Abstract—The purpose of this paper is to investigate the total factor productivity growth performance of selected Malaysian listed companies with reference to adoption and adaptation of technology. To do this, we utilize the linear programming based operations research technique known as Data Envelopment Analysis (DEA) methodology of Malmquist index of total factor productivity, TFP. The decomposition of TFP into technological change and technical efficiency change is useful in distinguishing innovation or adoption of new technology by best practice firms from the diffusion of technology. Data on 114 selected Malaysian listed companies for the period 2008–2011 are utilized in the study. Results obtained are analyzed and discussed, and some policy implications are suggested.

Keywords- Data envelopment analysis, Malmquist productivity index, technological change, technical efficiency change.

I. INTRODUCTION

Traditionally, productivity can be mathematically defined as the relationship between a set of input values and the output values. This gives rise to the concept of partial productivity which represents the change of output produced corresponding to each input used such as labor productivity and capital productivity. However, as technology progresses, it is observed that it is possible to produce more from less inputs by adopting better means and methods of production. It is therefore essential to conduct and analyze the productivity trends as well as the technological changes in order to understand the industrial situation and the productivity dynamics inherent in the business sector, for example.

Output or productivity growth is therefore not attributed to growth in inputs only. Improvement in input qualities, efficient use of production processes, adoption of new technology and other non-physical factors do contribute to the dynamics of productivity growth. This non-physical contributor is known as total factor productivity, TFP. In short, TFP addresses any effect in total output not caused by inputs or economies of scale and is often found to be a significant contributor to output growth. Improvement in TFP will enable the industry to generate a larger output from the same resources, and hence shifting it to a higher frontier. The technological change component of productivity growth captures shift in the frontier technology and can be interpreted as providing a measure of innovation. Technical efficiency improvement or catching up effect, on the other hand, is measured by the difference between the frontier output and the realized output. Thus, the decomposition of TFP into technological change and technical efficiency change is therefore useful in distinguishing innovation or adoption of new technology by best practice firms from the diffusion of technology.

The rest of the paper is organized as follows. The next section reviews selected literature in productivity performance analysis in business. This is followed by definition of DEA output distance function for two time periods, the formulation and decomposition of Malmquist TFP growth index. The methodology is applied to a set of 114 selected Malaysian listed companies for the period 2008–2011. Results and findings are presented, followed by concluding remarks in the final section.

II. LITERATURE REVIEW

DEA is receiving increasing importance as a management tool for evaluating and improving the performance of decision making units, DMUs. It has been extensively applied, among others, in agriculture [1, 2], banking [3,4], business [5, 6, 7], education and higher learning [8, 9], hospitals and health centres [10, 11], hotels [12, 13], manufacturing and industry [14, 15, 16], nations and regional studies [17, 18, 19] and transports [20].

Al-Shammari [14] empirically assesses the relative efficiency of profit oriented DMUs, viz. fifty-five Jordanian manufacturing shareholding companies listed in the Amman Financial Market using input and output data for the year 1995. The number of employees, paid-in capital and fixed assets are three input measures utilized for the study, whereas the market value per share, net sales and net income after taxes are three output targets chosen. Out of the sample of 55 companies, 12 (21.82%) were found to be relatively efficient. The relative efficiency score of the 43 inefficient DMUs ranged from 0.127 to 0.911. The study also illustrates the necessary adjustments in the slack variables in order to