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Review

Forecasting in telecommunications and ICT—A review

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ABSTRACT

Given the length of time that has elapsed since the IJF Special Issue on Telecommunications Forecasting in 2002 and our reliance on information and communications technology (ICT), it is now appropriate to review the flow of benefits from forecasting to ICT and from ICT to forecasting. The importance of ICT is demonstrated by its accounting for 8.2% of the value added and for over 20% of employment in the OECD countries. The literature reviewed is categorised by both the ICT area of application and the modelling approach. The ICT application areas are: mobile telephony, internet usage or provision, and other ICT related products and services. The main modelling and forecasting approaches are diffusion modelling and forecasting, time series forecasting and technological forecasting, and this review devotes a section to each of these approaches. Most of the research activity in the field (measured by numbers of papers) has occurred in the modelling of diffusion in ICT, particularly mobile telephony, producing beneficial cross-fertilisation between forecasting and ICT applications; examples are multi-generational modelling and choice modelling. Although call centre manpower planning has led to innovative forecasting models, other analyses of clusters of ICT time series data sets have been less innovative. Technological forecasting papers tend to be exercises based on expert opinion.

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1. Introduction

In this paper, we review applications of modelling and forecasting in information and communications technology (ICT). We understand the term ICT as including telecommunications and referring to both hardware and software. To put the importance of ICT in context, an analysis of 28 OECD countries showed that, in 2008, the ICT sector accounted for between 3.7% (Switzerland) and 13.9% (Finland) of the value added in manufacturing and business services (the average proportion was 8.2%). For the same countries, ICT-using occupations (including specialists, advanced and basic users) account for over 20% of total employment on average, ranging from 10.9% (Turkey) to 35.3% (Luxembourg) (see OECD, 2011).

It is over a decade since the *International Journal of Forecasting* published a Special Issue on Telecommunications Forecasting in 2002 (see Fildes, 2002, 2003). Given the time that has elapsed since then, and the almost total dependence of life in developed economies on ICT, we feel that it is now appropriate to review the flow of benefits from forecasting to ICT and from ICT to forecasting.

Our preliminary literature search found that studies focussing on hardware (television, cellular phones, computer and network equipment) predominated. ICT software applications, such as videoconferencing, distance learning and business to business communications (B2B), do not seem to have not generated forecasting studies. Within the constraints of the published forecasting literature, our aim is to make this review as inclusive as possible. The papers reviewed here are included primarily because they make some contribution to modelling and forecasting in an ICT context. To assess the levels of activity in different research areas, these papers can be categorised by both the ICT area of application and the modelling approach. The ICT application areas can be classified broadly into three categories: mobile telephony, some aspect of internet usage or provision, and other ICT products, such as PCs or television. The topic that has generated the most interest is mobile telephony, representing 27% of the papers reviewed. Modelling and forecasting in relation to the internet represented 19%, and other ICT products were discussed in

39% of papers. Forecasting theory and other related issues were the theme of the remaining 15%. Three main modelling and forecasting approaches have been identified in our review of forecasting in ICT and telecommunications. These are diffusion modelling and forecasting, time series forecasting, and technological forecasting. Considering the more recent papers (from 2000 onwards), we find that 55% can be classified as diffusion modelling, 34% can be classified as time series modelling, and 11% focus on technological forecasting. The review considers each of these approaches in turn: Section 2 discusses diffusion modelling, Section 3 covers time series modelling and Section 4 looks at technological forecasting. Within the discussion of each approach, we discuss the ICT categories identified, and also summarise the flow of benefits between forecasting and the relevant ICT applications for each approach. We have not attempted to use a common framework to analyse the three approaches described in Sections 2–4. The problems addressed differ between sections, and the degree of homogeneity among the applications of each approach differs considerably. For example, the studies modelling diffusion in a single country are comparatively homogeneous, and some general points about the modelling approach can be, and are, made. In contrast, the studies in technological forecasting have few issues in common, and no conclusions about the usefulness or appropriateness of a technique can be drawn.

The consequence of conducting a review with the self-imposed broad remit of ‘forecasting in ICT’ is that a wide range of analyses is included. Several factors determine the supply of academic analyses, of which we will identify two. Firstly, where quantitative analysis is crucial to the understanding of a topic, the availability of data attracts academic analysis. In the absence of easily available data, academic analyses are harder to execute and less common. The availability of data has facilitated the supply of studies in Sections 2 and 3. In contrast, there are areas of ICT activity in which forecasting studies are either rare or absent. For example, the probable effects of developments in ICT on the relative popularity and future usage of the different modes of delivery of music, films and

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