Competition in the U.S. cellular industry: The role of and prospects for small carriers

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Abstract:
The cellular industry is currently experiencing significant upheavals as the result of mergers and acquisitions among its largest carriers. However, as these giants fight for dominance amongst themselves they do so in the midst of a large number of smaller carriers. These smaller carriers number in the hundreds and serve predominantly, although not exclusively, rural areas. Despite their contribution to building the nationwide network we enjoy today, little is known about their role in the industry. In particular, little is known about the challenges they face and their prospects for the future. This research, primarily through secondary data analysis, finds that these carriers are currently faced with a range of challenges that derive from both their customer base and industry trends. For some, one of the most significant challenges they face is to shift away from a business model that relies too heavily on roaming revenues to one that embraces services innovation. In particular, we recommend that services innovations that meet the needs of a diverse range of local consumers can provide both economic opportunities as well as solidify a niche that is impervious to competition by national carriers. Finally, we argue that continued presence of these carriers in the market can serve as the basis for insuring a ubiquitous mobile infrastructure that is accessible to all.

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1. Introduction

The U.S. cellular industry is a vibrant, turbulent sector that continues to experience growth while facing complex technological, policy and market structure changes. As reported in the FCC's 2004 annual cellular competition report, competition in this market has continued to intensify with 88% percent of the U.S. population living in counties with access to five or more carriers, up from 83% the previous year. This gain was achieved during a period in which wireless carriers faced policy and technical challenges, including e911, Local Number Portability (LNP) and network upgrades. Furthermore, while the increases in competition mentioned above are likely due to expanding service areas of the then six national carriers, it would have been difficult to achieve without the service offerings of the large number of 'small' carriers.

These gains may however be reversed by the recent mergers among four of the industry's largest carriers, reducing the number of 'national' carriers from 6 to 4. In this environment, and despite the fact that combined they provide service to only 21%[2] of U.S. subscribers, the role of the hundreds of smaller carriers and their influence on competition in the market is of even greater importance. And in the face of their greater importance, little is known about their status and how they overcome the challenges of operating in this highly competitive environment.

This research aims to shed light on the role of small carriers in the U.S. cellular market. Through an empirical investigation of the small carriers we provide insight into both how competition influences their strategies and in turn produces market outcomes beyond mere price reductions. In addition to strategies, this research also provides insights into the different types of small carriers, their ownership structures, and what they perceive to be the most important challenges from both a policy, technical and market perspective. We begin by assessing the demographics of these carriers and then examine the challenges and strategic responses that their demographic characteristics enable. Finally, based on these demographics, challenges and strategic responses, we analyze their role in the market.

The paper is structured as follows. In section 2 we provide demographic information based on a sample of 53 'small' carriers, in which we describe their size, ownership structures, and degree of independence. In section 3 we present findings based on interviews and secondary data of the most important issues faced by these smaller cellular carriers and compare them to their larger counterparts. In section 4 we assess their role based on a analytic framework derived from evolutionary economics. Conclusions are presented in section 5.

[2] Calculation based on numbers reported in the FCC's 9th Annual CMRS Report, which are for year end 2003. In particular we used the FCC's own reports of the number of subscribers of the 6 firms and divided them by the results of the CTIA's annual survey of the total number of subscribers.

2. Small carrier demographics

To begin, it is unclear how many small carriers are operating in the U.S. From data gathered in 2000, the FCC estimates there were 390 (carriers with fewer than 500,000 subscribers), however it is unclear how many of these carriers continue operations today. While many of these carriers operate in rural areas, the extent to which they are *exclusively* rural and the degree to which rural issues dominate their agendas in general is unclear. In addition to the importance of rural issues, small carriers will also vary in their degree of independence (status as resellers, MVNOs, brand licensees, etc.), ownership (subsidiary, joint venture, independent), public or private, and size (subscribers).

To understand the nature of small carriers, a database of a sample of carriers was developed. The database was populated by gathering names of facilities and non-facilities-based mobile telephony providers from general industry databases and includes what we collectively refer to as 'small carriers', but are more specifically referred to as Tier II and III carriers, those with greater than and less than 500,000 subscribers respectively, by the FCC[3]. The database was populated with information from annual reports, carrier websites, industry groups such as the Rural Cellular Association (RCA) and the Cellular Telecommunication and Internet Association (CTIA) and FCC documents. Missing data from websites were supplied by firms themselves via phone and the secondary data was supplemented with a handful of in-depth semi-structured interviews with senior managers. After eliminating bankrupt, recently purchased and redundant parent/subsidiary firms the database contained information on 53 carriers.

Based on this data below we describe three important characteristics of these firms that are likely to influence their role in the market.

2.1 Size, ownership, and public status

The strategies of small carriers and their role in the industry will be influenced by their size, ownership, and status as public or private. In measuring size we decided to follow the FCC convention of the number of subscribers. This number was judged to be superior to revenue or number of employees due to its centrality to the wireless function, particularly in firms with other revenue streams, as well as its availability.

Description	Number	Notes
Subs < 50,000	13/53	These companies have 50,000 wireless subscribers or less.
50,000 ≤ Subs ≤ 500,000	4/53	These companies have between 50,000 and 500,000 wireless subscribers.
Subs > 500,000	12/53	These companies have over 500,000 wireless subscribers.
Undetermined	24/53	The number of wireless subscribers could not be determined.

[3] See Tier III Carriers FCC DOC-257626A2

Despite its greater availability compared with other size statistics, we were able to find subscriber figures for only a little over half of the firms in the sample. Among the 31 firms whose subscriber numbers were available either through annual reports or websites, we found they were primarily divided between large (12/53) and very small (13/53) cellular operations. The largest firm in our list is U.S. Cellular, which serves roughly 5 million customers in 25 states and one the smallest is Cellular29 in Iowa with 11,000 subscribers. However, we should note that a large number of the firms for which subscriber numbers could not be determined appeared to be small operations and thus we speculate that firms with less than 50,000 subscribers make up the majority of our sample.[4]

In terms of ownership, small carriers have been found to be subsidiaries of larger firms, joint ventures created through cooperation between telecom and non-telecom firms, are part of a traditional telephone cooperative, or may be independently owned.[5] For those firms that are independently owned, they may be either public or private firms, and among the private firms there are non-profit or cooperative as well as for-profit firms.

Description	**Number**	**Notes**
Self Owned	30/53	These companies are self-owned. Most of them are locally owned.
Other Owner	10/53	These cellular providers are wholly owned subsidiaries of one parent company. Some of them are owned by much larger corporations, but most are owned by a small parent company with diverse products and services.
Coop/Jointly Owned	9/53	These companies are either cooperatives, meaning ownership of the company is shared among the users, or they are jointly owned by more than one company. • 6/53 are cooperatives • 3/53 are jointly owned by 2 or more other companies
Undetermined	4/53	The ownership of these companies could not be determined.

Most of the companies that were evaluated are self-owned, but there was a fairly equal distribution across the other types of ownership schemes as well. In establishing whether firms were public or private, we included those firms that are wholly-owned subsidiaries of public firms as public, due to the culture and reporting requirements that are likely transmitted from the parent to the subsidiary.

[4] The size categories reflect the FCC's designation of Tier II and Tier III carriers, as well as mimicking the differentiation that scholars of small to medium sized enterprises (SMEs) make between small and micro-enterprises.

[5] Other mechanisms of influence such as joint boards and overlapping directorates are beyond the scope of this study.

Description	Number	Notes
Public	19/53	These companies are public; meaning shares of their stock can be traded on the open market.
Private	34/53	These companies are private.

Most of the companies that were evaluated were private, with fifteen of the private firms being self owned, while fifteen of ninteen public firms are self owned. Furthermore, whereas only two of the twelve smallest firms were public, the majority of the largest firms were. Also, three of the solely owned public firms were operators with diverse range of operations as will be discussed next.

2.2 Scope of operations (services & markets)

The scope of operations is important to both the issues these carriers face, their financial status as well as how they view and respond to policy changes such as WLNP. Here we describe the scope of operations of cellular carriers as the types of services they offer. Types of services may be limited to cellular services, however these small carriers may also offer fixed services or other types of wireless services such as microwave links or wireless LAN. Since the sample was constructed to represent cellular carriers, pure wireless in this case refers to companies providing either facilities based mobile services or are resellers of this service.

Description	Number	Notes
Pure cellular	30/53	The companies that are recorded as being pure cellular companies only sell wireless services to their customers, rather than other telecommunications services.
cellular and Fixed	8/53	The companies that are recorded as being wireless and fixed offer both wireless services and land line services to individual customers.
Cellular, Fixed and Other	15/60	The companies that are recorded as being wireless, fixed, and other offer the above services, plus additional things such as: • Internet access • Cable and Satellite TV services • two companies offer home security systems • one company offers LAN/WAN design and computer repair • one offers stand-alone voice mail services

The companies that were part of this study were mostly pure cellular companies. All of the companies that were part of this study kept their services limited to some aspect of the field of telecommunications. For some of the firms that offer a diverse range of fixed and cellular services, cellular is an important diversification strategy. For these companies declining margins on fixed services in general are made up by revenue increases in the wireless divisions. For example, CT Communications, Cincinnati Bell Wireless and Alaska Communication Systems (ACS), all experienced stable or increasing wireless

revenues that made up between roughly 19 and 21 percent of their overall revenues. An exception is Qwest, which makes only 3% of its revenues from its cellular operations.

2.3 Degree of independence

Whereas many industries will have variations in firms according to target markets, size and ownership, in the cellular industry firms also vary in their degree of independence. Mobile carriers must coordinate a variety of assets and or service elements and the degree of independence (and hence control over risk) can be assessed based on the number of outsourced elements. This is not to say that the outsourcing of all elements represents a similar degree of risk. For example, the industry trend toward the sale of tower assets and subsequent entry into management agreements appears to pose less risk than say than licensing a brand name.

We use the outsourcing of these elements to define the various levels of independence, with an eye toward matching the institutionalized types of relations the cellular industry has created. These relations are denoted as Mobile Virtual Network Operator (MVNO) and reseller or affiliate arrangements. In the table below the S refers to self-managed and O refers to outsourcing arrangements. Also, those elements related to network operation are shaded in gray.

Element	**Sprint resellers**	**Qwest MVNOs**	**Motiva MVNO**	**Brand licensee**
Spectrum	O	O	O	S
Network equipment	S	O	O	S
Tower	S	O	O	S
Land for tower	S	O	O	S
Billing	O	S	S?	S
Customer service	O	S	S	S
Data services	O	O	S	S/O
Voice service bundles and pricing	O	S	S	S
Brand	O	S	S	O
Stores management	S/O	S?	S/O	S

Whereas the Sprint reseller and Motiva MVNO roles are nearly exact opposites, the use of Sprint data services by Qwest is a departure from this duality. Furthermore, it should be clear from this table that MVNOs and resellers play a different role in the market and have different effects on competition. Despite these differences in its annual CMRS Competition report the FCC report combines these different firms and reports on them together under the title of resellers.

Description	**Number**	**Notes**
License Brand	1/53	These wireless carriers have their own networks and license another's brand, such as Cellular One.
MVNO	2/53	These companies lease cellular networks from other companies for their local access calling.

Reseller	12/53	These companies resell services for larger companies.
Independent	35/53	These companies have their own networks, spectrum, brand and define their own service bundles and prices.
Undetermined	4/53	The degree of independence of these companies could not be determined.

Our data consists largely of independent firms, with a higher number of resellers than MVNOs. Whereas this is likely an accurate reflection of the relative numbers of resellers and MVNOs in the market today, the number of MVNOs is expected to grow significantly in the coming years. Certainly market entry at this level, with its independence from infrastructure operations, is easier. Examples of resellers in our data set include CT Communications and Ubiquitel while MVNOs include Qwest and Cellular South. Previously Qwest owned its own networks but has recently sold them and changed to an MVNO business model. Also, it is important to note that while the national carriers are the wholesale providers for the majority of MVNOs, smaller carrier also have MVNO and reseller arrangements with even smaller carriers.

In conclusion, we see that among these 53 'small' cellular carriers there is a great degree of diversity. The carriers include truly small operators with only a couple thousand subscribers to those with several million. They also vary in the extent to which their operations are purely cellular or just one of many telecommunications products offered. Their ownership varies from collectives to self-owned with a little over one third being publicly held entities. This diversity is reflected in the challenges they face as well as their strategic responses, which are discussed next.

3. Small carriers' challenges and strategic response

The role small carriers play in the market will in part be shaped by the challenges they face and their strategic responses. Their challenges will also be influenced by the demographic variables discussed above. For example, the challenges faced currently by a Sprint reseller (given its merger with Nextel) differ from those of a self-owned independent carrier. Furthermore, given the nature of the industry, these challenges can be grouped into policy, technical/operational and financial categories, and are addressed in turn below. It should be noted that due to the more extensive information available through disclosures by public firms, who tend to be larger, the following discussion is biased toward the issues of Tier II carriers.

3.1 Policy

While the cellular market is currently adjusting to several policy mandates such as WLNP and e911, the small carriers, both in interviews and reflected in their annual and quarterly reports, find policy matters less challenging than technical or financial matters. Furthermore, among public carriers, those engaged solely in the cellular industry devoted significantly less space to the discussion of policy issues than their more diversified (fixed and cellular) peers. However, despite representing a less significant challenge, federal and state policies were still of some concern.

Included in these concerns is spectrum policy and in particular the fear that increased spectrum availability will degrade the value of their existing spectrum. The small carriers also paid attention to Universal Service Fund (USF) changes as some of them are recipients. There were also some carriers that were seeking to put off e911 compliance until their Public Safety Answering Points (PSAPs) were outfitted to take advantage of the service.

It should also be noted that in interviews there was a general agreement that as smaller firms it was easier for them to respond to federal and state mandates due to the flexibility their small size provided compared to their larger counterparts. One FCC action that has certainly had secondary effects on the small carriers is the approval of the Cingular/AT&T Wireless and Sprint/Nextel mergers, as will be discussed in the final section.

3.2 Technical/Operational

Similar to the challenge posed by policy, the challenges of rapidly changing technologies pale in comparison to the financial challenges. Whereas most smaller carriers follow the national carriers in the timing of their network upgrades (although a few cases of technology leadership exist –i.e. CellularOne Amarillo), many of the technical challenges have been resolved when it comes time to deploy their own network upgrades. Even with a slight delay some carriers find it hard to obtain network equipment as it is typically earmarked for the higher volume, and hence higher priority, larger carriers.

The network upgrades create the possibility for offering data services, including applications, ringtones and games. The provision of these services has been a challenge for the national carriers and it is interesting to see how these smaller carriers have responded to this development. Where information was available we found that these smaller firms tend to outsource the provision of these data services and do so to a variety of firms. For resellers it is convenient to offer the data services of the 'parent carrier' and for those using the CDMA 2000 family of network technologies, Qualcomm's BREW service appears to be a natural choice. There are also intermediaries entering the market, namely Danger, Inc., which offers an integrated handset and application platform that is designed to enable small carriers to easily offer advanced data services. The ability to offer these services is crucial to financial success, which is the next topic of discussion.

3.3 Financial

Of all the challenges faced by the small carriers, none can match financial pressures. The cause of these pressures have their roots in the small carriers' customer base as well as industry trends that affect small carriers disproportionately, both of which are partially the result of the industry's institutional history.

3.3.1 Customer base

To understand this history, take for example the case of a 'typical' rural cellular carrier that was the first firm to offer service in its market. Eventually additional carriers, sometimes national carriers, entered the market with attractive services and prices as well as newer technology. The early adopters, who in the cellular industry tend to be the most

lucrative customers, are lured away and the small or regional carrier is left with the less lucrative customer. This is the situation that exists today, with smaller carriers having lower average revenue per user (ARPU) than their national counterparts.

In addition to having lower ARPU, the smaller carriers have also attempted to increase their number of subscribers by serving what are referred to as 'credit challenged' customers. These customers typically lead to higher bad debt expense and contribute to higher churn through involuntary suspension of service. Thus, in addition to lower ARPU, smaller carriers also typically face higher churn rates. On the one hand these carriers' attempts to serve these less desirable customers can be seen as a positive social outcome, as more credit challenged (and typically lower income) users will have access to cellular service. However, shareholders may perceive this differently. One carrier who pursued this strategy (U.S. Unwired) was taken to court, accused of defrauding shareholders by inflating subscriber numbers through signing up large numbers of 'undesirable' customers. While the issue of credit worthiness is not only a problem for small carriers (Sprint also had problems), smaller carriers' lower levels of ARPU make it difficult to offset these losses, making the effects more drastic.

Despite these effects small carriers, in addition to some of their national counterparts, are scrambling to increase subscribers through a variety of initiatives including programs to increase subscribers by offering more attractive (although lower ARPU) prepaid plans, eliminating deposit and credit check requirements, and introducing fixed-rate plans. Small carriers are also trying to serve niche markets by reaching out to Hispanic users and making language accommodations in the customer service departments.

For some small carriers, particularly those with diversified product lines, bundling has been an approach to increase cellular subscribers. Others have emphasized high quality local customer service, which is sometimes reinforced with local community involvement.

3.3.2 Industry trends

In addition to their customer base, small carriers are also influenced, in both positive and negative ways, by four industry trends: 1. declining margins for voice service 2. drastic reductions in roaming prices 3. increased minutes of use (MOU) and 4. consolidations. First, given their lower overall ARPU, small carriers require additional revenue streams. The decline in voice margins and the need to offer 'large number of minutes' packages has increased these pressures. Whereas national carriers are making up for these losses in data revenues, another characteristic of the small carrier customer base, namely their slow adoption of data services, makes this strategy less feasible for small carriers.

While the margin decline in voice services presents a challenge, the real Goliath for many carriers is the steep decline in roaming prices. In some cases this creates a very significant challenge, particularly for those firms who relied on roaming revenues to 'make up' for lower ARPU. These carriers built networks where no others exist, completing the national network, and generated revenues when other carriers' subscribers roam onto these typically rural networks.

The decline of roaming revenues has affected the entire industry and as reported by the FCC, one analyst attributes the decline in roaming revenues to "larger operators negotiating lower roaming rates, as well as national carriers expanding their footprints through buildout, acquisition, and joint buildout/roaming agreements."[6] Indeed, the CTIA reported that roaming revenues for the mobile telephony industry declined from $3.9 billion in 2002 to $3.8 billion in 2003, and as a percentage of total service revenue they declined from 6.1 percent in 2001 to 5.1 percent in 2002 and subsequently to 4.3 percent in 2003.[7] While these numbers are representative of the role of roaming revenues in the financial results for some carriers, for example Cingular experienced a reduction from 8.67% in 2003 to 6.94% in 2004, for others they are not representative at all. Furthermore, while the exact percentage of the revenue contribution for roaming for Verizon Wireless is not available the following quote from their annual report suggests that any losses are being more than compensated by data revenues: "Data revenues were $1,116 million in 2004 compared to $449 million in 2003. These increases were partially offset by decreased roaming revenue due to bundled pricing."

For some Tier II carriers the contribution of roaming to overall revenues is as high as 23% (for U.S. Unwired), and others have experienced more significant declines, such as from 18% to 11% for TritonPCS from 2003 to 2004. As noted above these declines are due in part to renegotiations of roaming tariffs by national carriers. For example, in a renegotiation of data roaming rates with one of its largest affiliates, Alamosa Holdings Inc., Sprint agreed to pay $0.0055 per Kb through December 31, 2002 and in 2003 this rate was reduced to $0.0014 per Kb, more than cut in half. For 2004 through the end of the year 2006 the rate was set at $0.0020 per Kb, a slight increase over the 2003 rate, but still well below the 2002 rate. Some would consider such rate reductions draconian, and one reseller took Sprint to court over the matter. The dispute was settled when Sprint agreed to buy the carrier, which was also filing suit to block the Sprint/Nextel merger.

Of course the decline in roaming prices also has a positive side as well. Even though small carriers face large declines in roaming revenues they are also able to save on roaming expense, incurred when their subscribers roam on others' networks. This effect is compounded by the third trend which is increased minutes of use, including increased roaming minutes. While the margins on the general voice minutes has declined, at least for roaming the increased number of minutes has helped offset the price reductions to such an extent that some carriers are actually seeing an increase in roaming revenue.

While these first three industry trends are related to pricing and usage the fourth trend, industry consolidation, has broader effects. The effects of the mergers between the national carriers vary and include required divestments and spectrum swaps, renegotiations of roaming agreements, termination of exclusivity agreements, and subsequent take-overs of smaller carriers to facilitate a merger. For example, the merger of Sprint and Nextel certainly represents a disadvantage for some of Sprint's resellers. While some have come to agreeable terms, for those who were exclusive providers of

[6] *Wireless 411*, at 44, cited in the FCC's 9th Annual CMRS report 2004.
[7] See FCC 9th Annual CMRS report 2004.

Sprint service in markets served by Nextel the status of the exclusivity agreements has yet to be resolved. In addition to potentially losing their customers to Nextel, these carriers also stand to lose all the roaming revenue that was generated by Sprint customers from other affiliates who would now use the Nextel network.

Furthermore, the mergers of the national carriers in some cases require divestiture and sales of spectrum licenses in certain markets that have enabled some small carriers to consolidate their operations into a geographical region that may provide advantages such as niche market appeal and have enabled others to gain greater autonomy, for good or bad. The mergers have also required a flurry of re-negotiations of roaming agreements, although the extent to which this is beneficial for the small carriers is unclear.

In addition to the effects of the mergers of their larger counterparts, smaller carriers are also experiencing consolidation among their own ranks. The lifting of the limitation on ownership of rural licenses has also facilitated mergers between some of the Tier II carriers. These combined companies such as Western Wireless and ALLTEL could move them up into the ranks of national carriers, improving competition among the national carriers.

4. The role of small carriers

The above discussion paints a partial picture of the situation of the Tier II and III carriers. Based on this description we now turn to the task of understanding their role in the cellular industry and how they contribute to the level of competition. In particular we seek to understand

- What value they bring to the market currently and in the long run?
- To what extent are they similar to or different from other non-dominant firms in network industries? and,
- What strategies they might pursue, based on findings from studies of service innovations in other industries?

To answer these questions we begin with a review of the extant literature.

4.1 Services innovation and industry evolution

From the perspective of evolutionary economics industry evolution is tied to processes of innovation and imitation. According to Nelson and Winter (1982), whose work is based partly on that of Schumpeter (1934)[8], innovation in a competitive market enables a firm to earn transient quasi-rents, but these rents are eventually eroded by imitators. The imitators diffuse the innovation, which in turn drives the evolution of the entire industry and results in economic development. This process is shaped by and, in turn, shapes market structure.

[8] The implications of Schumpeter's work for telecommunication has previously focused on regulation (see Bauer 1997). Here, following Nelson and Winter (1982), we focus instead on its implications for the behavior of firms and their relationship to market structure.

While this view of the role of innovation and imitation is generally accepted among innovation scholars, less clear is the extent to which innovations in the manufacturing sector, the dominant subject of innovation research, are similar to those in services. One perspective, offered by Sundbo (1997) is that approaches to the study of innovation fall into one of three paradigms. There is the technical-economic paradigm, which emphasizes the technological development as the core innovation process, and the entrepreneur paradigm, which places the entrepreneurial act at the center of the innovation process. The third paradigm, and that most appropriate for the study of services innovation, argues the author, is the strategic innovation paradigm, which emphasizes the role of firm strategy in sparking innovation. Being related to firm strategy, service innovation is motivated by the market situation as well as customers, competitors and market possibilities. Further, Sundbo argues that while service innovation may have a technical component, it typically serves as the medium for the service innovation. And while Sundbo favors the strategic innovation paradigm, he concludes that all three, which were developed in the manufacturing realm, have a role to play in service innovation studies.

While Drejer (2004) agrees with Sundbo that models or paradigms to study innovation in the manufacturing sector can readily be applied to services, Drejer argues that a Schumpetarian view of innovation in services is preferable in that it provides a critical link between innovation and economic development, while at the same time providing a theoretical link between innovation in services and manufacturing. The Schumpetarian view particularly emphasizes the link between innovation and imitation, such that the innovation is widely adopted and moves the entire industry forward.

The issue of imitation in the services sector is not perceived to be a hurdle as services are typically considered easier to imitate than their manufacturing counterparts. Indeed, in a study of financial services, Sundbo (1997) observed that due to the ease of imitation of service innovations, some firms gave their service products a technological form to impede imitation. This finding contradicts an argument put forth by Lopez and Roberts (2002) that a technological basis for services would not create any appropriability advantages because IT products are easy to reproduce and imitators may subsequently be able to take advantage of reduced hardware prices. However, in their study of financial services, the authors found that despite this expectation of no advantage for first movers, they did find that early entrants benefited in the short and long term and were able to maintain at least some of their market share advantage.

Within the service industries, service innovation is considered to consist of both product and process innovations. And in the case of product innovations two separate types exist: primary and secondary service (product) innovations (Pearson 1997). In the financial services context, primary innovations were products for new types of risks, whereas secondary innovations were new products for existing risks. In the cellular industry primary and secondary innovations would be based on new or existing technologies.

The delineation of process and product innovations enables scholars of industry evolution to map the temporal sequence of these types of innovations. As explained by Pearson

(1997) who found that innovation in the financial services followed a process, process, product innovation cycle that interacted with but moved in the opposite direction to technological changes in Britain's industrial economy, this is opposite to the product life cycle of a manufacturing innovation that begins with product innovation and ends with process innovation.

As noted by innovation scholars, the extent and form of innovation will be influenced by the industry structure. One study of the evolution of a telecommunications industry, namely the internet access market in the UK, described the evolution of the industry as three waves of Schumpetarian 'creative destruction' (Javary 2004). The waves are marked by services innovations, namely beginning with metered usage, then moving to flat rate usage and finally the 'free service' business model. The transitions from one stage to the next were marked by consolidations, exit and subsequent entrance by entrepreneurs and were heavily influenced by the strategies pursued by the dominant firm, British Telecom. Thus, the new entrants innovated but their quasi-rents were quickly evaporated through the strategic response of the dominant operator. Similar results were obtained by van Gorp, Maitland and Hanekoop (forthcoming) considering the role of small ISPs in the Dutch market. These studies suggest that the force of imitation combined with market power can have detrimental effects for the innovator.

Whereas the brutal competitive dynamics experienced in the internet access sector might dissuade small cellular carriers from innovation, a study of the innovation experiences of rural telephone companies provides some hope. The study, conducted with over 100 rural telephone companies in Iowa found that involvement in local economic development activities had a strong, direct effect on innovativeness (Korsching et al. 2003). In fact, involvement was found to be the only predictor, even when firm size and manager attributes were included. In the study the authors delineated service and operational innovations, in that service innovations are intrinsically a part of the service the organization provides and require both organizational and end-user adoption. Furthermore, service innovations included the adoption of the underlying technologies that made the services possible. As rural firms may not experience the same demand patterns for advanced services, understanding the needs of the local community were expected to play an important role in services innovation.

While the Korsching et al. 2003 study examined predominantly fixed carriers, although some had wireless operations, it raises an important point about the role of the local telecommunications provider, fixed or wireless, as a member of the community. In their research the mean score for the carriers' level of interaction in the community reflected the carriers' understanding that their fate was tied to the fate of the area. Hence, they are active in promoting local economic development and workforce training. Consequently, one cost of the emergence of 'national' or (as Korsching et al. describe them) 'absentee' carriers is a disconnect with the needs of rural areas and a greater challenge for rural areas to reap the benefits for economic development that advanced telecommunications services as innovations can provide.

4.2 The role of small carriers

The above discussion of the nature of service innovation and industry evolution will inform our analysis of the role of small carriers in the cellular industry. In particular, it will enable us to understand the current and historical status of the carriers as well as provide a basis for recommendations for future actions.

Current and historical role

As described above the small carriers in this study are a heterogenous group that varies significantly in size, scope of operations and degree of independence. In the early years of the cellular industry many of these carriers were the first to offer service, contributing to the establishment of a nationwide cellular network. However, as noted by the FCC, 97% of American communities are now served by 3 or more carriers, and hence these carriers now face competition from national carriers as well as from the expanding footprints of Tier II and even other Tier III carriers. While consolidations may erode some of these advances, it is likely the competitive nature of many markets will remain.

Hence the era in which the role of small carriers was frequently to provide service to the otherwise unserved is drawing to a close. However, for those 3% of communities this role may still be very important. While this aspect of their participation in the market wanes, their role as imitators, and hence diffusers of innovations, and in some cases drivers of innovations, remain.

Another role that the small carriers have played, which is also now coming to an end, is as the disproportionate beneficiaries of high roaming rates. While these rates were beneficial to some carriers as a consequence of the business model they pursued, they were certainly not beneficial to consumers. However, assuming roaming revenues were necessary to make coverage in rural areas viable, it is unclear what the result may be. One possibility is that the viability of these networks would be greater if their owners could reap the benefits of greater economies of scale. This implies that either owners of rural networks need to cooperate to achieve these economies or that the networks may be bought by national or large Tier II carriers. Although only limited information was available, we were surprised to find a lack of coordination among the small carriers and one interviewee explained that this was due to fears of being accused of collusive behavior. The culture, the interviewee described, is that any meeting of multiple carriers must have an attorney present to steer meetings away from what could be considered anti-trust issues.

Finally, an important role that some small carriers play is a providing a local presence and perhaps a local face to technical innovation. A review of the websites of some carriers reflect their deep involvement with the local community through their sponsorship of recreational events to membership in local business organizations. This ‘local strategy’ can also apply to a higher quality of customer service, although empirical data on the results are not available.

To understand the role of the small carriers in the cellular industry it is informative to examine the development of other network industries. The evolution of the U.S. cellular

industry is similar to that of the internet in that the market's evolution has been simultaneously shaped by expansionist and consolidation forces, as well as its market structure at its origins and subsequently as a response to the development of advanced telecommunications services (see Javary 2004). There are also similarities in the role small firms play in these industries, particularly in the frantic nature of their existence, price squeezes, the constant need to respond to strategies of the dominant firms, and the rampant predictions of the small firms' demise.

However, in a departure from the internet access industry in the cellular industry the Tier II and in particular the Tier III carriers are much more active as imitators than innovators. They have been proactive in their build out of networks, which have served a vital role in building nationwide networks. However, this does not meet the Schumpetarian definition of an innovation. This is not to say that small carriers do not innovate, only that as compared to their small internet service provider counterparts their role is decidedly more imitative than innovative.

The presence of these small carriers has implications for consumers, national carriers, equipment manufacturers and policy markers. In sum, for consumers these carriers help fill gaps in network coverage, possibly provide service to the unserved through network coverage or the underserved by providing service to credit-challenged consumers, put a local face on technical innovation and are involved in their communities. However, these services have come at a higher cost for roaming. For national carriers these small carriers can present both a source of competition in innovation, as well as the imitative force that decreases the temporary quasi-rents gained through innovation. Increasingly they also purchase data services, providing additional revenues to offset investments in this area, and present competition in the purchase of both network and handset equipment. For equipment manufacturers, small carriers provide beneficial competition to large carriers in terms of equipment purchases, smooth – by dynamically distributing-- demand, and extend the timeline of revenue generation for recouping R&D investments through their delayed network equipment introductions. Finally for policy makers small carriers create a challenge in that there is a need to envision the far reaching effects of policy decisions such as mergers on the small carriers as they propagate through the myriad of inter-carrier relations (cross ownership, roaming, resellers, swaps, exclusivity agreements, etc.). The difficulty of this task is further complicated by the private nature of these small carriers, which makes information difficult to obtain.

Possible courses of action

In order to compete in this highly competitive industry and to adapt to the changes in market structure and in pricing trends small carriers will need to employ new strategies. Based on insights from their current role as well as the service innovation literature we make the following suggestions about possible courses of action.

One way that small carriers can respond to the changes in the market is by focusing on increasing their speed of imitation, thereby reducing the competitive advantages gained by the national carriers. Naturally this must be done in such a way that it meets the needs

of their customers. They may also find advantages in focusing on both process and product/service innovations. Process innovations can reduce the cost of providing service and may also generate possibilities for offering new services. Additionally, a focus on service innovations that do more to meet the needs of their consumers can have multiple advantages. Examples of previous service innovations include national calling plans, buckets of minutes and more recently unlimited local calling. If small carriers focus particularly on needs that are unique to their customers, such as special international calling arrangements, different local and regional boundaries, or niche language accommodations, these innovations may prove difficult to imitate. While small carriers are more likely to focus on secondary service innovations, those based on existing technologies, their small size and flexibility may make primary service innovations, those based on new technologies easier. Furthermore, as the research discussed above suggests, the first mover advantages of these innovations can provide lasting benefits. However, primary innovations will only succeed if the market for the services exists.

As the research on innovation also suggests, the process of innovation will be influenced by the market structure. And as research from the internet access markets suggests small firms need to be keenly aware of market structure and the use of market power by larger incumbents. Increasing the speed of imitation is one way to reduce the advantages of market power. A second means is through coordination and collaboration that creates market power for the smaller firms. For example, as described by Burkart (2005), in the Brazilian wireless industry the structure in the medium term consisted of regional duopolies, similar to the early days of the U.S. cellular market. However, over time across regions joint ownership arrangements increased the market power of those firms. Although the resulting oligopoly of the Brazilian market is not the goal here, the example is to suggest cross ownership as one way to increase the market power of small carriers.

A potentially less complicated way to increase market power for the small carriers is a more intense level of cooperation. While the diverse nature of these carriers may make cooperation difficult in that there are many conflicting goals, carriers should find ways to overcome these differences. Areas of cooperation could include lobbying, purchasing cooperatives, development of rural-oriented data services, and process improvement task forces. While anti-trust legislation must be adhered to, it should not be seen as a hurdle greater attaining more efficient operations and maintaining competition in the industry rather than thwarting it. Cooperation would hopefully lead to greater transparency in the market, enabling both policy makers and industry analysts to understand the trends and challenges faced by this segment of the market.

Underlying this discussion is the issue of whether or not these small carriers are necessary to maintain competition and its benefits. While some would argue that a market with four or five large national players is an adequate degree of competition, and as pointed out by the FCC in the CMRS is at or above the level of competition in many other countries, we oppose this view. In terms of quality of service and adequate coverage the U.S. is far behind other nations and the reported high degree of customer satisfaction can only be due to ignorance of what truly superior service is. Thus, we believe that small carriers can have a fundamental role to play in driving and diffusing

innovation. Furthermore, as cellular service encroaches on fixed service as America's default medium for communication we may also become more concerned with a 'mobile divide' and it is likely that the small carriers with their closer customer relations will play a fundamental role in increasing the widespread adoption of mobile services.

5. Conclusions

The turbulent nature of the U.S. cellular industry is made increasingly complex by the diverse range of carriers operating in it. Whereas much of the attention paid to the industry focuses on the behavior of the four large national carriers, there are hundreds of regional and local carriers that contribute to the highly competitive environment.

This research has provided insight into the role played by these small carriers. Through an empirical investigation of the demographics of and challenges faced by 53 small carriers, we provide insight into their strategic responses to these challenges. The investigation shows that small, or Tier II and III, carriers, vary significantly in size, degree of independence, ownership structures and in their service offerings. Some of the greatest challenges they face, which derive from both their customer base and industry trends, include reduced voice margins, reduced roaming margins, the slow uptake of data by their customers and merger activity. While these changes affect all carriers, large and small, we have argued that these challenges, due to differences in business models, create disproportionately more stress for the smaller carriers.

Further, based on these findings, and combined with insights from studies of service innovation and network industry evolution, we make a series of recommendations for possible courses of action that small carriers can take to confront the industry trends that threaten their existence. These recommendations are made with an eye toward helping insure the continued participation of these carriers in this industry as they have played, and, through their relationships with their consumers' communities, have the potential to play an even more vital role in the evolving cellular industry.

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