IDENTIFICATION AND REALIZATION OF CHANGING TECHNICAL EFFICIENCY BASED ON PATH-CONVERGED DESIGN

JUYING ZENG[1], BING XU[1,*] AND JUNZO WATADA[2]

[1]Research Institute of Quantitative Economics
Zhejiang Gongshang University
No. 149, Jiaogong Road, Hangzhou 310035, P. R. China
riverzjy@yahoo.com.cn; *Corresponding author: bingxu0@yahoo.com.cn

[2]Graduate School of Information, Production & Systems
Waseda University
2-7 Hibikino, Wakamatsu, Kita-Kyushu 08-0135, Japan
junzo.watada@gmail.com

ABSTRACT. *Most of previous researches have been presented to compute and analyze technical efficiency from economics and statistics perspectives. However, none of any application-based research to realize technical efficiency from management engineering perspective was found in literatures. This paper establishes an innovative Path-converged design technique not only to identify technical efficiency but also to realize technical progress in different regions. The FDI path identifies technical level increasing trend in Eastern region and declining trend in both Middle and Western regions in China during 1996-2005. TFP growth is mainly attributed to technical progress rather than efficiency improvement in both Eastern and Middle regions. Most importantly, the innovative realizations of technical progress are obtained in Middle and Western provinces with more than 0.8 and 0.65 times of national GDP per capita, respectively.*
Keywords: Path-converged design, Technical progress, Efficiency improvement

1. **Introduction.** Since Farrell's [9] pioneering research on production efficiency, various studies have computed and analyzed technical efficiency from economics and mathematics perspectives, while no application-based studies were found in previous literatures to realize technical efficiency from an engineering perspective. Because the production frontier surface, the standard method in existing measurements of DEA [3,4,9] and SFA [6,14,20], can not be observed [7] and it is hard to control the variables and isolate the relations to identify an unknown underlying production function.

The measure of technical efficiency is usually referred to as Total Factor Productivity (TFP) in "Solow" residual model. In previous frameworks of DEA and SFA, productivity growth is decomposed into technical progress and efficiency improvement. Whether the productivity growth attributes to technical progress or efficiency improvement in a region or industry has been the focus of both theoretical researches and governmental decision-makers.

Murakami [21] demonstrated the entry of foreign-owned firms has a positive effect on the productivity of local firms in Japan as a result of technology spillovers in the long run. Fare et al. [8] found that productivity growth is generally achieved through technical progress, and the efficiency change negatively contributes to productivity growth for Taiwanese manufacturing. However, Cook and Uchida [5] found that efficiency improvement dominates technical progress in developing countries. Kim and Park [13] showed both domestic and foreign R & D played an important role in increasing efficiency and