

# The quantitative eco-efficiency measurement for small and medium enterprise: a case study of wooden toy industry

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**Abstract** Eco-efficiency is a tool for the analysis of the sustainability of industries, which indicates the economic relationship and environmental impact. This research presents the development of eco-efficiency indicators for quantitative measurement of the wooden toy industry, as well as the raw material suppliers who are a part of the supply chain. The eco-efficiency of the wooden toy industry was measured by using the key indicators of the three axes of sustainable development, which are (i) economic indicator: net sale and gross margin, (ii) environmental indicator: material, energy, water consumption, waste disposal, and (iii) social indicator: frequency rate of accidents, local employment, and corporate social responsibility. Moreover, the combined eco-efficiency evaluation of the supplier and company showed that the company's eco-efficiency has likely increased during 2 years of observation, while the eco-efficiency of the supplier-company combination has decreased. The evaluation of socio-economic efficiency results showed that the company has acquired a socially supportive management system at the company level, community level, and social level. This research can contribute to the improvement of the resource and process efficiencies in economic, environmental, and social dimensions. It can also provide a basic framework on

eco-efficiency evaluation for the small and medium enterprises in Thailand, which will feed into policy and strategic development.

**Keywords** Eco-efficiency · Socio-economic efficiency · Small and medium enterprise · Economic indicator · Environmental indicator · Social indicator · Supplier

## Introduction

Currently, capitalism under globalization has played an important role in the strategic development of countries, including Thailand. The invention of manufacturing processes and competition in production responding to human needs have caused the deterioration of natural resources and environment (Charmondusit and Keartpakpraek 2011). The economic development, growth of industry, and urban development have occurred all over the world. In the future, these situations are likely to increase as a result of technological developments and economic growth in the industry. The consequential impact is unavoidable, and it will take effect directly on the ecosystem. The impact on one system will have a chain reaction-type effect on other systems, because every system is linked. Pollution results from the consumption of materials in production and transportation, including waste emissions from industrial processes. These are a main cause of the environmental problems. Therefore, multiple parties have jointly attempted to resolve the issue. In the past, the proposed solutions to pollution problems, such as using new technology to treat the waste before emitting it into ecological and environmental systems, etc., did not hit the mark. On the contrary, those "solutions" adversely increased the production costs and product prices. Meanwhile, companies of

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