>Financial</b></p> <p>Incomes (sales, revenues)</p> <p>Outcomes (expenditures, costs ((direct - raw material costs, labour costs, capital costs, operating costs; potentially hidden - recycling revenue, product disposition cost; contingent - employee injury cost, customer warranty cost))</p> <p>Financial result (profit or loss, EBIT - profit before interest expense and income tax)</p> <p>Gross margin - net sales minus costs of goods and services sold</p> <p>Value added - net sales minus costs of goods and services purchased</p> <p>Taxes</p> <p>Donations</p> <p>Investments</p> <p>Assets and liabilities</p> <p><b>Socio-economic</b></p> <p>Socio-efficiency (value added/ social impacts)</p> <p><b>Eco-economic</b></p> <p>Eco-efficiency (value added/ environmental impacts)</p>
<p><b>Environmental</b></p> <p>management systems, design for the environment, environmental accounting), integration of environment with other business management systems)</p>	<p><b>Social</b></p> <p>Marketing communications (policies, procedures, management systems, and compliance mechanisms for adherence to standards and voluntary codes related to marketing communications; number</p>	<p><b>Economic</b></p>

Environmental expenditures <b>Environmental condition indicators</b> Air (contaminant concentration, odour measured at specific distance from the organization’s facility, fine and ultrafine particles) Water (contaminant concentration, number of coliform bacteria per litre of water) Land (impermeable surface, natural habitats, protected areas, soil contaminated by heavy metals, pesticides, nutrients) Flora (extinguished and endangered species) Fauna (extinguished and endangered species) Humans (life expectancy of local population, environmental diseases of local population, concentration of contaminants in blood of local population) Aesthetics, heritage and culture (natural monuments)	and types of breaches of marketing regulations) Satisfaction (policy, procedures, management systems, and compliance mechanisms related to customer satisfaction, including results of surveys measuring customer satisfaction; customer complaint handling) <b>Public (community)</b> Public (community) relations (polices, procedures, programmes... treating corruption, lobbying, competition and pricing problems; number of complaints) Stakeholder dialogue (consultative meetings with stakeholders) Recognition and awards (prizes relevant to social, ethical, and environmental performance)	
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For the realisation of the empirical research are used the reports for 2005 published (in their websites, in downloadable official format, in English) by the top 100 industrial enterprises ranked in Fortune Global 500 list for 2006. As there are different ways for sustainability reporting – special report, covering the main sustainability dimensions (economic, environmental, and social), additional part to the annual report or different reports for different dimensions, there are problems how to choose where to stop with the investigation. The approach, which is used, is to scan first for environmental and social indicators and then to check for economic ones in the reports covering the first ones. The reason to do this is that first – for the economic dimension there is special legal form in which can be found enough important indicators, so for this dimension is possible quite different approach and next – it is useful to find which economic indicators have place together with the environmental and social ones in practice. So, if there is no available data for environmental and social aspects it is not necessary to check for economic indicators because the idea for sustainability is broken [1]. This approach also has the advantage not to restrict itself only to those reports with suitable title but to include all accessible reports, comprising sustainability indicators. To give an idea for the results of this scientific work, it has to be mentioned that the categorisation table (Table 1) consists of 10 categories (3 environmental, 4 social and 3 economic), 53 subcategories (21 environmental, 21 social and 11 economic) and hundreds indicators. The table, which summarises the results of the coverage check (Table 2), represents the presence or absence of these categories and subcategories in each of the 15<sup>th</sup> most powerful international reporting schemes in the sustainability area, with focus on micro level, mentioned numerous times in the scientific literature. Most of the initiatives have wide coverage over different sustainability aspects but Global Reporting Initiative (GRI) holds the widest one. It is also the most popular in the business world. So, a further analysis of the GRI reporting frameworks (Table 5) and sustainability indicators usage by 100 leading industrial enterprises (Table 4, 5) gives empirical support and possible directions for the efforts to build a useful framework for sustainable performance measurement, evaluation and control.

Table 2. Main initiatives coverage check

Initiatives	GRI	G2	GRI	G3	ISO	WBCSD	UNEP	WRI	UNISAR	SAIL	ChemE	EC	DEFRA	BMU	JMEEA	NRTEE
	Indicators categories and subcategories															
<b>Environmental</b>																
<b>Operational performance indicators</b>	1	1	1	1	1	1	1	1			1	1	1	1	1	1
Materials	1	1	1	1	1	1	1				1	1	1	1	1	1
Energy	1	1	1	1	1	1	1	1			1	1		1	1	1
Services supporting the organization’s operations	1	1	1	1	1	1						1		1	1	
Physical facilities and equipment	1	1	1	1	1	1						1		1		
Supply and delivery	1		1								1	1	1	1	1	1
Products	1	1	1	1	1	1					1	1	1	1	1	1
Services provided by the organization	1	1	1	1	1						1	1			1	1
Emissions	1	1	1	1	1	1	1	1			1	1	1	1	1	1
Effluents	1	1	1	1	1	1	1				1	1	1	1	1	1
Wastes	1	1	1	1	1	1	1	1			1	1	1	1	1	1
<b>Management performance indicators</b>	1	1	1	1	1	1					1	1		1	1	1
Compliance with laws and regulations	1	1	1	1	1	1					1	1		1	1	1
Environmental targets			1		1	1						1		1		
Environmental management practices			1		1	1						1		1	1	1
Environmental expenditures	1	1	1	1	1	1						1		1	1	1
<b>Environmental condition indicators</b>	1	1	1	1	1	1					1	1		1	1	1
Initiatives	GRI	G2	GRI	G3	ISO	WBCSD	UNEP	WRI	UNISAR	SAIL	ChemE	EC	DEFRA	BMU	JMEEA	NRTEE
Indicators categories and subcategories																
Air				1								1		1		
Water				1								1		1		
Land	1	1	1	1		1					1	1		1	1	1

Flora	1	1	1		1				1	1		1		1	
Fauna	1	1	1		1				1	1		1		1	
Humans			1							1					
Aesthetics, heritage and culture			1							1					
<b>Social</b>															
<b>Suppliers</b>	1	1			1				1						
Purchasing criteria (selection of suppliers)	1								1						
Social performance	1	1							1						
<b>Human resources</b>	1	1		1	1		1	1	1	1		1	1		
Child labour	1	1							1	1					
Forced labour	1	1							1	1					
Occupational safety and health	1	1			1		1	1	1	1		1			
Freedom of association and collective bargaining	1	1					1	1							
Non-discrimination	1	1							1	1					
Disciplinary practices	1								1						
Working hours				1					1						
Security	1	1					1								
Indigenous rights	1	1													
Training and education	1	1					1			1		1			
Satisfaction															
<b>Customers</b>	1	1			1										
Product information and labels	1	1													
Marketing communications	1	1													
Satisfaction	1	1													
<b>Public (community)</b>	1	1	1		1		1		1	1		1	1		
Public (community) relations	1	1					1		1	1					
Stakeholder dialogue									1	1		1	1		
Recognition and awards	1				1										
<b>Economic</b>															
<b>Financial</b>	1	1	1	1	1		1		1				1		
Incomes	1	1		1			1		1				1		
Outcomes	1	1		1	1				1				1		
Financial result				1					1						
Gross margin				1					1						
Value added				1					1						
Taxes	1						1		1						
Donations	1	1			1		1		1				1		
Investments	1	1		1					1						
Assets and liabilities				1	1										
<b>Socio-economic</b>															
Socio-efficiency															
<b>Eco-economic</b>				1			1							1	
Eco-efficiency				1			1							1	
<b>Total (categories)</b>	8	8	5	6	8	1	5	1	7	5	1	5	7	3	1
<b>Total (subcategories)</b>	38	33	21	20	20	5	13	9	29	25	6	21	19	14	5

Table 3. Sustainability indicators categories and subcategories frequency of occurrence in the analysed initiatives

Indicators categories and subcategories	Frequency of occurrence [-]	Frequency of occurrence [%]
<b>Environmental</b>		
<b>Operational performance indicators</b>	14	93
Materials	13	87
Energy	13	87
Services supporting the organization's operations	8	53
Physical facilities and equipment	7	47
Supply and delivery	8	53
Products	11	73
Services provided by the organization	8	53
Emissions	14	93
Effluents	13	87
Wastes	14	93
<b>Management performance indicators</b>	10	67
Compliance with laws and regulations	9	60
Indicators categories and subcategories	Frequency of occurrence [-]	Frequency of occurrence [%]
Environmental targets	4	27
Environmental management practices	6	40
Environmental expenditures	9	60
<b>Environmental condition indicators</b>	10	67
Air	3	20
Water	3	20

Land	9	60
Flora	8	53
Fauna	8	53
Humans	2	13
Aesthetics, heritage and culture	2	13
<b>Social</b>		
<b>Suppliers</b>	4	27
<b>Social</b>		
<b>Suppliers</b>	4	27
Purchasing criteria (selection of suppliers)	2	13
Social performance	3	20
<b>Human resources</b>	10	67
Child labour	4	27
Forced labour	4	27
Occupational safety and health	8	53
Freedom of association and collective bargaining	4	27
Non-discrimination	4	27
Disciplinary practices	2	13
Working hours	2	13
Remuneration	3	20
Workforce, management systems and diversity	7	47
Security	3	20
Indigenous rights	2	13
Training and education	5	33
Satisfaction	0	0
<b>Customers</b>	3	20
Product information and labels	2	13
Marketing communications	2	13
Satisfaction	2	13
<b>Public (community)</b>	9	60
Public (community) relations	5	33
Stakeholder dialogue	4	27
Recognition and awards	2	13
<b>Economic</b>		
<b>Financial</b>	8	53
Incomes	6	40
Outcomes	6	40
Financial result	2	13
Gross margin	2	13
Value added	2	13
Taxes	3	20
Donations	6	40
Investments	4	27
Assets and liabilities	2	13
<b>Socio-economic</b>	0	0
Socio-efficiency	0	0
<b>Eco-economic</b>	3	20
Eco-efficiency	3	20

Table 4. Analysis of the GRI reporting frameworks and sustainability indicators usage by the top 100 industrial enterprises

Environmental						Social						Economic											
GRI-G2 (2002)			GRI-G3 (2006)			GRI-G2 (2002)			GRI-G3 (2006)			GRI-G2 (2002)			GRI-G3 (2006)								
I	Type	IE	I	Type	CI	I	Type	IE	I	Type	CI	I	Type	IE	I	Type	CI						
EN1	C	Q1	24	EN1	C	Q1	EN1 <sup>0</sup>	LA1	C	Q1	57	LA1	C	Q1	LA1 <sup>0</sup>	EC1	C	Q1	82	EC1	C	Q1	EC1 <sup>0</sup>
EN2	C	Q1	8	EN2	C	Q1	EN2 <sup>1</sup>	LA2	C	Q1	34	LA2	C	Q1	LA2 <sup>0</sup>	EC2	C	Q1+2	61	EC2	C	Q1/2	...
EN3	C	Q1	71	EN3	C	Q1	EN3 <sup>0</sup>	LA3	C	Q1	25	LA3	A	Q2	LA12 <sup>1</sup>	EC3	C	Q1	46	EC3	C	Q1	
EN4	C	Q1	27	EN4	C	Q1	EN4 <sup>0</sup>	LA4	C	Q2	36	LA4	C	Q1	LA3 <sup>0</sup>	EC4	C	Q1	1	EC4	C	Q1	EC9 <sup>0</sup>
EN5	C	Q1	65	EN5	A	Q1		LA5	C	Q2	63	LA5	C	Q1		EC5	C	Q1	38	EC5	A	Q1	
EN6	C	Q1+2	8	EN6	A	Q1+2	EN17 <sup>1</sup>	LA6	C	Q1+2	17	LA6	A	Q1	LA13 <sup>1</sup>	EC6	C	Q1	57	EC6	C	Q1+2	
Environmental						Social						Economic											
GRI-G2 (2002)			GRI-G3 (2006)			GRI-G2 (2002)			GRI-G3 (2006)			GRI-G2 (2002)			GRI-G3 (2006)								
I	Type	IE	I	Type	CI	I	Type	IE	I	Type	CI	I	Type	IE	I	Type	CI						
EN7	C	Q2	10	EN7	A	Q1+2		LA7	C	Q1	78	LA7	C	Q1	LA7 <sup>0</sup>	EC7	C	Q1	29	EC7	C	Q1+2	
EN8	C	Q1	73	EN8	C	Q1	EN5 <sup>1</sup>	LA8	C	Q2	39	LA8	C	Q2		EC8	C	Q1	42	EC8	C	Q2	EC12 <sup>0</sup>
EN9	C	Q1	13	EN9	A	Q2	EN20 <sup>0</sup>	LA9	C	Q1	27	LA9	A	Q2	LA15 <sup>0</sup>	EC9	C	Q1	6	EC9	A	Q1+2	EC13 <sup>0</sup>
EN10	C	Q1	62	EN10	A	Q1	EN22 <sup>0</sup>	LA10	C	Q2	73	LA10	C	Q1	LA9 <sup>0</sup>	EC10	C	Q1	59				

EN11	C	Q1	61	EN11	C	Q1+2	EN6 <sup>0</sup>	LA11	C	Q1+2	66	LA11	A	Q2	LA16 <sup>0</sup> LA17 <sup>0</sup>	EC11	A	Q2	4					
EN12	C	Q1	48	EN12	C	Q2	EN7 <sup>0</sup>	LA12	A	Q2	56	LA12	A	Q1		EC12	A	Q1	1					
EN13	C	Q1	25	EN13	A	Q2	EN26 <sup>1</sup>	LA13	A	Q1/2	10	LA13	C	Q1+2	LA11 <sup>0</sup>	EC13	A	Q2	18					
EN14	C	Q2	45	EN14	A	Q2		LA14	A	Q2	12	LA14	C	Q1										
EN15	C	Q1	24	EN15	A	Q1	EN28 <sup>0</sup>	LA15	A	Q1+2	5	HR1	C	Q1	HR2 <sup>1</sup>									
EN16	C	Q1+2	35	EN16	C	Q1	EN8 <sup>0</sup>	LA16	A	Q2	19	HR2	C	Q1	HR2 <sup>1</sup>									
EN17	A	Q2	51	EN17	C	Q1	EN30 <sup>0</sup>	LA17	A	Q2	65	HR3	A	Q1	HR8 <sup>1</sup>									
EN18	A	Q1	2	EN18	A	Q1+2		HR1	C	Q2	73	HR4	C	Q1+2	HR4 <sup>1</sup>									
EN19	A	Q1	2	EN19	C	Q1	EN9 <sup>0</sup>	HR2	C	Q2	59	HR5	C	Q2	HR5 <sup>1</sup>									
EN20	A	Q1	1	EN20	C	Q1	EN10 <sup>0</sup>	HR3	C	Q2	56	HR6	C	Q2	HR6 <sup>1</sup>									
EN21	A	Q2	3	EN21	C	Q1	EN12 <sup>1</sup>	HR4	C	Q2	64	HR7	C	Q2	HR7 <sup>1</sup>									
EN22	A	Q1	10	EN22	C	Q1	EN11 <sup>0</sup>	HR5	C	Q2	44	HR8	A	Q1/2	HR11 <sup>1</sup>									
EN23	A	Q1	4	EN23	C	Q1	EN13 <sup>0</sup>	HR6	C	Q2	52	HR9	A	Q1+2	HR12 <sup>1</sup>									
EN24	A	Q1	1	EN24	A	Q1	EN31 <sup>0</sup>	HR7	C	Q2	49	SO1	C	Q2	SO1 <sup>1</sup>									
EN25	A	Q2	1	EN25	A	Q1+2	EN32 <sup>0</sup>	HR8	A	Q2	27	SO2	C	Q1	SO2 <sup>1</sup>									
EN26	A	Q2	1	EN26	C	Q2		HR9	A	Q2	28	SO3	C	Q1	SO2 <sup>1</sup>									
EN27	A	Q2	35	EN27	C	Q1	EN15 <sup>0</sup>	HR10	A	Q2	42	SO4	C	Q2	SO2 <sup>1</sup>									
EN28	A	Q1	0	EN28	C	Q1	EN16 <sup>0</sup>	HR11	A	Q2	6	SO5	C	Q2	SO3 <sup>0</sup>									
EN29	A	Q2	3	EN29	A	Q1+2	EN34 <sup>1</sup>	HR12	A	Q2	19	SO6	A	Q1	SO5 <sup>0</sup>									
EN30	A	Q1	21	EN30	A	Q1	EN35 <sup>0</sup>	HR13	A	Q2	0	SO7	A	Q1	SO6 <sup>1</sup>									
EN31	A	Q1	39					HR14	A	Q1	2	SO8	C	Q1										
EN32	A	Q2	0					SO1	C	Q2	76	PR1	C	Q1+2	PR1 <sup>1</sup>									
EN33	A	Q2	55					SO2	C	Q2	55	PR2	A	Q1+2	PR4 <sup>1</sup>									
EN34	A	Q2	31					SO3	C	Q2	31	PR3	C	Q1+2	PR2 <sup>1</sup>									
EN35	A	Q1	42					SO4	A	Q2	49	PR4	A	Q1+2	PR7 <sup>0</sup>									
								SO5	A	Q1	13	PR5	A	Q1+2	PR8 <sup>0</sup>									
								SO6	A	Q2	5	PR6	C	Q2	PR9 <sup>1</sup>									
								SO7	A	Q2	25	PR7	A	Q1	PR10 <sup>1</sup>									
								PR1	C	Q2	55	PR8	A	Q1	PR11 <sup>0</sup>									
								PR2	C	Q2	28	PR9	C	Q1										
								PR3	C	Q2	35													
								PR4	A	Q1	1													
								PR5	A	Q1	0													
								PR6	A	Q2	16													
								PR7	A	Q1	0													
								PR8	A	Q1+2	40													
								PR9	A	Q2	15													
								PR10	A	Q1	0													
								PR11	A	Q1	0													

**Notes:** GRI-G2 (2002) – GRI framework version 2002 (see [2]); GRI-G3 (2006) – GRI framework version 2006 (see [3]); I – indicator; C – core; A – additional; Q1 – quantitative; Q2 – qualitative; Q1+2 – with quantitative and qualitative character; Q1/2 – with quantitative or qualitative character; IE - % of the top 100 industrial enterprises using this indicator in their reports, concerning sustainability issues; CI – corresponding indicator from GRI-G2; <sup>0</sup> – without revision or with non-significant revision; <sup>1</sup> – with revision.

Generalising the data presented till now [1, 20], it is visible that:

- 85 of the top 100 industrial enterprises have published data about indicators concerning all sustainability dimensions, 89 – about social and economic, and 74 are part of the GRI corporate register.
- There are few countries and sectors which are outlined against the others according to the number of industrial enterprises among the top 100 and consequently are influencing the average data – USA, Japan, Germany and France together have 65 % share; Petroleum Refining, Motor Vehicles & Parts, Electronics, Electrical Equipment – 49 % share.
- There are some indicators, which are really widely used and there are some, which are really rarely used.
- 52 of the top 100 industrial enterprises have a score over the average for environmental dimension, 60 – for social, 48 – for economic, 59 – for sustainability but only 29 – for all three together.
- 62 of the top 100 industrial enterprises report the most widespread quantitative indicators (greenhouse gas emissions; standard injury, lost day, absentee rates, number of work-related fatalities; net sales), which represent also the most widespread indicators from each dimension of sustainability – all together.
- The average scores represent 25,74 % from the maximum score for the environmental dimension, 33,61 % – for social, 34,15 % – for economic, and 30,85 % – for all three.
- Half of these which haven't report sustainability data haven't published useful reports in English, and the others are US enterprises, mostly from aerospace and defence sector.
- The old GRI framework consists of 97 indicators (35 environmental, 49 social, 13 economic) and the new one – 79 indicators (30 environmental, 40 social, 9 economic), so there is 18,56 % reduction of the number of indicators but the weight of the different sustainability dimensions is the same.
- The old GRI framework consists of 50 core and 47 additional indicators and the new one – 49 core and 30 additional, so there is reduction of the number of additional indicators.

– The old GRI framework consists of 44 quantitative indicators, 45 qualitative, 7 with quantitative and qualitative character, and 1 with quantitative or qualitative character and the new one – 43 quantitative, 17 qualitative, 17 with quantitative and qualitative character, and 2 with quantitative or qualitative character, so there is substantial reduction of the number of qualitative indicators.

– The top 10 environmental indicators (according to the usage by the top 100 industrial enterprises) consist of 7 core and 7 quantitative, the top 10 social indicators consist of 9 core and 3 with quantitative character, the top 10 economic indicators consist of 9 core and 9 with quantitative character, so in the practice of the leading industrial enterprises there is an accent on core and quantitative indicators.

– Most of the core indicators have quantitative character (except the social ones in the old GRI version).

– There are 5 core and quantitative environmental indicators, 3 core and with quantitative character social indicators, 4 core and with quantitative character economic indicators which are used by more than a half of the top 100 industrial enterprises, so there are enough quantitative indicators with potential for benchmarking study among the top 100 industrial enterprises.

*Table 5. Top 6 indicators in each sustainability dimension according to their usage by the top 100 industrial enterprises*

Indicators	IE
<b>Environmental</b>	
Greenhouse gas emissions	73
Direct energy use	71
Total water use	65
NO <sub>x</sub> , SO <sub>x</sub> , and other significant air emissions	62
Total amount of waste	61
Performance of suppliers relative to environmental components	55
<b>Social</b>	
Standard injury, lost day, and absentee rates and number of work-related fatalities	78
Description of policies to manage impacts on communities in areas affected by activities	76
Description of equal opportunity policies or programmes	73
Description of policies, guidelines, corporate structure, and procedures to deal with all aspects of human rights	73
Composition of senior management and corporate governance bodies (including the board of directors), including female/ male ratio and other indicators of diversity as culturally appropriate	66
Specific policies and programmes for skills management or for lifelong learning	65
<b>Economic</b>	
Net sales	82
Geographic breakdown of markets	61
Donations to community, civil society, and other groups broken down in terms of cash and in-kind donations per type of group	59
Distributions to providers of capital	57
Cost of all goods, materials, and services purchased	46
Total sum of taxes	42

Table 6 offers an exemplary set of 10 sustainability indicators for industrial enterprise performance measurement, evaluation and control. It is based on Tables 3 and 4 and the rule 2:2:1 for inclusion of environmental, social and economic indicators. It represents the first 4 environmental indicators, the first 4 social indicators, and the first 2 economic indicators according to the average result from Tables 3 and 4. This means that for ranking is used AR:

$$AR = \frac{(IE + FO)}{2}, \quad (1)$$

where *AR* – average result; *IE* – % of the top 100 industrial enterprises using this indicator in their reports, concerning sustainability issues; *FO* – frequency of occurrence of the indicator subcategory in %.

This approach gives equal weight to theory and practice. The rule 2:2:1 is drawn, using Table 1, having in mind that there are 21 environmental, 21 social and 11 economic subcategories and it is close to GRI rule 3:4:1. Table 6 consists of 8 quantitative and 2 qualitative indicators, all of them – core indicators according to GRI description. It includes only indicators with *AR* > 50 %. All this reflects the contemporary trends. It has to be mentioned that some of these indicators are in fact group of indicators because they include more than one indicator in their content. Therefore, Table 6 offers more than 10 single indicators. This is more than enough to start sustainable performance measurement, evaluation and control in industrial enterprise without experience in this field and give focus for the efforts in industrial enterprise with previous experience.

*Table 6. Exemplary set of sustainability indicators for industrial enterprise performance measurement, evaluation and control*

Indicators	IE	FO	AR
<b>Environmental</b>			
Greenhouse gas emissions	73	93	83
Direct energy use	71	87	79
NO <sub>x</sub> , SO <sub>x</sub> , and other significant air emissions	62	93	78
Total amount of waste	61	93	77
<b>Social</b>			
Standard injury, lost day, and absentee rates and number of work-related fatalities	78	53	66
Description of equal opportunity policies or programmes	73	47	60

Practices on recording and notification of occupational accidents and diseases	63	53	58
Diversity measures	66	47	57
<b>Economic</b>			
Net sales	82	40	61
Donations	59	40	50

**Using sustainability indicators for multi-criteria evaluation – some ways for data processing and visualisation.** In a situation of growing multidimensionality, a multi-criteria evaluation is vital. There are different approaches to do such an evaluation but they have their advantages and disadvantages.

The weighted sum method provides a possibility for alternatives ranking according to one composite index, formed on the base of criteria evaluation and importance coefficients (see formula (2)). Disadvantages of this approach are its time and resource consumption for expert opinions collection and processing, certain subjectivity, and compensability (existence of trade-offs):

$$SI_k = \sum_{j=1}^n N_{kI_j} w_{I_j}, \tag{2}$$

where  $SI_k$  – composite rating of alternative  $k$ ;  $n$  – number of indicators;  $N_{kI_j}$  – normalised performance of alternative  $k$  according to

indicator  $j (I_j); j = 1 \dots n$ ;  $w_{I_j}$  – weight attached to  $I_j$ , with  $\sum_{j=1}^n w_{I_j} = 1$  and  $w_{I_j} \in [0;1]$ .

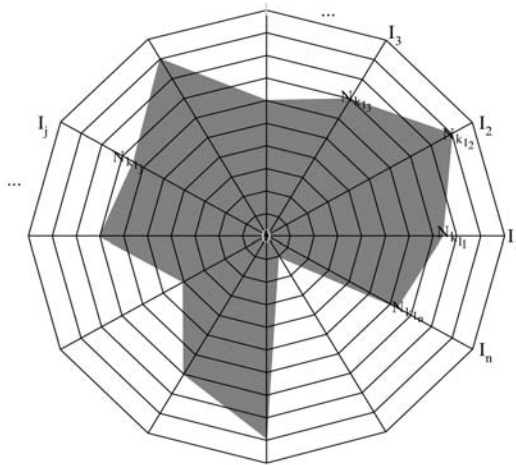


Fig. 1. Spider web diagram

The spider web diagram (Fig. 1) provides a possibility for graphic interpretation of the results, which facilitates the benchmarking process, strengths and weaknesses identification, and alternatives comparison. For this aim, it is necessary to start with data normalisation.

In case of using «distance from the best and worst performers» technique, for data normalisation is used formula (3):

$$N_{kI_j} = \begin{cases} \frac{P_{kI_j} - P_{\min I_k}}{P_{\max I_j} - P_{\min I_j}}, & \text{if } I_j \text{ is better to go up;} \\ \frac{P_{kI_j} - P_{\min I_j}}{P_{\max I_j} - P_{\min I_j}}, & \text{if } I_j \text{ is better to go down,} \end{cases} \tag{3}$$

where  $N_{kI_j}$  – normalised performance of alternative  $k$  according to indicator  $j (I_j)$ ,  $N_{kI_j} \in [0;1]$ ;  $P_{kI_j}$  – performance of alternative  $k$  according to indicator  $j$  ( $I_j$ );

$$P_{\min I_j} = \min_k (P_{kI_j}, k = 1 \dots s); P_{\max I_j} = \max_k (P_{kI_j}, k = 1 \dots s); s - \text{number of alternatives.}$$

In case of using «distance from the group leader» technique, for data normalisation is used formula (4):

$$N_{kI_j} = \begin{cases} \frac{P_{kI_j}}{P_{\max I_j}}, & \text{if } I_j \text{ is better to go up;} \\ \frac{P_{\min I_j}}{P_{kI_j}}, & \text{if } I_j \text{ is better to go down.} \end{cases} \tag{4}$$

It is possible, by multiplying with certain coefficient, to change the scale from [0; 1] to more precise (for example – with coefficient 100 to [0; 100]).

Covered area calculation forms a composite index, which provides a possibility for alternatives ranking according to one single criterion:

$$S_k = \frac{1}{2} \sin\left(\frac{2\pi}{n}\right) \left( N_{kI_1} N_{kI_n} + \sum_{j=1}^{n-1} N_{kI_j} N_{kI_{j+1}} \right), \tag{5}$$

where  $S_k$  – surface of the figure for alternative  $k$ ;  $n$  – number of indicators;  $N_{kI_j}$  – normalised performance of alternative  $k$  according to indicator  $j (I_j), j = 1 \dots n$ .

In case of such a visualisation, the bigger is the surface, the better. Certain disadvantage in this case is the indicators equal weight, which is not always desired. The surface calculation does not give an idea to what extent there is balance in performance as well. The centre of gravity determination can give an idea for this.



An alternative is to put the indicators in order (Fig. 2): these, for which is better to go up are grouped upper and those, for which is better to go down – below:

$$N_{kI_j} = \frac{P_{kI_j} - P_{\min I_j}}{P_{\max I_j} - P_{\min I_j}}; \quad (6)$$

$$N_{kI_j} = \frac{P_{kI_j}}{P_{\max I_j}}. \quad (7)$$

In this case, for data normalisation with «distance from the best and worst performers» technique is used formula (6) and in case of using «distance from the group leader» technique – formula (7). The bigger is the surface of the upper figure (the darker part in Fig. 2) and the smaller is the surface of the figure below (the lighter part in Fig. 2), the better.

**Conclusion.** The first part of this report presents: sustainability indicators categorisation as a result from a deep literature study; coverage check of well-recognised international reporting schemes in the sustainability area; sustainability indicators categories and subcategories frequency of occurrence; results from profound empirical research and analysis of trends, and etc. Thus, step-by-step, is built the base for sustainable performance measurement, evaluation and control.

The second part presents some alternatives for multi-criteria evaluation, putting attention on one of the possible ways to reach a good visualisation together with good analytical opportunities (the well-known “spider web diagram”). This type of diagram is really powerful because it makes easy to detect the problem areas. And it is not so difficult to construct it. You just need to choose the proper normalisation technique first. For the aims of this research, two different techniques are presented – “distance from the best and worst performers” and “distance from the group leader”. Both of them consist of different formulae for different types of indicators – one for these, which is better to grow, and another one for those, which is not. It is mentioned that there is also another way to cope with this direction problem and this is illustrated with alternative diagram – so called «wheel». At the end, to upgrade its analytical opportunities, a proposal for building a composite index is made. The idea is to calculate the covered area from the analysed alternative. It is easy obtainable and offers further possibility for ranking of alternatives. The problem here is how to ensure the balance between different indicators. It is not one and the same where exactly lies the figure. One possible solution is to take into account the centre of gravity as well.

This report has to be seen as an expression of sustained efforts, which span research work in Technical University - Sofia, Università degli Studi di Genova, and Technical University - Dresden, as well as a result of pursuing more holistic approach in analysis of industrial enterprise and its surroundings, led by a strong belief in sustainability.

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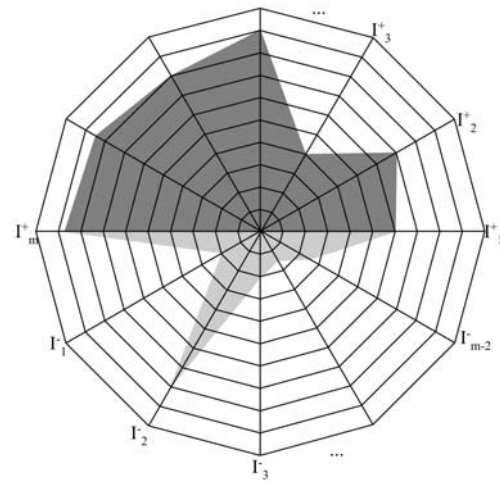


Fig. 2. Alternative spider web diagram

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## ДОСЛІДЖЕННЯ БАГАТОКРИТЕРІАЛЬНОЇ ЗАДАЧІ

### МЕТОДОМ «СУПЕРЦІЛІ»

*Вивчається метод «суперцілі» для розв'язування багатокритеріальних задач. Наведено приклад розв'язання лінійної та нелінійної задач вказаним методом.*

*Following article is devoted to method of «super purpose» research for the multicriteria problems decision. Decision examples of a linear and nonlinear problem by mentioned method are given.*

**Ключові слова:** багатокритеріальна задача, метод «суперцілі», нелінійна задача.

**Вступ.** Ефективність великомасштабних, складних економічних операцій, що зачіпають різноманітні інтереси їх організаторів і суспільства в цілому, не може бути повністю охарактеризована за допомогою одного-єдиного показника ефективності  $F(x)$ . Такі задачі дослідження операцій називаються багатокритеріальними, в яких існує ряд кількісних показників  $F_1(x)$ ,  $F_2(x)$ , ..., одні з яких бажано перетворити в максимум, інші в мінімум [1–9].

**Постановка завдання.** Наведемо постановку завдання, яке знаходить застосування у плануванні рекламної діяльності оператора мобільного зв'язку. Оператор мобільного зв'язку планує запустити три нові акції. Рекламу цих акцій можна замовити на телебаченні, радіо, у газеті. У табл. 1 вказано ціни на рекламу відповідно по кожній акції. Необхідно зазначити, що на рекламу акції 1 виділено 7 тис. грн, на рекламу акції 2 – 18 тис. грн, на рекламу акції 3 – 15 тис. грн. Максимальний прибуток також можна отримати, якщо відмовитися від однієї реклами на телебаченні і вдвічі збільшити кількість реклам на радіо та втричі в газеті.

Таблиця 1

	Акція 1	Акція 1	Акція 1	Прибуток
Радіо	5	3	1	1
Телебачення	4	6	5	2
Газета	3	4	9	2,5

Позначимо  $x_i \geq 0$ ,  $i = \overline{1,3}$  кількість замовлень відповідної рекламної продукції. Запишемо економіко-математичну модель:

$$5x_1 + 3x_2 + x_3 \leq 7; \quad (1)$$

$$4x_1 + 6x_2 + 5x_3 \leq 18; \quad (2)$$

$$3x_1 + 4x_2 + 9x_3 \leq 15; \quad (3)$$