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The role of environmental management system on introduction of new technologies in the metal and chemical/paper/plastics industries

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Abstract

Pollution prevention with the use of modern cleaner technologies in industrial sectors is the cornerstone of successful environmental policy certified according to the requirements of the international standard ISO 14001. The analyses were performed with the objective of assessing general aspects of technology modernisation as a result of the ISO 14001 certification in industrial enterprises in order to develop a better understanding whether the ISO 14001 certification can accelerate initiatives for the adoption of new and cleaner technologies within the certified firms on one hand, and, on the other hand, to find out to what extent it helped to upgrade their environmental performance. The research was performed within Slovene metal and chemical (including pharmaceuticals, paper and plastics) manufacturing companies with an additional emphasis on firms which are committed to implementing the IPPC directive. In general, certified enterprises consider ISO 14001 as a very useful tool in promoting and adopting new cleaner technologies. ISO 14001 seems to be particularly important to create better conditions for the technology changes in companies which are committed to the IPPC Directive. Companies in chemical and related industries, to a much higher extent, used predominantly modified technologies to diminish their environmental impacts, while companies in metal industries, to a higher extent, used a combination of existing and new technologies after ISO 14001 certification. It seems that better environmental performance is associated with higher productivity in ISO 14001 certified firms.

Keywords: Environmental management system; ISO 14001; Certification; Metal industry; Chemical industry

1. Introduction

The industry as well as other economic branches are constantly faced with more and more stringent environmental legislation and market pressures. Under such conditions companies have to raise the question whether their present technologies and products will also be acceptable in the future and find new opportunities according to sustainable development requirements. On the other hand, the ability of some companies to exploit the environmental issue as a competitive advantage has changed efficient pollution prevention into an opportunity to improve production process performance by means of new cleaner technologies as well as by making product modifications. Moreover, firms have to define environmental problems as their own responsibilities which could not be ignored because otherwise they will threaten their long-term existence.

Normally, a newer technology is cleaner since there is a continuous development among equipment suppliers also in the environmental field. The important role of technology in reducing environmental impacts of industrial activities is also emphasized on the international level, for instance, through the United Nations Environmental Programme (UNEP), which brought in the concept of Cleaner Production.

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This is an approach to environmental management which is designed to encourage new processes, products and services which are cleaner and more resource-efficient [1]. It emphasizes a preventive approach to environmental management taking into account impacts over the whole life cycle of products and services. Cleaner production, thus, requires responsible environmental management and evaluating technology options. Cleaner production is achieved by upgrading technology, process changes and process modifications, substitution of input materials, good operating practices (good housekeeping), on-site reuse and recycling and/or product redesign. The importance of technology in industrial pollution prevention was recognized earlier by Organization for Economic Cooperation and Development (OECD) as well, which defined clean (or cleaner) technologies as: *'Technologies that extract and use natural resources as efficiently as possible in all stages of their lives; that generate products with reduced or no potentially harmful components; that minimise releases to air, water and soil during fabrication and use of the product; and that produce durable products which can be recovered or recycled as far as possible; output is achieved with as little energy input as is possible'* [2]. Another similar term in use is 'Environmentally Sound Technologies' (EST). These are usually meant as the technologies that have the potential for significantly improved environmental performance relative to other technologies. They protect the environment, are less polluting, use resources in a sustainable manner, recycle more of their wastes and products, and handle the residual wastes in a more environmentally acceptable way than the technologies for which they are substitutes. ESTs are not just individual technologies. In a wider term, they also cover end-of-pipe technologies [3]. Recently, the European Commission adopted the Environmental Technology Action Plan in order to improve the development of environmental technologies and to overcome existing barriers of their wider use [4]. No matter what concept or term is used, it is a clear trend that the role of new technologies is becoming more and more important in the global economy. The percentage of cleaner technology investments across industry has been shown to differ substantially in the European Union (EU) [2]. The investments in individual countries are influenced by a range of factors, including the sectoral composition of industry (affecting the scope of the investment), different regulatory measures in force, particularly with regard to the emphasis on end-of-the-pipe versus cleaner technologies, age of process plants, and the availability of the technologies, to mention only a few. Most of the new EU member states spend more on traditional end-of-the-pipe technologies than on cleaner (process integrated) technologies [2].

In 1996, the EU adopted the Directive 96/61/EC concerning integrated pollution prevention and control, the IPPC Directive. The purpose of the IPPC Directive is to achieve integrated prevention and control of pollution arising from certain activities and to reach a high level of protection of the environment as a whole. All impacts on the environment have to be taken into consideration, i.e. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, risk management, etc. This means that in addition to the integrated control of emissions to air, water and soil, the IPPC Directive requires consideration of energy efficiencies, use of raw materials, off-site waste disposal and site restoration. The directive introduces a system for issuing integrated environmental permits and a concept of Best Available Techniques (BAT), and lists industrial activities that are obliged to obtain integrated permits. It is one of the key environmental directives in the industrial sector in the EU. It also stimulates the introduction of modern cleaner technologies as well as continuous improvements of industrial processes and products. Hence, the IPPC Directive is an important driver for the diffusion and implementation of newer cleaner technologies.

Many modifications on technologies and different technology substitutions were performed to avoid environmental pollution in different industrial branches [5–7]. In addition, Kemp [8] classified environmental technologies into three groups. The first one, pollution control technologies, prevent the direct release of hazardous emissions into the air, waters, or soil (end-of-the-pipe technologies). The second, off-site recycling and waste treatment technologies include treatment of effluent in collective waste waters treatment plants, the clean up of polluted soils, and the upgrading of solid wastes. The third category is comprised of the so called process-integrated changes in production technologies, input material changes, and good housekeeping which are all focused on reducing the amounts of pollutants and wastes generated during production. The purpose of the process-integrated technologies is to eliminate or reduce the creation of waste *within* the production process.

However, technologies alone cannot be a guarantee for assuring a firm's environmental as well as economical effectiveness, in the long run. Additional tools and practices led by top management commitment must be introduced with a well defined environmental policy as a prerequisite for successful firm's environmental performance. One such tool is environmental management system (EMS) certified according to the requirements of international standard ISO 14001. Among different aspects, ISO 14001 requires the organization to establish an appropriate environmental policy, identify the environmental aspects as a result of the organization's past, present or future activities, products and services, identify priorities and set appropriate environmental objectives and targets, and facilitate planning, control, monitoring, preventive and correction actions to minimize the impacts on the environment. Reference to pollution prevention in ISO 14001 is given by the demand that the environmental policy of a company shall contain the commitment to continuous improvements in terms of reduced environmental impacts. In order to achieve such goals, EMS should encourage organizations to consider the implementation of the best available technology, where appropriate and where economically viable, and that the cost-effectiveness of such techniques is fully taken into account, as stated in ISO 14001 itself [9]. This means that ISO 14001 and technology changes (especially in manufacturing companies) became closely linked and interdependent [10]. Cagno et al. [11] showed, on the basis of the study which included over