# Forecasting Methodology of 3G Mobile Services with Consideration of Policy Issues

Jin Ki Kim, Ph.D.
Korea Aerospace University, Department of Business Administration, kimjk@kau.ac.kr

## ABSTRACT

In most countries, mobile subscribers are already experiencing 3G-like services. At the moment of launching 3G services, lots of studies showed estimates of the number of subscribers for 3G services, using long-term demand curves, econometric methods or survey methodologies. Those studies mainly focused on the potential number of subscribers and the point of rapid growth rather than precise estimates for the services. Even though we've already experienced parts of 3G services, full length of 3G services are expecting in near future. Therefore, now we need to have more accurate estimates for 3G services. While we thought that 3G services were moved from 2G, in real place 3G services are being evolved from 2G services. In the process of evolving, regulators' policy affects service demand and diffusion significantly. For the more accurate estimates, we need to consider policy issues which influence service diffusion practically in real place. This study aims to present a model which shows better estimates for 3G services with consideration on policy issues, such as numbering issues, price regulation, and competition policy. The consideration can provide more accurate estimates for 3G services with service providers. The methodology could help academicians in forecasting of similar telecommunications services as well.

## INTRODUCTION

Various third-generation (3G) mobile services have launched around 2002. Unexpectedly 3G services have been evolved from 2G digital services. While 3G services migrated from 2G services, several kinds of 3G-like services boomed up expectation for 3G services in telecommunications market. Lots of studies estimated 3G mobile market with positive perspective. However, service launching was hampered by unexpected obstacles, such as delay of hand-set provision, indifferences from 2G services, and near-saturation of mobile subscription.

Discrepancy between the estimates and the real number of subscribers in 3G services came from improper assumptions which were the most critical factors in estimating the new services. Two major mistakes led to the substantial discrepancy in estimation of 3G mobile services: misunderstood on relationship between 3G and previous 2G services; and omitting the affects of major policy issues.

Even though we've already experienced the migration from 1G to 2G mobile services, we thought that 3G mobile services could be totally different from 2G services and substitute the previous services. However, in real market, 3G services have been evolved from 2G services. Even 2.5G mobile services show the better capacity and availability compared to the new 3G services.

Regarding on the consideration of policy, we missed the critical effects of policy issues, such as licensing fee, numbering plan, interconnection, spectrum policy, and so on. Those policy issues delayed launching of 3G services, made 3G services similar to the previous 2G services, and gave time to 2G service providers in order to add features to their services for competing with 3G services.

This study aims to present a new model which shows better estimates for 3G services with consideration on policy issues, such as licensing fee, numbering issues, price regulation, interconnection, and competition policy.

## LITERATURE REVIEW

The diffusion of technology and products has been approached from a number of different perspectives, including geography (Brown 1981; Clark 1984), marketing and consumer behavior (Mahajan et al. 1990), economics (Gurbaxani 1990) and sociology (Rogers 2003). Early empirical studies depicted the diffusion of an innovation as a generally slow process, wherein the intensity at which adoption of a new technology spread across an economy changed over time with an S-shaped logistic curve (Griliches 1957; Mansfield 1961; Mansfield 1968).

However, diffusion research has evolved to further understand the process by focusing on four key factors: innovation, communication channels, time, and social systems (Mahajan et al. 1990). By assuming that potential adopters of an innovation are influenced by means of communication, researchers employed contagion modeling metaphors (Bass 1969; Mansfield 1961). (Bass 1969) adapted this epidemic perspective to model the diffusion of innovations, using the spread of diseases as its main metaphor. He argued that potential adopters of an innovation are influenced by two means of communication: mass media as an external influence and word of mouth as an internal influence. One group of potential adopters, called potential innovators, is influenced only by mass-media communication, whereas the other group, called potential imitators, is influenced only by word of mouth. Although the Bass model has found empirical support and been widely accepted, it has been questioned whether his conceptualization has over-generalized the communication structure and neglected individual adoption decision-making (Chatterjee et al. 1990).

Tanny et al. (1988) proposed an extension of Bass's communication structure hypothesis. In their modified model, both potential innovators and potential imitators are influenced by mass-media communication, but only potential imitators are influenced by word of mouth.

To enhance the power of diffusion models, researchers expanded their models to include a dynamic or evolutionary view of the adopter's perceptual uncertainties (Chatterjee et al. 1990; Jensen 1988). Chatterjee et al. (1990) conceptualized an individual's adoption decision as a choice determined by his evaluations of an innovation and by the innovation price with the budget constraint.

Liikanen et al. (2004) showed how technology diffusion takes place under a period when two consecutive generations of a technology are on offer. The new generation impedes the diffusion of the old generation, whereas the old generation has a positive effect on the diffusion of the new one, at least once the old generation penetration rate is high enough. An intermediate technology such as 1G can have a positive impact on the diffusion speed of a superior (new) technology, and thus substitution effects are dominated by network effects. Thus, lock-in into an inferior technology seems not to have been a major problem regarding mobile phones.

It clearly emerges that the network effects are largest within technological generations. With regard to fixed line telephony, substitution effects dominate any network effects. Understanding the effects of within- and between-generation network externalities and substitutability will be of great importance also in the ongoing generational shift from 2G to 2.5G and 3G (Liikanen et al. 2004).

Both economic variables and demographics strongly influence the diffusion process, and that even the geographic structure of a country plays a role. Contracting features, market structure and licensing decisions by governments influence the diffusion speed of mobile phones. Calling-party-pays system and use of the prepaid–technology enhance diffusion of digital phones, as does an increase in the number of licenses (Liikanen et al. 2004).

Harno (2002) performed a basic demand forecasts for the Western European market. The demand for 3G services is based on the overall mobile penetration, so the study was started with total mobile subscriber penetration forecasts.

As a basis for forecasting models used, a logistic model was applied to perform demand forecasts. This model is recommended for long-term forecasts and for new services. To achieve a good fit, a four-parameter model including the saturation level is used.

The model is defined by the following expression:

$$Y_t = M/(1 + \exp(\alpha + \beta t))^{\eta},$$

where the variables are as follows:

$Y_t$ : demand forecast at time t,

M: saturation level,

t: time,

$\alpha$, $\beta$, $\eta$: parameters.

The parameters $\alpha$, $\beta$, $\eta$ cannot be estimated simultaneously by ordinary least squares regression since the model is nonlinear in the parameters. Instead, a stepwise procedure is used to find the optimal parameter estimates. The saturation level M is estimated, and is a fixed input to the forecasting model.

Based on the assumptions for the evolution of the total subscriber penetration combined with the assumptions regarding each of the mobile systems, the penetration forecast for the four different mobile generations was calculated.

## POLICY ISSUES

In order to consider policy issues into estimation of 3G mobile services, it needs to identify policy issues which affect the service demand. Licensing fee and schemes, numbering plans, interconnection charges and obligations, and competition policy issues are the major considerable topics. In this study, for each policy issues, policy alternatives are identified and then will be considered as control variables into an estimation model.

## RESEARCH MODEL

Several 3G-like systems have launched and provided services with customers. In terms of technology, each service has its own strong and weak points compared to other services. However, from the perspective of customer, most services are supposed to be similar if they provide similar features. By the technological limit and policy consideration, it is hard to provide several kinds of technology alternatives for 3G mobile services in a certain area. Thus if we suppose the difference between 2G and 3G services are the same regarding on the different alternatives of 3G mobile services, we can estimate 3G mobile services by some groups which have similar technological features.

Services that we can consider as 3G services are followings:

- General Packet Radio Services (GPRS)
- Enhanced data Global System for Mobile Communications (GSM) environment (EDGE)
- Wideband code-division multiple access (W-CDMA), also known as Universal Mobile Telecommunications System (UMTS)
- High Speed Downlink Packet Access (HSDPA)
- CDMA2000 1X Evolution, Data-Only (1X EV-DO)
- WiBro

## EXPECTED CONTRIBUTIONS

The consideration can provide more accurate estimates for 3G services with service providers. The methodology could help academicians in forecasting of similar telecommunications services as well.

## REFERENCES


Bass, F.M. "A new product growth for model consumer durables," *Management Science* (15:5) 1969, pp 215-227.

Brown, L.A. *Innovation diffusion: A new perspective* Methuen, London, New York, 1981.

Chatterjee, R., and Eliashberg, J. "The innovation diffusion process in a heterogeneous population: A micromodeling approach," *Management Science* (36:9) 1990, pp 1057-1079.

Clark, G. *Innovation diffusion: Contemporary geographical approaches* Geo Books, Norwich Norfolk, 1984.

Griliches, Z. "Hybrid corn: An exploration in the economics of technological change," *Econometrica* (25:4) 1957, pp 501-522.

Gurbaxani, V. "Diffusion in computing networks: The case of BITNET," *Communications of ACM* (33:12) 1990, pp 65-75.

Harno, J. "3G Business Case Successfulness within the Constraints Set by Competition, Regulation and Alternative Technologies," FITCE Congress, 2002.

Jensen, R. "Information cost and innovation adoption policies," *Management Science* (34:2) 1988, pp 230-239.

Liikanen, J., Stoneman, P., and Toivanen, O. "Intergenerational effects in the diffusion of new technology: the case of mobile phones," *International Journal of Industrial Organization* (22:8-9) 2004, pp 1137-1154.

Mahajan, V., Muller, E., and Bass, F.M. "New product diffusion models in marketing: A review and directions for research," *Journal of Marketing* (54) 1990, pp 1-26.

Mansfield, E. "Technical change and the rate of imitation," *Econometrica* (29:4) 1961, pp 741-766.

Mansfield, E. *Industrial research and technological innovation: an econometirc analysis* Norton, New York, 1968.

Rogers, E.M. *Diffusion of Innovation*, (5th ed.) Free Press, New York, 2003.

Tanny, S.M., and Derzko, N.A. "Innovators and Imitators in Innovation diffusion modeling," *Journal of Forecasting* (9:4) 1988, pp 437-453.