

## Chapter 7.1

# The Critical Mass of Wireless Communications: Differences between Developing and Developed Economies

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### **ABSTRACT**

*The aim of this chapter is to identify and analyze the timing and level of critical mass in the development of market penetration for wireless communications. The authors assume that critical mass is fulfilled at the point when the acceleration of the diffusion process is at its maximum. In practice, this point is determined by estimating the diffusion function and calculating the second derivative with respect to time. The diffusion of mobile subscription is modelled using the Bass diffusion model. The penetration levels and points of time of critical mass of 209 countries or areas of the world are identified and subsequently subjected to regression analysis against population and economic characteristics. The findings suggest considerable differences between developing and developed countries.*

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## INTRODUCTION

During the last two decades mobile telephone technology has diffused all over the world. In addition to the drastic impact it has exercised on the habits and styles of everyday communication, it has had a noticeable impact on business and entrepreneurship. Diffusion of telecommunications is desirable since by decreasing the costs of transactions and speeding up the propagation and dissemination of knowledge it exerts a positive economic influence. Mobile technology may have its greatest impact in the developing world, because it brings telephony to districts fixed-line telephones formerly never reached. However, as data has not been available until recently, empirical evidence on mobile telephony impact or diffusion in developing countries is scarce.

Like many other modern technologies mobile telephony has positive network effects. Economides (1991) concludes that network effects occur when “The buyer of the last unit of a good has a higher benefit than the buyer of the first because the sale of the earlier units has created some benefits in a related dimension”. The existence of network effects makes forecasting the success of telecommunication services less easy and reliable, especially when traditional forecasting methods are applied (Schoder, 2000). Network effects can significantly influence the adoption and hence the diffusion of goods and services (Church and Gandal, 1993; Katz and Shapiro, 1985; Witt, 1997). One of the consequences of network effects is the existence of a critical mass point in the innovation’s diffusion process. The rate of adoption does not take off until a critical mass of adopters has been reached, but becomes self-sustaining thereafter (Mahler and Rogers, 1999). Despite the importance of the critical mass and the fact that telecommunications has been one of the main application areas of innovation diffusion studies (Meade and Islam, 2006), existing research on this topic is scarce and there are no established guidelines on how to identify the critical mass point.

## BACKGROUND

Mobile telecommunication diffusion has been studied generally in a number of recent papers (Grajek and Kretschmer, 2009; Jang et al., 2005; Botelho and Pinto, 2004; Lim et al., 2003; Gruber 2001; Gruber and Verboven, 2001) but only a few of them focus on developing countries (e.g., Singh, 2008) or, especially, on comparing the diffusion in developed and developing countries (Rouvinen, 2006). However, there are some studies that report different patterns and types of use of mobile phones in low-income economies compared to high-income economies (e.g., Hahn and Kibora, 2008; James and Versteeg, 2007). Moreover, the magnitude of this innovation may be greater in geographic areas, where the fixed telephone provision has a very limited presence or is technically unreliable (Hahn and Kibora, 2008). Thus, the diffusion of mobile telecommunications may exhibit very different features in the least developed or developing countries compared to developed countries.

The diffusion of products with associated positive network effects—such as mobile phones—depends on whether the technology gains enough users or adopters to become self-sustaining. If the technology does not reach the critical mass of adopters, it languishes or can be marginalized by competing technologies. An ability to predict the point of time when critical mass will be achieved may have positive consequences for gadget producers and service providers and may also offer an effective planning tool for governments. In case of telecommunications, for instance, strategic investment to speed up otherwise slow rates of adoption may pay off and telecommunications can positively influence economic growth. However, the existing research on the critical mass or takeoff time is scarce and no conclusive guidelines as how to identify the critical mass are available. Even the definitions of the phenomena are somewhat confusing in the literature, as some authors equate the concepts of critical mass and takeoff (Kim and Kim, 2007), while others maintain takeoff

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