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Editorial

## Special Issue on Growth in Mobile Communications

As is widely recognized, accurately predicting the evolution of demand for new applications of technology has eluded experts again and again. The history of mobile communications has been characterized by underestimation of overall demand, overestimation of the potential of certain applications (such as WAP), and the failure to foresee the popularity of others (such as SMS). But the difficulty of forecasting does not imply that actors in the mobile communications arena cannot influence developments by creating conditions for growth. This means that it should be a priority to identify and remove concrete barriers to continued growth. More specifically, there must be a balance between the demand of consumers and businesses, the availability of infrastructure and services, the financial health of operators and other players in the mobile wireless system, and the control applied by regulatory bodies. A prerequisite for this balance is an understanding of demand drivers and of the complex relationship between the market, technology and regulation. As the telecommunications industry strives to recover from the sharp downturn and turbulence of recent years, a sound analysis of conditions for growth is more relevant than ever.

The policy challenges accompanying developments in mobile communications are profound. With technological uniformity being replaced by diversity, regulatory frameworks formed during the years of monopoly and fixed line communication are becoming outdated. For instance, while the 3G market is highly regulated with regard to frequency allocation, licenses and standards, the parallel structure of smaller market participants emerging “from below” is largely unregulated. While diversity will no doubt turn out to be a positive development for users, policymakers and regulators must strive to catch up with technological developments in order to avoid a lack of coordination: conflict between service providers and a resulting reduction of connectedness. Following the controversial 3G auctions, regulatory interventions will be closely watched, and it is essential to establish where they are needed and where decisions are better left to the market. The bottom line is that regulation is not only an administrative process but also an important force in shaping technology and growth prospects.

With markets maturing, another key point is that the nature of demand has changed. No longer can service providers focus on rolling out generic new capacity to meet a steadily growing, uniform demand for communication services. Instead, companies must address the needs of specific user groups with innovations and applications that comprise group-specific bundles of value added services. The ability to differentiate between customer groups is growing, and there is increased inter-system and inter-technology competition to meet user needs. In short, the competitive system is undergoing dramatic changes, and while the potential for growth is clearly present, it is unclear how it will be realized. Which constellations of companies will best be able to serve this complex market? How will the strategies of operators, start-ups and other actors evolve

as the battle for customers intensifies? And how will prices and the power of consumers be affected by these changes?

These questions were the topic of debate at the 14th Biennial Conference of the International Telecommunications Society in Seoul, South Korea, with the theme “Challenges and Opportunities in the Digital Century: The Role of Information and Telecommunications.” For this special issue of *Telecommunications Policy*, seven papers relating to conditions for growth in mobile communications have been selected from the conference. These papers, which are briefly summarized below, should contribute new perspectives on the complex and urgent issue of the conditions for growth.

A necessary foundation for the analysis is an understanding of actual growth. To this end, Banerjee and Ros, and Madden, Coble-Neal and Dalzell examine the spectacular growth of global mobile telephony in two separate papers, analyzing data from a large number of countries to identify underlying patterns of growth and to establish connections between growth and economic factors. In the first study, Banerjee and Ros identify three different patterns in telecommunications diffusion, including the leapfrogging of fixed telephony by mobile telephony observable in the relatively less affluent OECD countries and European transition block countries. South American and a number of Asian countries have followed the more conventional course of building out fixed networks first, while highly developed countries have already achieved high levels of both teledensity and cellular density. In explaining these observations, the authors reach an interesting conclusion, namely that growth is driven either by technological or economic substitution, leading to markedly different paths depending on the country in question. Where fixed networks are deficient or provide services of poor quality, consumers have turned increasingly to mobile services as a substitute for fixed network services despite relatively higher mobile service prices. In contrast, in countries where both mobile and fixed line services of acceptable quality are available simultaneously, evidence of price-based substitution is beginning to emerge.

Madden, Coble-Neal and Dalzell penetrate the economic factors affecting growth further. Using a dynamic demand model, the authors relate the exponential network growth of mobile telephony to the economic drivers of income, price and network externalities. Rather than modeling the diffusion process per se, they consider optimizing economic agent behavior directly. More specifically, it is assumed that an individual’s instantaneous indirect utility of subscribing to mobile telephony depends on income, price and current network size, where network size is the number of current subscribers. The results of the analysis suggest that GDP and the network externality effect are important in explaining network growth, as is price. However, the authors also note that increases in income will yield a cumulative subscription effect 8.6 times larger than the equivalent change in price. Income, then, is a more significant contributor to worldwide mobile growth than price.

Following the impressive growth of the previous decade, markets in many parts of the world are maturing, and operators and other industry players are being forced to make significant adjustments to their strategies. Two papers focus on the evolution of the market for mobile telecommunications and the strategic responses of operators to these changing conditions. Kim, Park and Jeong shed new light on customer satisfaction and switching barriers and the relationship of these two variables to customer loyalty for South Korean mobile communications services. This topic is critical to the marketing strategies of mobile operators, who recognize that a

significant portion of future revenue growth is likely to come from new services provided to existing customers. Based on the results of a number of earlier studies, Kim, Park and Jeong formulate six hypotheses and test these using a survey distributed to users of mobile telecommunication services. One noteworthy finding is that certain aspects of service quality, including call quality, value-added services and customer support, are crucial for enhancing customer satisfaction and thus loyalty; price structure, on the other hand, does not appear to be a decisive factor. Switching barriers are also found to have a positive effect on customer loyalty, and the authors identify switching costs such as loss cost, move-in cost, and interpersonal relationships as important factors in creating these barriers.

A further manifestation of a rapidly changing mobile communications market is the appearance of flagship firms, which have been studied by Whalley. Flagship firms are multinational enterprises that coordinate the investments and operational activities of other companies within their business network; the operators Vodafone and Hutchison Whampoa are the subject of the analysis in Whalley's study. The coordination strategies employed by these flagship firms, including global and exclusive supplier contracts, test-bed markets and European wide re-branding, highlights the fact that competition requires new modes of operation and networking between companies. Although the strategies of Vodafone and Hutchison Whampoa share certain elements, the companies have contrasting goals in their coordination efforts: the former has focused on creating a single, recognizable network throughout Europe, and the latter has mainly sought to reduce costs and the time to market. As Whalley notes, these strategies have implications not only for the content, service, and equipment providers surrounding flagship firms but also for consumers and competition.

The telecommunications industry has shifted from being dominated by technology concerns to an increasing awareness of the need to understand the market and actively develop relevant content and services. Nevertheless, the systematic deployment of successive generations of mobile networks is still critical, leading to revenue growth by enabling the creation of new services and the improvement of existing ones. Park and Chang make an important contribution in this area by presenting a techno-economic model for evaluating mobile network evolution strategies. Applying this model to the evolution of the South Korean market, the authors evaluate six typical network service provisioning strategies having different network deployment and coverage plans. Their main finding is that a direct evolution from cdma2000 1× to W-CDMA is more profitable than that via 1xEV-DO, given the condition that the W-CDMA network should be installed before 2004. The direct evolution from cdma2001 1x to 1xEV-DV is found to be a comparable alternative in terms of profitability. These conclusions are highly dependent on risk factors and assumptions concerning the evaluation period, supplier market risk, and regulatory requirements. The analysis leading to the evaluation results demonstrates the complexity of investment choices in light of market dynamics, market demand uncertainties, and the existence of multiple interim technological solutions.

While industry players are having to adapt to changing technologies and market conditions to take advantage of growth opportunities, policymakers and regulators have an important role in creating the conditions for growth. The contentious issue of frequency management is the topic of papers by Falch and Tadayoni, and Yan, the former debating economic and technical approaches to allocation as well as assignment processes, and the latter providing an overview of the innovative 3G licensing scheme in Hong Kong. From Falch and Tadayoni's overview of current

spectrum management practices, it is clear that a focus on technical variables in allocation processes may lead to missed opportunities for innovation and expansion. An economic evaluation of the different uses of the Danish spectrum is particularly revealing, indicating that a reallocation of some parts of the spectrum to more economically valuable applications could be justified. However, the authors also show that a free market approach still has its limitations and that technical and harmonization issues require some form of regulatory intervention in parts of the allocation and assignment processes. For instance, the risk of interference between various applications implies that restrictions on usage will enable more licenses to be issued and hence a more efficient use of the spectrum. Whether the advantages of a free market system will outweigh such considerations depends on the level of scarcity, the authors conclude.

Where regulatory intervention does occur, it is critical that there is a balance between spectrum efficiency and market competition, as stressed in Yan's analysis of Hong Kong's 3G license auctions. Learning from the mistakes of previous auctions in other markets, Hong Kong authorities designed these auctions based on a royalty percentage of future 3G revenues rather than upfront payments. In addition, requirements were placed on licensees to open up part of their network capacity to Mobile Virtual Network Providers (MVNOs) and content providers. Together, these novel characteristics of the auctions may serve to encourage entry, alleviate license scarcity, and prevent overbidding. In particular, Yan notes that by keeping the financial burden on 3G licensees at a manageable level, Hong Kong regulators are hoping to avoid the "winner's curse" that has seriously threatened the development of the European 3G market.

In summary, the papers collected in this special issue address a wide range of issues that will affect the growth of mobile communications in the coming decades: regional growth patterns and underlying drivers, market evolution and operator strategies, network evolution, and new approaches to frequency management. They present a clear picture of specific barriers to growth and the opportunities for removing them. But while the issues are addressed separately here, the ultimate effect on growth will be determined by the techno-economic system of mobile communications as a whole. The dynamics of this system are defined by processes of competition, substitution, and complementarity that affect all actors involved in the production or consumption of mobile communication services.

Future research, therefore, should continue efforts to define and understand the complex relationships between industries, technologies, regulation, and firms. There are several connections suggested in these papers that should be pursued. How, for instance, do different approaches to frequency management encourage or discourage growth? Are current limitations on spectrum use, as Falch and Tadayoni speculate, causing a suppression of demand? The appearance of flagship firms is interesting in terms of operator strategy but also has implications for industry structure and policy. How can governments adapt regulation and policies to permit the simultaneous growth of entrepreneurial start-ups and multi-national players burdened by debt from 3G auctions?

An important goal of future research, then, should be to inform the formulation of policies and frameworks that promote growth and reduce barriers to mobile applications uptake. While the research issues may be complex, the goal is clear: how to formulate new, dynamic industrial policies that can deal successfully with a diverse, complex structure of smaller as well as larger companies and competing technologies? History indicates that relevant research can have a considerable effect on such policies. For example, the analysis of auctions in the early 1990s

provided critical input into the 3G licensing policies in the 1996–1997 time period. But the gestation time from analysis to policies is quite long—in the case of auctions, 10 years. If policy in the 2015–2020 time period is to be based on comprehensive analysis, focused research efforts must begin now.

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