



# Adoption of information and communication technology and firm profitability: Empirical evidence from Tunisian SMEs



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## ABSTRACT

Research has shown that Information and Communication Technologies (ICTs) are a major determinant of performance in developed countries. However, less is known about the current situation of firms in developing countries. This article addresses this issue by examining the relationship between ICT use and the performance of Tunisian SMEs operating in the electrical and electronic industry based on net profit margin. Using an econometrical approach (linear regression, Granger causality, Kruskal–Wallis test, Welch ANOVA test, and post hoc tests), the results show that there is a significant statistical relationship between the level of ICT use and the performance of Tunisian SMEs in the electrical and electronic industry.

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## 1. Introduction

The increasing use of ICT (Information and Communication Technology) has been one of the most significant trends of the last three decades. Today, ICTs are generally considered to be the main engine of growth in the knowledge economy. As a determinant of technological change, ICTs have brought about a digital revolution in developed countries and the BRICS (Brazil, Russia, India, China and South Africa). Their influence is also rapidly spreading to other emerging countries, thereby opening new growth prospects and resulting in major organizational and managerial changes (Black & Lynch, 2004; Bloom, Draca, Sadun, Kretschmer, & Van Reenen, 2010; Brynjolfsson & Hitt, 2004; Caroli & Van Reenen, 2001; OECD, 2009). Therefore, it is important to examine the relationship between the new ICTs and firm performance in developing countries. The purpose of this paper is to provide an empirical and statistical insight into ICT use and performance in these countries. After identifying the relationship between ICT use and various measures of firm performance based on a review of the literature, the paper will develop and test three models based on a sample of 50 Tunisian SMEs with fewer than 100 employees operating in the electrical and electronic industry using linear regression with dummy variables, Granger causality (1969), the Kruskal and Wallis (1952) and post hoc tests, and a single-factor ANOVA test (Welch, 1951) and post hoc tests. The models were developed to examine the statistical relationship between a continuous quantitative dependent variable (net return or profitability, i.e. the chosen performance measure) and a discrete qualitative variable measuring the level of ICT use. The study makes two contributions to the literature. First, research on ICT has tended to focus on firms in developed countries. This paper uses the results of a recent survey (2009) based on a sample of Tunisian firms. Second, the study uses advanced statistical and econometric tests based on data collected on firm profitability.

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## 2. Theoretical overview and prior studies

### 2.1. The diffusion of ICT

Economic theory suggests that the diffusion of new technologies can have a significant impact on economic growth and development. The continued diffusion of new ICTs is an example of the dynamics of technological change and economic development (Freeman & Soete, 1997; Koellinger, 2006). These changes affect almost all aspects of the economy, including the dynamics of innovation, productivity and growth, firm performance, the development of market structures and the demand for labor. In short, ICTs are an important factor of progress. The assumption is that firms invest in ICT in order to become more successful in highly competitive markets (Koivunen, Hätonen, & Välimäki, 2008; Paré & Sicotte, 2004). ICTs are used as a production technology to improve labor productivity and coordination within the firm (Raymond & St-Pierre, 2005). The use of computer-aided design (CAD) and computer-aided manufacturing (CAM), has revolutionized manufacturing by providing better information and the transformation of entire production process, both in the machinery sector as well as in electrical and electronic industries with complex production processes (Carbonara, 2005; Ghobakhloo, Benitez-Amado, & Arias-Aranda, 2011). The use of ICT in SMEs has increased significantly over time, but different studies have reported that SMEs are generally lagging behind large firms (Lawson, Alcock, Cooper, & Burgess, 2003; Stockdale & Standing, 2006). A major factor is that SMEs often have limited financial and human resources compared to large firms. Duan et al. (2002) identified the lack of skills and knowledge needed to use ICT in SMEs as one of the major obstacles facing all European countries. This low level of adoption is observed particularly in SMEs in developing countries.

ICT have been a major technological innovation for developed countries and are spreading increasingly to developing countries. While many studies have examined ICT use in developed countries,<sup>1</sup> there has been very little research on ICT use in developing countries.<sup>2</sup> Kossai, Lapa de Suza, and Roussel (2010) showed that investment in human capital is the main determinant of ICT use in Tunisian SMEs operating in the electrical and electronic industry. Machikita, Tsuji, and Ueki (2010) examined the adoption of ICT in four ASEAN countries (Indonesia, Philippines, Thailand and Vietnam) and showed that the firm size positively affects the probability of adopting ICT. Based on an analysis of the determinants of the adoption of new technologies in the Indian electrical and electronic industry, Ktrak (1997) and Lal (1999) found a significant relationship between existing technological skills and the level of ICT use.

In developing countries, a range of factors, including various legal and regulatory factors, limited technological capabilities, limited R&D and the excessive use of foreign technology, have been identified as major obstacles to the use of ICTs (Koivunen et al., 2008). Lal (2007) found that inadequate facilities were the main factors preventing SMEs in Nigeria from using ICTs. Kapurubandara and Lawson (2006) also identified a range of obstacles to the use of ICT by SMEs in developing countries—both internal (the managerial characteristics of the firm and the manager, the cost and the return on investment) and external (infrastructures and the social, cultural, political and regulatory environment).

### 2.2. Performance measures

The economics and management literature uses a wide range of concepts and variables to measure and interpret economic and financial performance. Reference is generally made to economic growth, productivity growth, profitability and consumer well-being. The idea suggested by Porter (1980) that firm performance depends on the ability of firms to be more effective than their competitors in controlling the laws governing their environment was for long the dominant method of performance analysis. Morin, Savoie, and Beaudin (1994) also proposed a multidimensional approach, arguing that a firm is competitive if it increases its profits, maximizes return (profitability) and satisfies the greatest number of customers, employees and partners.

Labor productivity is also used as an indicator of the economic performance of countries, industries and firms. An increase in work productivity is an indication that resources are being used efficiently to create value. A firm that is more productive than its competitors is generally more profitable. March and Sutton (1997) used profit, sales, market share, productivity, debt ratios and share price to measure performance. Ittner, Larcker, and Rajan (1997) made a distinction between financial and non-financial measures of performance and found that many of these measures are in fact correlated. Employment growth (Baldwin & Rafiqzaman, 1995) and wages paid by the firm (Audretsch, Van Leeuwen, Mendveld, & Thurik, 2001) are also widely used as measures of firm performance. Koellinger (2006) measured performance based on turnover and profitability. For exporting firms different types of performance measures are also used. They include indicators of value and profitability (export profitability, export level, export growth rate, the share of exports in total sales, etc.), indicators of growth (total sales, the growth rate of total sales, the rate of profit and employee growth rate) and subjective qualitative indicators (satisfaction with market share, satisfaction with profitability and satisfaction with product competitiveness). (Cavusgil & Knight, 1997; Culpan, 1989; Ogbuebi & Longfellow, 1994).

<sup>1</sup> Bayo-Moriones & Lera-Lopez, 2007; Giuri, Torrasi, & Zinovyeva, 2008; Hollenstein & Woerter, 2008; Lucchetti & Sterlacchini, 2004; Schubert & Leimstoll, 2007; Tsuji et al., 2010; etc.

<sup>2</sup> India (Lal, 1999); Chili (Fuentes & Gilchrist, 2005); Mexico (Verhoogen, 2008); Nigeria (Apulu & Latham, 2011; Lal, 2007); Tunisia (Kossai et al., 2010); Golf Arab Countries (Nour, 2011); Pakistan (Mughal & Diawara, 2011); Malaysia (Alam & Noor, 2009); etc.

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