

SIX SIGMA AND LEAN MANAGEMENT - IMPORTANT TOOLS OF THE ENVIRONMENTALLY ORIENTED PRODUCT POLICY

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Abstract

Among the major global problems of our civilization belong excessive consumption of natural resources and unprincipled pollution of the environment. The idea that natural resources are infinite and we can utilize them according our unlimited plans, that we can sustainably manage them at both the global and regional level, that economic growth is making progress, that science and technology will resolve all our present and future problems, it is dominant at the part of population. By contrast, the proportion of the population, in turn, radically rejects such an approach to tackling of current environmental problems. The solution is somewhere between these two extremes. The role of the contributing to the sustainable development (SD), and not only from

the perspective of the mankind, but also of all forms of life on this planet, means rethinking our priorities. It is necessary to limit the excessive pollution of the environment, to reduce population growth, particularly in developing countries and to reduce excessive consumption in industrial countries. Super-consumption of industrial countries and under-consumption of developing countries (dialectically associated with oversupply and leeway) is the main source of global instability. A significant trend of the current product policy is to focus on value product strategy, i.e., a continuous process of development of the product programme, based on the category of value for the customer.

Key words:

environment, management, product

Sustainable oriented production and consumption

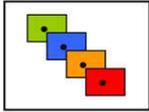
Call for sustainable consumption was delivered already at the Earth Summit in Rio de Janeiro in 1992. Chapter 4- "Changing of consumption patterns" of the document AGENDA 21 contains two programme areas: Sustainable production and consumption patterns, and Development of national policies and strategies conducive to sustainable consumption patterns. Unlike the thoughts of SD focused in particular on the corporate sphere, the sustainable consumption, in particular is the task for consumers – of the individual or the state. It is necessary for consumers to change their buying behaviour. But they are unable to do it by themselves. Sometimes they have a lack of information about how to live in „a more sustainable way of life".

The 6th EU action plan for the environment (6EAP) states that consumers need information which would help them in choosing the products more environmentally friendly in order to positively influence the market as follows. The first EC programme for a consumer protection and information policy is aimed at ensuring adequate information to consumers to enable them to:

- determinate the essential features of the goods and services offered (characteristics, quality, quantity, price);
- implement a rational choice between competing products and services;
- use the product safely and to full customer satisfaction;
- seek compensation for any risk resulting from the delivered goods or services.

Due to the fact that aspects of the environment protection have become increasingly more important role in the area of consumption and consumer policy in the EU there was originated a closer link between environmental and consumer policy. The report "Sustainable Consumption Opportunities – a strategy for bringing about change", prepared by UNEP ROE (Regional Office for Europe), and UNEP DTIE (Division of technology, industry and environment), defines four basic strategies leading to the sustainable consumption:

- effective consumption – theme for industrial sector;
- changed consumption – touches in particular the state sphere;
- responsible consumption – a task for the social and environmental organisations;
- reasonable consumption – to define and optimize consumption.



Environmentally-oriented product policy

Policy for the protection of the environment has started to increasingly implement in developed countries in the 1960s of the 20th century. There have been gradually accepted and amended basic component law regulations (to protect the air, water, nature, to management of wastes and with chemicals, to protect against noise, etc.). The report "Our Common Future" of 1987 of the World Commission on Environment and Development under the leadership of the Norwegian prime minister Gro Harlem Brundtland concerns of heritage which will be left to future generations in case there will continue a devastation of natural resources and natural relations of man with nature. In this report, there is also expressed a doubt as to whether it is possible without substantial changes in the behaviour of human society to ensure its further development. The term "sustainable" or "sustainable development" is then applied to the majority of official documents. Gradually, it began to promote a new approach to the protection and development of the environment.

In 1972 EU presented its 1st Environment Action Programme. Over the years there was expanded the knowledge that environmental policy cannot be restricted solely to the policy of environment relating to investments and waste policy. In the 1970s the first steps have been made in the area of environmental policy applied to products (e.g. reduction of lead in petrol in Germany). The scientific and political discussion slowly moved from the close „end-of-pipe“, or "end-of-life" approach towards a broader, more integrated perspective on the environment. Among the themes there belonged:

- the focus on components: environmental policy is focused mainly on investment and solution of waste, that is focused on the protection of the individual components of the environment (water, air, soil). The means to address the environmental challenges are for example filter technologies which lead to the shifting of environmental problems from one component to another;
- economic efficiency: filtering technologies are costly and subject to cost-progression, i.e. for a certain percentage of environmental improvements there are arising excessive amount costs. In addition, the limit values act for all locations equally, so they are averaging different costs.
- the lack of motivation: the limit values are often fulfilled, and therefore there is no economic incentive to further reduce of emissions;
- shortcomings in the implementation: the whole range of reasonably sounding regulations were limited only on their "paper" form, while occurring large gaps in the implementation of the individual measures in some Member States;
- global challenges: by the globalization of environmental problems there were arisen global challenges of the meantime unknown dimensions (e.g., greenhouse effect, ozone depletion). For this reason, the environmental policy could not be confined to the national horizon any longer.

In practice, there gradually started to implement new environmentally-oriented activities. In the developmental stages of business entities, we can follow different approaches in their environmental orientation, such as:

- minimizing and preventing the emergence of unwanted product (Waste Management);
- protection and security, the prevention of occurrence of damage to the components of the environment (Safety Management);
- quality assurance as an element of competitiveness on the market through a system of quality (QMS); application of technical regulations in the development of an environmental management system (EMS/EMAS);
- integrated management system for quality and environmental protection.

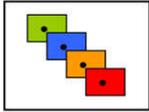
These different trends in environmental policy formulation resulted in two new areas - environmental product policy and environmental policy of the flow of substances. Gradually there has been occurred a change in environmental policy, its principles and tools

In order to promote some fundamental changes in current trends and practices, as well as for the inclusion of all sections of society, in the sense of shared responsibility, it is necessary to use a greater number of tools, while the environmental policy is based on the so called mix of instruments:

- legal instruments,
- market-based instruments - economic and fiscal instruments and voluntary agreements,
- supporting tools – research, information, education, etc.,
- financial instruments.

SIX SIGMA

Six Sigma is one of the powerful business strategies that improves quality initiatives in many industries around the world. It is a company-wide systematic approach to achieving continuous process improvements. [3] It is a method of improving productivity, efficiency and quality of products and services and simply means a measure of quality that strives for near perfection. Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects in any process



– from manufacturing to transactional and from product to service. The aim is producing only 3.4 defects out of every million opportunities for a process [4].

The basis of Six Sigma is a detailed knowledge of customer requirements. These requirements must be translated into specifications (CTQ – Critical To Quality). The successful implementation of Six Sigma next requires stringent application of tools and templates at different stages of the methodology. [3]

The tools and templates applied in the evaluation of six sigma phases can be classified as statistical tools like MSA (Measurement System Analysis), IPO Diagram (Input-process-output), CE (Cause-and-effect diagram), Histogram, Pareto diagram, DMAIC (Define, Measure, Analyze, Improve, Control), Run chart, Control chart, Scatter diagram, Regression Analysis, DOE (Design of Experiments), FMEA (Failure Mode and effect analysis), SOP (Standard Operating Procedure), QFD (Quality Function Deployment). [2]

Furthermore, Six Sigma revolves around a few key concepts:

Unit: A unit is any item that is produced or processed which is liable for measurement or evaluation against predetermined criteria or standards. [1]

Defect: A defect is defined as any part of a product or service that:

- does not meet customer specifications or requirements, or
- causes customer dissatisfaction, or
- does not fulfill the functional or physical requirements. [1]

Opportunities: Simply stated, opportunities are the total number of chances per unit to have a defect.

Defects per unit (DPU) represents the number of defects divided by the number of products.

Defects Per Million Opportunities (DPMO):

$$\text{DPMO} = \frac{\text{Total defects}}{\text{Total opportunities}} * 1\,000\,000$$

Defects (%) is the total number of defects in the percent.

$$\text{Defects} = \frac{\text{Total defects}}{\text{Total opportunities}} * 100 \text{ [%]}$$

Yield is the percentage of a process that is free of defects.

$$\text{Yield} = 100 - \text{Defect percentage} \text{ [%]}$$

For example:

Area: Production of light sources

Customer requirements: Energy saving lamp shall shine more than 8000 hours

CTQ specification: Time of light performance more than 8000 hours

Unit: Energy saving lamp

Opportunity: 500

Defect: 6

$$\text{DPMO} = \frac{6}{500} * 1\,000\,000 = 12\,000$$

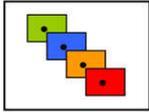
$$\text{Yield} = 100 - 1,2 = 98,8 \text{ [%]}$$

The final step is to look up sigma on a sigma conversion table, using process yield (98,8 %). Process Sigma is equal to 3,76.

LEAN PRODUCTION

Lean management or lean production, often simply "lean", is a systemic method for the elimination of waste in a process. Lean differentiates seven types of waste: defects, overproduction, transportation, waiting, inventory, motion and processing. Lean is related to developments of the product, technical preparation of production, logistics and administration. Lean production influences financial performance through improving organizational processes and cost efficiencies.

The various lean tools taken are 5S, OEE, 8 step Practical Problem Solving (PPS) Method, Pareto Analysis, Elimination of Waste, Kaizen, Setup Time Reduction, Process Mapping, Value Stream Mapping (VSM), Quick & Easy Kaizen, SPC / Control Charting, 5 Whys, Autonomation, Continuous Improvement, Continuous Flow, Visual Controls, Design for Six Sigma (DFSS), Cellular Manufacturing, Production Leveling, KANBAN / Line Balancing, VOC (Voice Of The Customer), Jidoka, ANOVA, Work Standardization, Work Simplification, Fishbone diagrams, Six Sigma, Takt Time, QFD and Poke Yoke / mistake proofing. [5]



Various lean tools are used based on the needs of the industries. The usage of these tools is changing over a period of time and their suitability.

The basic metric of lean is the speed of the process (PLT) and the effective of process (PCE).

Process Lead Time (PLT) is the time from release of a product into a process until its completion.

$$PLT = \frac{WIP}{ER}$$

where:

WIP (Work In Process) - product that is within the boundaries of the process

ER (Exit Rate) - the output of a process over a defined period of time

Process Cycle Efficiency (PCE) is a measure of the relative efficiency in a process. PCE is the performance indicator of how efficiently the process is converting work-in-process into exits. Shows it how much waste is in process.

$$PCE = \frac{VA\ Time}{PLT} * 100\ [%]$$

Where:

VA Time (Value added Efficiency) - the amount of time that value is actually being added to a product (the time that the customer is willing to accept).

The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste. To accomplish this, lean thinking changes the focus of management from optimizing separate technologies, assets, and vertical departments to optimizing the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments to customers.

Environmental policy and value system

Environmental policy is currently being inclined from the side of the problems solutions at the outlet to the problem solving at the inputs, i.e. at the beginning of the economic processes (resources and energy), to the principle of ex ante management evaluation, to a strategy to minimise the consumption and to the value system issues. In the background of this paradigms change, we can distinguish three basic strategies in the context of the environmental oriented product policy:

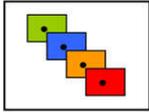
- reduction of the products flow rate – the strategy touches on "flowing amount" of products through technological process. It is directing to the fact that the total quantity of the products used per unit of time goes down. An important role here is played by the issues of consumers behaviour, as well as issues of increased productivity of resources utilization (e.g. the intensification of the use of the product, or extending of the product life).
- change of the product in respect of its characteristics from the point of view of the environment – this includes all kinds of product changes, including the reduction or refund in the product contained dangerous substances, the raw materials used and also the change of technology of production of the product.
- change in the use of and disposing of a product – this strategy refers to the improvement of the commercial characteristics of the product and its disposal after the end of its useful life. In doing so, it is about minimizing environmental burdens throughout the stages of use and to increase its ability to use or recovery.

These various strategies overlap in several cases. They are characterized by their ideal types of environmentally-oriented product strategies. In practice they occur in mixed form, and not all of these strategies is relevant for each product or product group.

Conclusion

The product policy, or policy of products is analysis, planning, implementation and the control of actions (measures, decisions) relating to the product as a marketing tool, for example, the external appearance of a product, product line composition and brand policy formulation, etc. It is part of the marketing mix. It is closely related to the quality policy. To the forefront of strategic considerations of the enterprise product policies there enter in a competitive environment some corporate structural factors which are key determinants of the competition. The success of a business entity is currently based on the philosophy of training and products placing on the market that meet the needs, wishes and demands of consumers, or even just create these needs; the business philosophy is based on finding customers to an existing offer of products on the market.

Strategic decisions of business subjects in terms of competition and globalization of markets require a knowledge of markets, focus on quality, cost reduction and innovations.



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