

## Chapter 32

# The Strategic Association Between Information and Communication Technologies and Sustainability: A Country–Level Study

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### ABSTRACT

*The authors investigate the strategic association between information and communication technologies (ICTs) and sustainability using empirical data. Their hypothesis is that ICTs can promote a country's sustainability. In their framework the authors include the ICT factors of access, quality, affordability, applications, and institutional efficiency & sustainability. Sustainability is represented by individual development indicators, grouped in the clusters of environment, transportation infrastructure, energy consumption efficiency, economic development, and education. Using secondary data on ICTs and sustainability development indicators for countries from the World Bank, meanwhile controlling for the wealth effect, our main multivariate result indicates that ICTs factors have a positive association with sustainability. ICTs, therefore, have the potential to promote sustainability. The authors' results are useful in shaping strategic policy decisions that involve the nature and extent of investment in ICT infrastructure at the country level.*

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## 1. INTRODUCTION

The purpose of this exploratory work is to examine the association between information and communication technologies (ICTs) and sustainability at the macro level. When we talk about the macro level, we are referring to the sustainability impact that arises out of the application of ICTs across society (Avgerou, 2010; Bengtsson & Agerfalk, 2011; Heeks, 2010; Mascarenhas, 2010; Melville, 2010; Millet & Estrin, 2012; Spence & Smith, 2010; Watson et al, 2010). Many of these papers have discussed the macro impacts of ICTs as net positive. Therefore, it is worth investigating the actual association between ICTs and sustainability. Although the greening of ICTs, for example, the reduction of electronic waste or of the energy consumed by computers – is an important goal of the information technology community, the focus of this research is “greening through ICTs,” that is, the applications of ICTs to promote sustainability broadly (Millet & Estrin, 2012).

In this paper we develop a framework for conceptualizing and studying the association between ICTs factors and sustainability development indicators at the country level. Our research is motivated by various propositions that ICTs’ factors such as access, affordability and applications, and the like — have the potential to improve country sustainability at the macro level. Once in place, these improvements may lead to improved environment, efficient transportation, efficient delivery of energy, increased economic development, and higher literacy.

This study addresses the relationship empirically. Although studies in past decades have examined and generally confirmed the positive role of ICTs in development, productivity and other macro level indicators (Avgerou, 2010; Bengtsson & Agerfalk, 2011), none have examined the quantitative role of ICTs in enabling sustainability. Despite the anecdotal evidence and the potential, the relationship between ICTs and the broader social goal of sustainability is not well understood (Berkhout & Hertin, 2004). Scant research has been conducted into whether and what types of ICT favorably influence sustainability (Jokinen et al., 1998). Unlike many of the others, our study provides empirical data on which country leaders can base decisions to allocate their limited resources to ICT infrastructure selection and development and thus derive maximum benefits.

In this study, sustainability is characterized by a number of world development indicators that collectively specify the sustainability level of a country (Carraro et al, 2009; Hueting & Reijnders, 2004; Pinter et al, 2005; Spangenberg, 2005; UN, 2007). The indicators are grouped into the broad research constructs of environment, transportation, energy, economic development and education (World Bank, 2010). The ICTs are represented as a group of factors in the global ICT index developed by the World Bank (2010) for each country (Minges & Qiang, 2006). This group of factors has been used in prior studies on ICTs and country-level public health delivery (Raghupathi & Wu, 2011a) and ICTs and country-level governance (Raghupathi & Wu, 2011b). The data for all the indicators and factors are derived from various country-level World Bank data sets. We believe that important insights can be derived from studying potential associations between ICTs and sustainability development indicators.

This study makes several contributions. First, we introduce the contemporary literature on sustainability and ICTs’ role as a potential enabler to the information systems research community. Second, we develop an initial framework of the relationship between ICTs and sustainability. Third, we empirically examine the relationship with a large data set, so generalizability of the conclusions is possible. Fourth, by studying the macro effects, countries can make selective investments in ICTs to promote different aspects of sustainability.

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