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## **BENCHMARKING TOOLS TO IMPLEMENT CONCEPT OF CLEANER PRODUCTION IN ECONOMIC ACTIVITY**

**Abstract.** The article analyzes the methods that are useful when conducting environmental benchmarking initiated to implement cleaner production. The relevance of this research due to the fact that environmental benchmarking is a new phenomenon for Ukrainian society, therefore, it is important to understand specifics of implementation of this process at work. The result of the implementation of cleaner production depends on choosing the correct methodological basis for environmental benchmarking. We paid attention to the definition of “environmental benchmarking”, substantiated its importance in the implementation of environmentally friendly production, gave sample list of methods that can be used for this implementation and analyzed their contents.

**Keywords:** benchmarking, clean production, method.

**Actuality of theme.** The vast majority of species of economic activity causes negative effects on the environment, exacerbated by the consumption of basic natural resources and raw materials, and the creation of waste. Corporate culture of production and consumption in Ukraine leads to waste almost 90% of primary resources used. According to various indicators annually 700 to 800 mln tons of waste is produced in Ukraine. The total volume of accumulated wastes in Ukraine reaches 30 billion tons, including harmful (toxic) – 2.9 bln tons<sup>1</sup>. Rational use of resources and implementation of ecologically clean production methods are topical issues today and the success of economic development and the state of environment depend on them. Environmental benchmarking is one of the most important contemporary tool of the analysis of experience in the field of ecologically clean production, the use of which allows: to reduce significantly the temporal scope of implementation of new ideas, to visualize a lot of factors within the existing approaches to solving this problem, with high probability to minimize the possibility of future mistakes in reforming production system and gradually simulate any structural changes. Supportive benchmarking process, in turn, is the basic framework for comparative activity and occupies a key place in its process, given the fact that the true choice of the methodological framework for benchmarking process largely determines the axiological side of research. Unfortunately, in Ukraine the agreement on the possibility of using this tool in enterprises has not reached, and the lack of consolidation of the term in national regulations is the evidence. The small number of scientific studies on the subject affects the lack of resolution of this issue in some way.

**Analysis of recent research.** Research of environmental benchmarking is lit in the works of these scholars: N. Andreeva, M. Bartolomeo, B. Burkinskyi, A. Ball, T. Volfmann, A. Ebinhaus, F. Zekeli, F. Ranhyeri, S. Harichkov, etc .

**The purpose of the article.** The purpose of the article is the research of the content of definition “environmental benchmarking” and analysis of the methodological support of environmental benchmarking as tools for implementing ecologically clean production.

**Presenting main material.** The origin of the concept of benchmarking is associated with the activities of Japanese experts late 50s who visited the leading companies in the USA and Western Europe to study and further use of their experience.

It should be noted that in the late 1960s in the Soviet Union the signs of benchmarking at the national level are also observed. Thus, in the resolution of the USSR Council of Ministers “On improvement of training the managers and workers of industry, building, construction, transport, communications and trade” on June 6, 1967 the systematic study of the latest achievements of domestic and foreign science and technology, effective methods of planning and economic incentives, scientific organization of labor and management with

<sup>1</sup> Андреева, Н., Харичков С. (2010). Экологически чистое производство: институциональные предпосылки, пути и механизмы их активизации в Украине. *Экономист*, 10, 25.

the use of computer technology, mechanization and automation of production processes and a wide sharing of best scientific, technical and production experience were identified as the main areas. The very same term “benchmarking” appeared in 1972 at Cambridge Institute of Strategic Planning (USA)<sup>2</sup>.

Although the term “environmental benchmarking” as himself “benchmarking” is new to Ukraine, it has got his recognition at the international level. Proof of this is the international standard ISO / TR 14062: 2002 “Management of the environment. Environmental aspects, which are taken into account in the design and product development.” In accordance with paragraph. 8.3.3. of this standard, environmental benchmarking is the measurement of properties of products which related to the environmental impact throughout the product life cycle. Measurements can be made relative to the baseline of the previous products or similar products of the competitors. Properties which are measured can be: power consumption when operating mode or standby; application materials: materials to supply the main categories of components used in the production; analysis of package: package mass ratio by weight of products and volume of packaged products to volume production; transportation distance; the number of potentially dangerous substances; the number of devices required for dismantling and other properties<sup>3</sup>.

In the scientific community the term “environmental benchmarking” was investigated and analyzed mainly by foreign scientists. T. Volfmann, A. Ebynhaus and F. Zekeli determine this definition as a process that accompanies any business, and is a structured approach to careful study and comparison of products on its impact on the environment. The objective of environmental benchmarking, according to scientists, is the comparison and evaluation of products, which will result in a greater performance of the company and reduce the impact on the environment<sup>4</sup>.

Italian scientists M. Bartolomeo and F. Ranheri believe that environmental benchmarking is a method of environmental management, which plays an important role in the fight against environmental pollution due to shortcomings in the work of the company by comparing actual and target level and production conditions. The object of benchmarking, in their view, might be the projects of some manufacturing processes, other organizations, countries<sup>5</sup>.

Thus, the contents of benchmarking is choosing the best exemplary of similar production to borrow installed elements of the manufacturing process and implementing them in their own enterprise.

The criteria that will choose the best production includes the long-term success; quantitatively and qualitatively measurable results of performance; external recognition of positive results; innovation; significance at a certain level and other indicators.

It should be noted that the implementation of environmental benchmarking should focus on those processes that as a result of detailed analysis are considered imperfect and are critically important for the enterprise development. For example, a company wants to reduce the amount of waste generated by the production to comply with the limits on volumes of generation of waste and disposal, but the measures used in the manufacture impede the achievement of the goal. In this case, it is advisable to use developments of more successful entrepreneurs in this area.

Environmentally friendly production provides the possibility of production of goods and services with minimal impact the environment. It is not only an environmental strategy, but does not deny and prevent the development of any human activity. Its main purpose is to introduce the conceptual foundations of the strategy in the field of environmental management and environmental protection, and their practical implementation for sustainable economic and social development of the country<sup>6</sup>. Effective environmental benchmarking is the process that provides the possible introduction of environmentally friendly production, and therefore sustainable economic development of the country. The success of the process of environmental benchmarking depends on:

1. The content, i.e. it should exercise a positive dynamic influence on the object of analysis, leading to higher quality products and reducing its cost.

<sup>2</sup> Кравченко, О.В. (2008). Можливості застосування бенчмаркінгу як інструмента активізації управління підприємством. *Соц.-ек.проблеми сучас.періоду України*, 6(74), 102-103.

<sup>3</sup> ISO / TR 14062 (2002). *Environmental management – integrating environmental aspects into product design and development*. Switzerland.

<sup>4</sup> Szekely, F., Vollmann, T., Ebbinghaus, A. (1996). *Environmental benchmarking. Becoming green and competitive*. Business and the Environment – Practitioner Series, Stanley Thornes Ltd, Cheltenham, 12.

<sup>5</sup> Bartolomeo, M., Ranghieri, F. (1999). Environmental Benchmarking in Italy. *International environmental management benchmarks: best practice experiences from America, Japan and Europ*, Springer, 197.

<sup>6</sup> Буркинський, Б. (2006). Екологічно чисте виробництво. Наукові засади впровадження та розвитку. *Вісн. НАН України*, 5, 11-17.

2. High degree of clarity of objects to compare;
3. Analysis of problematic issues related to implementation of borrowed strategies regarding the development of the object of study;
4. The presence of the economic and legal possibilities for modifications, improvements, development of the manufacturing processes;
5. Obtaining the evidence of new ideas borrowed from other information sources<sup>7</sup>.

The process of implementation of the environmental benchmarking can be divided into the following stages: defining problematic economic and environmental phases of the production; the selection of analysis object; the determination of analysis level (internal or external); in the case of external benchmarking, the selection of contractor-reference models; choice of methods of analysis; information retrieval; analysis and research of the information; the comparison of the results of development with its own achievements and implementation in the study area; implementation of information in its own production in case of obtaining progressive economic and environmental elements.

In the process of environmental benchmarking is important to understand that the achievement of the result depends on the characteristics chosen for comparison. Thus, the production, which is the best in using the resources in its processes, can lose regarding environmental chosen raw materials and quantities of toxic waste. Qualitative structural and comprehensive analysis is important because of fact that the work on implementation of ecologically friendly production certainly affects several areas simultaneously. That is, the analysis of only one component of the manufacturing process cannot result in the achievement of the aim. Thus, the very important factor in carrying out the benchmarking in order to implement environmental friendly production is the election of a clear and structured system for analysis. Unsystematic, or unprofessional acts in carrying out the benchmarking will cause to obtain false results and in turn will determine the potential possibility for adverse changes in the facility recipient of the studied parameters. In view of the threat defined above, it is appropriate to structure the known approaches to the analysis of work of the institutions within the cleaner production:

– SWOT-analysis (Strengths, Weaknesses, Opportunities, Threats) – is one of the advanced types of analysis, which provides a structured approach and visualizes the obtained data by creating a table that includes strengths (bifurcation resistant sides of the institutions, which allow to feel comfortable in a competitive environment), weaknesses (defects in development or structure causing the critical backlog from competitors), the potential opportunities (the potential of institutions in achieving hypothetical purposes), threats (internal or external factors that may harm the institution). These four areas are structured according two principles: vector (internal – the strengths, weaknesses; external (potential opportunities, threats)) and actions (positive – strengths, potential opportunities; negative - weaknesses, threats). In addition, it is agreed to provide: production activity (volume, quality and quantity of production, its energy, production technologies, ecologic factor, etc.), marketing (pricing, cost of production, market segment occupied, trademarks and brands, etc.), management an enterprise (administrative structure, hierarchy and coordination, competence of staff, etc.), finances (production liquidity, profitability, costs and production cycle analysis, economic strategy etc.), supply (external relations for the supply of means of production, dependence on external supplies and raw material storage, etc.), personnel (staff experience, personnel policy, a mechanism of permanent professional growth, labor conditions, staff “migration”, etc.), customer relationships (customer base, dynamic in customer changes, quality assurance, warranty, customer promotion methods, etc.), innovative activity (cost analysis on innovation, factor efficiency of the already implemented innovations, the cost of retraining the staff that interact with innovative implementation, etc.) as basic facilities for the analysis in the internal environment of the studied institutions. In the environment: economic factors (economic environment, market climate, the forms of market relations regulations (indicative, imperative, free market economy)), factors of environment (environmental factors that affect the functioning of the institution), legislative factors (factors of the existing legal environment, which regulates the relations in the area of implementing the institution economic interests), competition factors (relationship of competition – fair and unfair competition (cartel agreements, dumping, industrial espionage, etc.), the relations between competing institutions at the market, etc.), scientific and technical factors (factors of scientific and technical world, the impact of scientific and technological revolution on the institution, innovations that are available for the institution, etc.), consumer factors (the factors of product consumption through the prism of the law of supply and demand ).

<sup>7</sup> Bolli A., Emtairah T. (2001). Environmental benchmarking for local authorities: from concept to practice. *Environmental issues report. January*. EEA, Copenhagen.

– PEST-analysis (Political – political factors, Economic – economic factors, Social – social factors, Technological – technical factors). This method of analysis has only external vector of direction, leaving aside the analysis of the internal environment. PEST-analysis is also called environmental analysis of institutions that designed to create a basic picture of the environmental situation of the institution.

– STEEPLEG-analysis (Social – Social factors, Technological – technical factors, Economic – economic factors, Environmental – environmental factors, Political – political factors, Legislative – normative factors, Ethnic – ethnic factors, Geographical – geographic factors). In fact, this method of analysis is broader in content than PEST-analysis and introduces promising areas to the analytical framework as the analysis of regulatory factors (description of the legal framework of the institution, taking into account the regulatory and security standards of the state where institution leads its activity), ethnic factors (factors related to grouping people by ideological, language, cultural, customary, traditional, axiological, religious and other reasons, which leads to some unity in choosing certain products, providing benefits to some services and categorical rejection of some products), geographical factors (in this case it is not a purely geographical features, but the geopolitical features, which largely determine the external environment of the enterprise).

– SNW-analysis (Strengths v strengths, Neutral – neutral side, Weaknesses – weak). The above method of analysis is the subject of the internal environment of the institution and visualizes: strengths (unconditioned strengths – those that are treated in every situation as an advantage of the institution; situationally-strengths – those that can be considered an advantage only under certain conditions; randomly-strengths – those that can, at a certain awareness, to be used by competitors for the purpose of causing harm); neutral side (amorphous sides – those that by their inability cause impossibility of their positioning; permanent side – those that exist in terms of traditions and are not the object of analysis in view of the adoption of the entire community institutions; bifurcation point – those that mediate the presence of stability in relations with both positive and negative tones, latent sides – those that are hidden from analysis and are determined in the approximate percentage of relationships that are not analyzed by the subject of analysis in the context of the entire spectrum of relations, which is taken as 100%); weaknesses (unconditioned weaknesses – those that are unconditional weaknesses of the institution and cause harm to it; situationally – weak – those that are weak in some situations, pseudo weaknesses – those that are used by the institution for the purpose of braking processes of galloping development, braking of the processes of market monopolization (if it is directly prohibited by regulations), etc.).

– Porter five forces analysis (Porter's five forces analysis). According to this method of analysis, it is proposed to investigate in the relationship the following areas of market conditions, in order to develop a successful strategy for promoting ecological product: analysis of competition (number of competitors, their share of the market, the cost of advertising the product, the limit of the successful "input" into the market, etc.), analysis of threat of substitute products (quantity and quality of substitute products, the propensity of consumers to change product, price correlation analysis of basic product and substitute products, etc.), analysis of threats due to new actors at the market (regulatory barriers to entry the market (licenses, permits), access to distribution, etc.), bargaining power of suppliers (raw materials, the dynamics of growth of prices, raw material market monopolization, etc.), bargaining power of customers (number of customers, prioritize of consumers, consumer demand for the products offered and the dynamics of change).

– ABB (Activity Based Budgeting) – involves analyzing activity of institution as budget planning. The objects of analysis in this case are: estimates, staffing of expenditures, tax records, etc.).

– ABC (Activity Based Costing) – is entirely the process of analyzing of production costs formation, spending on it and structuring of pricing policies on components.

– ABM (Activity Based Management) – analysis of efficiency of institution management through the prism of human relations. Attention is also paid to economic and market positions for promoting products to the market.

– ARP (Activity Resource Planning) – analysis of the effectiveness of the use of raw materials required with the compulsory formation of fundamental and promising paths for implementation of existing innovations to shift the consumption of raw materials at a qualitative or quantitative level.

– BPR (Business Process Reengineering) – is the analyze of existing business relationships with institution contractors and must be provided with a large number of promising business ideas to implement, which consists of the change of the contractor, reorientation of production, etc.

– CPI (Continuous Process Improvement) – the analysis of the effectiveness and consequences of innovations in the structure of the analyzed institutions.

– CPN (Color Petri Nets) – «colored Petri net», which involves the creation of a dynamic model of business project, creating an opportunity for prospective imaging of features of the production process implementation in the light of temporal framework.

– DFD (Data Flow Diagrams) – is a visual display of power and fullness of data flows with correlation of subjects studied. Charts, given the scale of single measurements can be superimposed on one another for the full review of the efficiency of information processing in the institution and identifying weak structural units or units with very low real load.

– ERD (Entity-Relationship Diagrams) – analysis of external and internal relations of institution and display them using diagrams. It is used to analyze the efficiency of the administrative structure of the institution and to analyze the presence of overlapping authority. External environment is characterized by using visualization of presence of cross and mutually ties.

– SADT (Structure Analysis and Design Technique) – the analysis of market structures of innovation and technological developments with the prospect of their implementation in institutions of different levels. There is analysis of pricing formation for innovations and determination of the coefficient of efficiency.

– STD (State Transition Diagrams) – analysis of structural changes in the institution according to the temporal feature binding prediction of its future institution development.

– TQM (Total Quality Management) – analysis of the quality management system (products and services).

**Based on the foregoing, the following conclusions:**

1. Environmental Benchmarking is the process of analyzing and comparing the actual and exemplary standards and production conditions for the implementation of successful achievements and the expected environmental and economic results.

2. Environmental benchmarking consists of certain stages, important of which is given to the analysis of the company as their own and selected for the “standard”. Detailed analysis will allow to make comparative characteristics, taking into account all factors that contribute to the implementation of environmentally friendly and economically attractive production.

3. The correctness of the decision in the introduction or maintenance of implementing the results depends on choosing the correct method.

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