

Original Research

Quality and Environmental Management Systems in Polish Shipbuilding Industry – Methods of Implementation

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Abstract

Both the assumptions and results of the work carried out within the framework of the research problem “Environmentally Friendly Polish Shipyard Industry” are presented in our work, which is a part of the project “Environmentally Friendly Ships for the Baltic Area” – BALTECOLOGICALSHIP.

The aim of our research was to prepare selected companies belonging to the sector of productive, co-operative and supply shipbuilding industry (c.a. 50) to implement quality (if necessary) and environmental management systems. Swedish standards for implementation processes and experience were used.

The direct results of one year work were that 13 companies finished reports on quality investigation and two companies were led to QMS certification, 26 companies finished reports on environmental investigation (environmental audit) and two companies were EMS certified. The project realization enabled indication of barriers to implementation of quality and environmental management systems, especially in small and medium sized enterprises.

Keywords: environmental management system, ship production, life cycle analysis, ISO 9001, ISO 14001, QMS, EMS, Poland, Sweden.

Introduction

Compatibility, innovation and ability of an enterprise to adapt to changing economical conditions determines now and will determine in the future the strength of the Polish economy as components of the European and global economic systems.

The quality of products produced and delivered to the customer and estimation of influence both of these products and of activity carried out on the environment play a key role in the world free-market economy. Satisfying customer requirements established by a receiver in a con-

tinuous way and achieving intended quality and care of the environment give good economical results. It is not only a single achievement but a repeatability of earlier set quality levels that shows the deliverer to be technically competent. It makes possible to implement product quality assurance systems and environmental protection based on definite principles of quality and environmental management [1, 2].

Inquiries into the years 1994-2001 indicate that of the 90% of Polish enterprises in the maritime sector that implemented quality management systems, the tendency to increase compatibility and to improve company image was the most important motivation for implementing QMS [3].

Moreover, the increasing pressure of legal requirements in the area of environmental protection (Water

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Directive 2000/60/EC, Directive 2003/4/EC on access to information on the environment, Directive 2001/42/EC on the strategic environmental assessment, and other directives) means that companies must also take this aspect into account in their activities.

Due to historical conditions, Polish enterprises have a lot to do in this area.

Such general remarks were the grounds of the project BALTECOLOGICALSHIP, which was realized within the framework of EUREKA program financed by the European Union [4].

The project aim was to create technically advanced, environmentally friendly and cost-effective ships for transportation of liquid, solid and modularized goods in the Baltic Sea and to develop competitive, high quality and cost effective methods for design and production of such ships. The technological and business risk management models were applied and certification procedures for production infrastructure were performed.

The expected results were to design specific types of technically advanced, environmentally friendly and cost-effective ships satisfying requirements of the Baltic Sea area. Such ships would be characterized by lower emissions and smaller amounts of waste, better efficiency in terms of internal space planning, lower level of environmental pollution during the building process and lower cost of building by adaptation of progressive building strategy.

The essential element behind this undertaking is to put modern management as well as quality and environmental inspection systems into effect. In this connection the research committee granted financial resources to “*Environmentally Friendly Polish Shipyard Industry*,” which was realized within the period 01.03.2003 and 31.05.2004 in the Chemical Faculty of Gdańsk University of Technology (GUT).

The analysis of the progress of companies in the field of environmental protection standards fulfilment is required to realize this aim in the process of adaptation to work in European Union free-market conditions. Special attention should be paid to:

- development of program of implementation of changes in companies;
- analysis of existing and future environmental protection law requirements;
- performance of environmental and quality audits;
- proposals and recommendation developments;
- implementation of environmental and quality management systems.

The main aim of increasing the scope of operations within BALTECOLOGICALSHIP was to prepare select Polish companies belonging to the sector of productive, co-operative and delivery shipbuilding industry to obtain ISO 9001 and ISO 14001 certificates. This aim was achieved as a result of the adequate environmental investigations in selected companies, with results analysis and implementation of procedures leading to the certification.

In the time of duration of this project a database for the Polish shipbuilding industry was created; it will permit optimization of ship production costs on the basis of analysis of the product life cycle costs (*LCC*).

The research task realization should result in the following advantages:

1. preparation of select shipbuilding companies to achieve ISO 9001 and 14001 certificates, which are essential to compete in the European Union free-market;
2. improvement in the competitive ability of Polish shipbuilding companies via product and service parameters;
3. obtaining orders for Polish shipyards not only for producing ecological ships but also for deliveries of systems, devices and different parts of ship equipment for foreign contractors;
4. reduction of production/services costs by means of errors and defective product elimination and reduction of material consumption index in production, which makes an increase of prices possible;
5. reduction of influence on environment as well as in payments and financial penalties for environmental use;
6. better possibilities to obtain capital, especially foreign one.

Description of the Work

The main aim of this work was to prepare ca. 50 Polish companies from the shipyard sector for implementation of environmental and quality management systems (EMS and QMS), which could enable them to get ISO 9001 and 14001 certification in the future.

It was implemented within nine tasks presented schematically in Fig. 1 and described below.



Fig. 1. General scheme of the work carried out within the framework of the project.

Preparation

The successive tasks success was dependent on the interest in our project by Polish companies. Therefore the preparation stage was important and included:

- finding appropriate people to realize project tasks (experts, consultants, etc.);
- preparation of a database of Polish shipyard industry sector companies and cooperating enterprises;
- preparing a promotion program, whose aim was to invite companies to participate in the project;
- information and recruitment campaigns among companies;
- visiting the companies interested in the project and meeting with top managers;
- making an agreement between these companies and GUT;
- analyzing information

IT Platform

This subtask was carried out by the Swedish company Centercom AB. The intention of the task was to create an IT platform for collection and presentation of data that could be used for LCA/LCC analysis of ship production processes. All participating companies were presented in the test module that was used for communication.

Compilation of Training Program

The education program with documentation and presentation materials and a guideline for environmental investigations were produced within this subtask. They included:

- seminar presentation and workshop materials;
- Power Point presentation for top management meetings;
- the Polish version of the Swedish handbook of Environmental Investigation (CD and book) together with excel files: 1) Inventory – enabling inventory of inputs and outputs; 2) FMEA (Failure Mode Effect Analysis) enabling estimation of significant aspects [5];
- the handbook of implementation of ISO 9001:2000 standard;
- analysis of foreseen trends in changes of environmental law (resulting from Poland's accession to the EU) relating to changes in the shipbuilding industry.

Internal Training Conference

The Polish and Swedish experts finalized the education seminar presentation of material and documentation for the participants at an international training conference in Poland. The objective of this conference was to finalize all paperwork included and to train each other in how to use the material in order to get a standardized training program for all groups of trainees.

Compilation of Polish Laws

Requirement according to ISO 14001 standard was, that companies that wanted to be certified had to fulfil the environmental laws in the country of operation. An executive summary of Polish laws was available as a basis for environmental investigations. The Polish side prepared such documents in the way given by Swedish partners.

Environmental Investigation

This subtask was the largest part of the project. It was run between March 2003 and May 2004. 37 invited companies were divided into four groups and they started:

- a one week education seminar for each group (1-3 persons per company);
- after the seminar each company, with the assistance of experts, started to collect data according to the guideline for environmental investigation and to check the list for quality investigation (if necessary). In addition, they prepared documentation and set up internal procedures to form the basis for ISO 9001 or ISO 14001 handbook in the company as needed for certification;
- one week study tour in Sweden;

Companies which ended their work in the project prepared environmental reports with executive summary and quality reports (if quality investigation was performed) with assistance of experts. After finalizing this work, a quality management system was implemented in two companies according to ISO 9001:2001 standard and in two other companies an environmental management system was implemented according to ISO 14001 standard.

Results

After more than 300 invitations had been sent, different types of problems appeared during contact with companies. The most important were:

- all companies stressed the generally difficult economic situation in Poland and particularly in their company (they were focusing on finding contracts).
- top management did not see a connection between an environmental management system and market position (it should be stressed that top managers in Poland generally have poor knowledge of EMS).
- implementation of ISO 14001 is connected with spending money without profit; it is not seen as an investment in the future;
- little knowledge of environmental management systems;
- majority of companies lacked appropriate specialists (environmental specialists with good practice and knowledge), who could advocate for environmental and quality management.

Ultimately, 50 companies answered positively to organizers and after negotiation 37 companies decided to participate in the project.

A short characteristic of the project participants is presented below to give a picture of our work. Distribution of these companies according to their size was as follows: big companies – 27%, medium – 24%, small – 49%. Nearly all large Polish shipyards participated in our project (Szczecin Shipyard NOWA, North Shipyard, Gdańsk Shipyard, Naval Shipyard, Shipyard Gdynia).

Almost all big companies had a quality management system and 50% of big companies started to implement EMS. However, 60% of small and medium companies did not had any management systems. The companies informed generally that they needed environmental managers with good practice and experience. Small companies needed additional money to employ such persons.

The project described here was the source of support for companies involved only during the first step of ISO 14001 and if necessary the ISO 9001 implementation process, but from the psychological point of view this first step was very important.

The appropriate motivation of top management and transfer of knowledge accompanied by assistance in the first stages of system build-up makes the position of employees responsible for the process comfortable. The share of duties in the field of implementation of ISO

14001 between company, experts and certification body is schematically presented in Fig. 2. In the project, obligatory, individual meetings of top management authorities took place. The studies indicate [3] that the main motivation of implementation of management systems is inspiration of a firm's top management. Therefore. this task was important.

The top management meetings were a chance to change the attitudes of management toward implementation of EMS, which was directed exclusively to obtain the certificate. It also helped to change the declared participation in implementation process into active operations giving higher importance to problems of environment protection [6].

During this project persons responsible for EMS implementation in companies:

- received optimal amounts of theoretical knowledge not only on economic activity influences on the environment but also on the activity of global effects such as global warming, acid rain and the ozone hole;
- received legal requirements compendium in force in the country;
- were acquainted with ISO 14001 standard requirements [2];
- carried out an environmental audit (environmental investigation) accompanied by a consultant and under his control, on the basis of guidebook, co-operating with other people in company;
- did their training in Swedish companies.

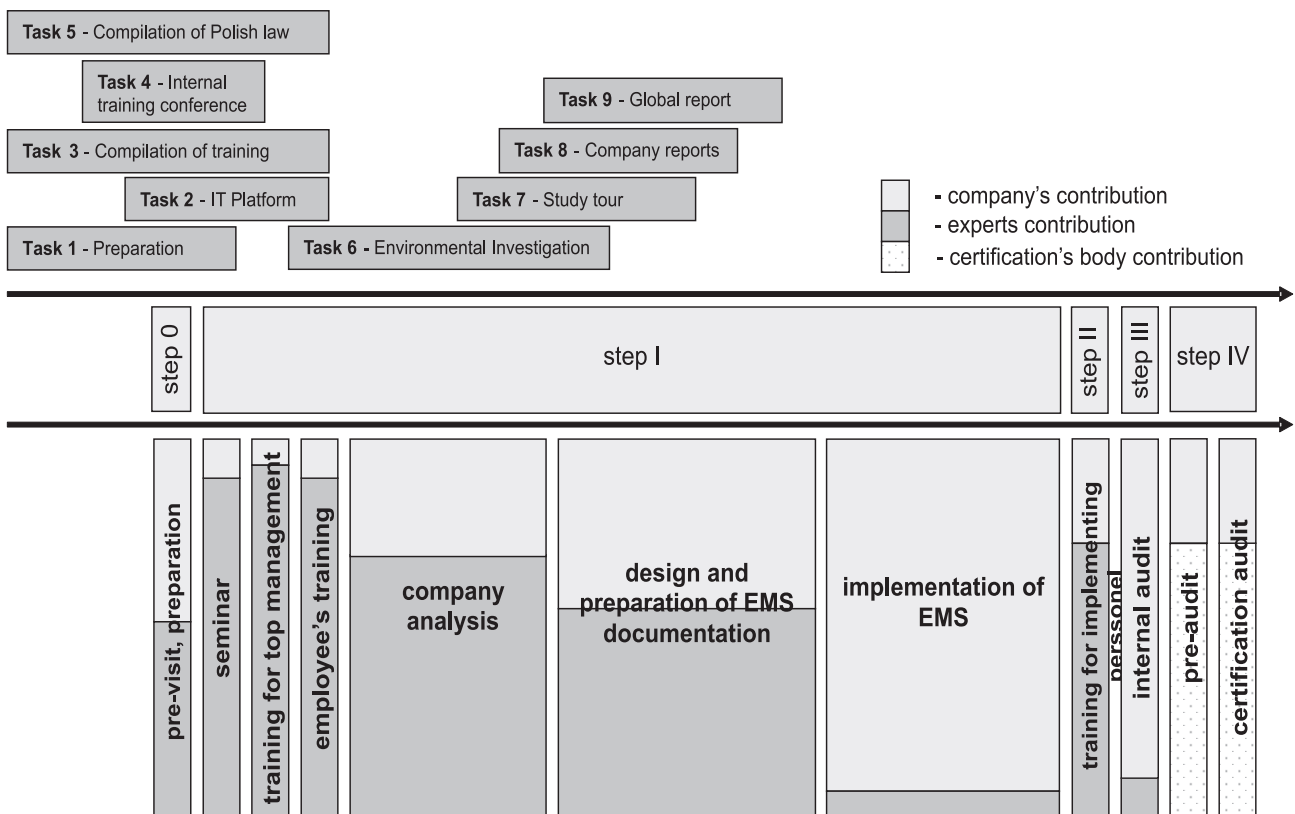


Fig. 2. Share of duties in the process of implementing of ISO 14001 between company, experts and certification body.

In each case environmental investigation was finalized by a comprehensive report. In order to quantify the magnitude, resource consumptions and emissions were calculated using one measure of environmental impact only *i.e.* ELU (Environmental Load Units). Following these calculations a failure mode and effect analysis on the basis of resource consumption, emissions, waste, accident risks etc., were made.

In addition, the companies prepared executive summaries, which included the following problems:

- area of activity and policy of the company;
- methodology;
- company environmental aspects;
- dangerous materials and substances;
- measurement of environment indexes;
- proposed improvements (routine administrative activities and technical activities).

The direct results of our project are as follows:

- companies worked for 25,000 man-hours within quality and environmental management systems;
- 13 companies finished reports on quality investigation and two companies were led to certification;
- 26 companies finished reports on environmental investigation (environmental audit) and two companies were led to certification (there were different reasons why not all 37 companies completed the project);
- 5 companies declared implementation of EMS in 2005 and certification of the system, other companies would use EMS without certification;
- about 45 persons received new levels of competence in their areas, giving them better positions in the job market.

Indirect effects are first of all:

- increase in pro-ecological consciousness and environmental management principles and increased knowledge of managerial personnel;
- to enable companies proxies of environmental management to establish cooperation and to exchange experiences as a result of participation in the project;
- increase in interest of possibilities of getting resources for proecological activities;
- better consciousness of proecological law and trends in its change in the area of shipyard industry connected with access to the EU;

and in further prospects:

- resulting from EMS system implementation advantages such as costs and payment reduction, accordance with law rules, easier access to credits, better competition abilities,
- the realization of this project resulted in a new proposal aimed at informing managers of the largest number of Small and Medium-Sized Enterprises (SMEs) resulting from their implementation;
- environmental condition improvement.

Further project results are:

- carrying out research in the field of new instruments used within the framework of environmental management and finishing it with an attempt to work out standards to do a Life Cycle Assessment (Analysis) of the ship (LCA);
- formation of the data base concerning Polish companies working within the framework of the shipyard in-

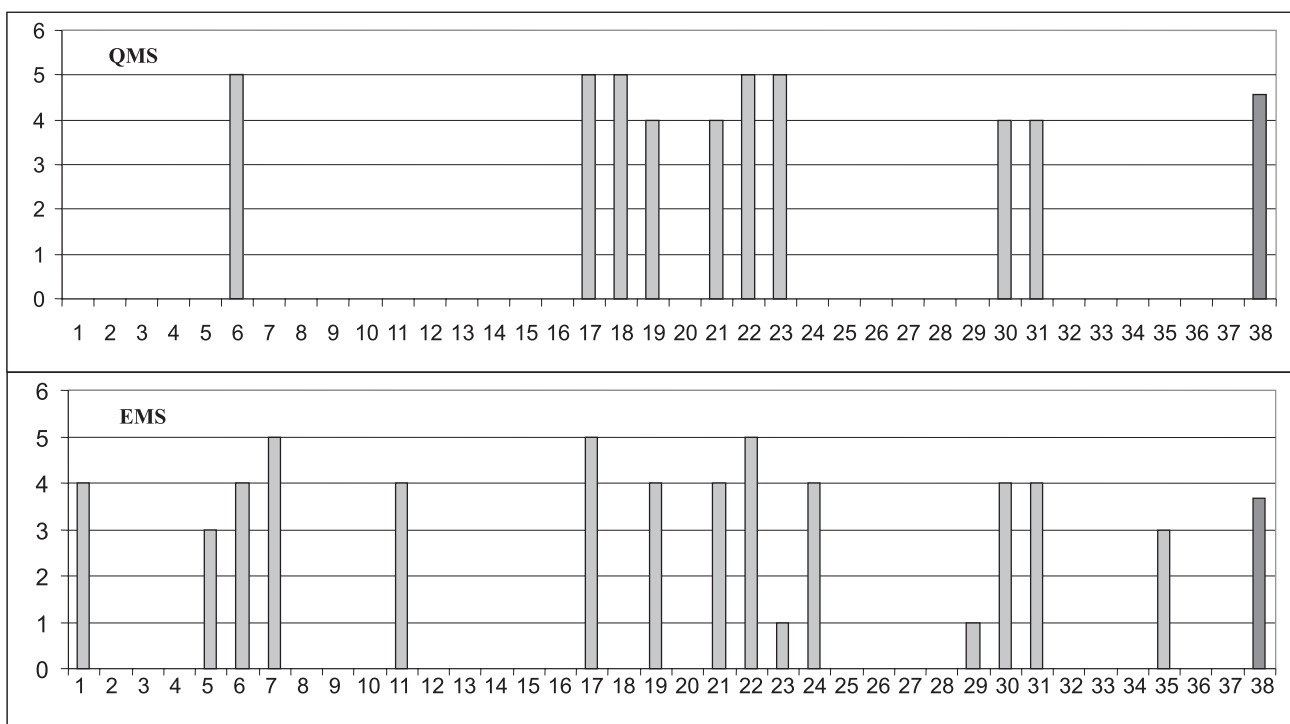


Fig. 3. Possibility of implementation of QMS and EMS in companies participating in the project – on the basis of the opinion of managers (0 – lack of possibility, 5 – high probability of implementation, * – average value).

Table 1. Suggested directions of further work in the field of research task.

Aim to achieve	Suggested actions
Increase of environmental consciousness level among decision-makers and Polish management personnel.	It is suggested to create the individual training system for <i>top management</i> in the field of general environmental knowledge, balanced development ideas, tools used in environmental management and advantages resulting from EMS implementation.
To enable companies to employ specialists (for example, graduates of specialization “Environmental Protection” and “Environmental Protection Technologies” run at the Department of Chemistry of the Gdańsk University of Technology) on the position of proxies for environment.	“Graduate” program support.
<ul style="list-style-type: none"> ▪ To enable students to study the realities of the work of Polish company (carrying out of audits within the confines of tutorials), ▪ Training of proper personnel in the field of: <ul style="list-style-type: none"> – development of new tools, – improvement of ecological conditions. 	Starting the project, which could be a collaboration between university and industry in the field of EMS implementation and also could help to solve ecological problems worrying Polish companies.

dustry (on the strength of environmental audit results), which will be the future basis for the further research on Life Cycle Analysis of the ship (LCA) [7, 8];

- to enable students of the Gdańsk University of Technology, Chemical Faculty, within “*Environmental Audits and Influence on Environment Estimation*,” not only to acquaint with Swedish standards of carrying out environmental audits but also to participate actively in environmental inspections realized within this project.

The opinions of managers participating in the project concerning the changes in their knowledge in the field of EMS and QMS before and at the end of the project are also presented. Evaluation of the results was conducted on the basis of satisfaction questionnaires filled out by companies after project completion.

Generally managers started with not quite a bad level of knowledge in the field of QMS, and assessment of their knowledge after the project grew by one unit.

Knowledge of EMS was generally not satisfactory (average estimation of their knowledge by managers was of about 1.5 marks in a 5-mark range), but after the project it grew by two units.

Estimation of the possibility of implementation of EMS and QMS by managers in given companies are presented in Fig. 3. A lot of companies declared that after participation in the project they had enough knowledge to implement EMS by themselves.

The above opinion confirms that the ways of working established in this program are correct, though this opinion is a subjective one.

At the end of the project a special survey between managers who participated in implementation of ISO 14001 had been carried out. They had been asked to evaluate the quality of work of the group of consultants. Histograms presented in Fig. 4 confirm the high quality of their work.

Summary

The research realization and the investigations conducted can be the basis for the following conclusions:

- there is great diversification of management systems among Polish companies;

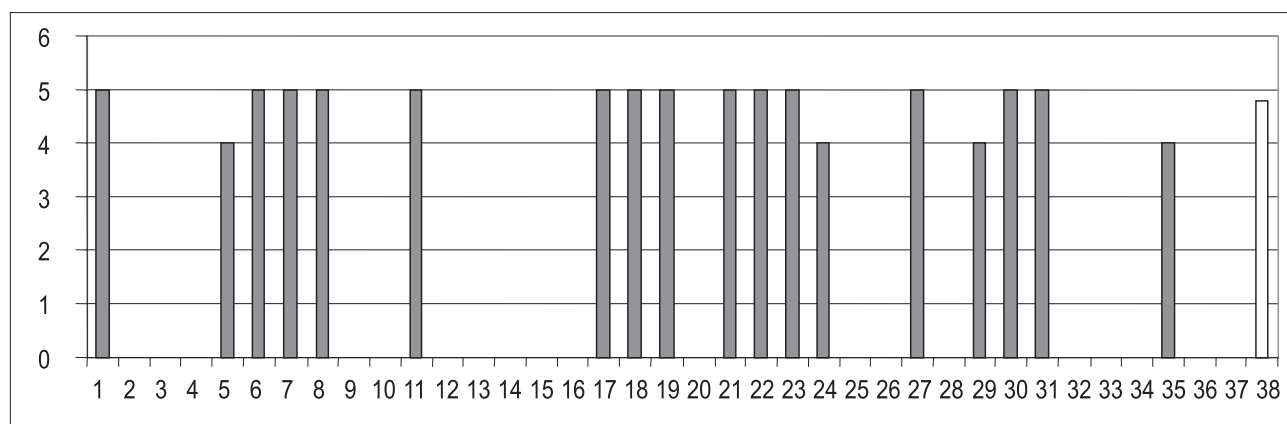


Fig. 4. Results of evaluation of the work of consultants by managers participating in the project (0 – negative, 5 – high appreciation, * – average value).

- generally low ecological consciousness both among top managers and managerial teams;
- poor knowledge of laws concerning environmental protection;
- lack of wages budgeted for salaries of environmental protection proxies;
- lack of knowledge of benefits resulting from implementation of EMS;
- poor knowledge of possibilities for obtaining extra funds for pro-ecological investments.

Members of the team taking part in the present research are convinced that these investigations should be continued.

Suggested directions of future research and results, which could be achieved consequently with this projects continuation are presented in Table 1.

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List of Acronyms

QMS – Quality Management System
 EMS – Environmental Management System
 FMEA – Failure Mode Effect Analysis
 ELU – Environmental Load Unit
 LCA – Life Cycle Assessment (Analysis)
 LCC – Life Cycle Cost
 GUT – Gdańsk University of Technology

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