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**Incumbents' and Entrants' Strategies in new Sub-markets within Regulated
Environments: The Case of public WLAN Hotspots in Western Europe's
Telecommunications**

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The purpose of this paper is to reveal the incumbents strategies and explore how being regulated affects the success in new sub-markets for entrants in the public hotspot market. Therefore 62 mobile network operators and the entrant market share in 17 Western European countries were analyzed according to their strategies and success. The results reveal that incumbents are caught in an area of conflict between regulation, internationalization, and technology strategy. The finding that late UMTS launch had an influence on incumbents in their sub-market strategy points to a sustaining scenario, as they could enhance their presence in the mobile broadband market. The results of the entrants strategies to enter the hotspot market indicate that the success of entrants in regulated markets depends on the

regulation as well as on the incumbents resistance to regulation in the specific country. Finally, the impact of WLAN used as public hotspots shows a predominately sustaining innovation character regarding Western Europe's Telecommunications.

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Abstract

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Keywords: Technology Strategy, Diversification, Regulation, Disruptive/Sustaining Innovation

1. Introduction

The incumbents' sub-market strategies and sub-market success have been studied especially in the context of the theory of disruptive innovation (Christensen 1997, Christensen/Raynor 2003, Chesbrough 2003, Christensen et al. 2004). The decision depends on the industry structure, the market size of the new market, and on the structure of the incumbent itself with partially contradictory results (Christensen et al. 2004, Chesbrough 2003, Fernandez/Usero 2009). Whitley (2002) contributed to this discussion in showing a connection between firms' behaviors and institutional settings. Chesbrough (2003) pointed to differences in the adaptation schemes by entrants and incumbents. He demonstrated that sub-market entry decision and subsequent disruption – seen as the replacement of incumbents – did not occur in environments that differ in their institutional frameworks (Chesbrough 1999, 2003). Therefore, incumbents might evaluate the disruptive potential of technologies and their subsequent sub-market entry decision embedded in their institutional context. Anthony et al. (2002) and Christensen et al. (2004) propose that there are different regulative and institutional designs that enhance or diminish the chance of disruption. Competitive markets thereby seem to be the main assumption (Anthony et al. 2002). However, they fail to support their proposition with large scale empirical evidence from different regulative and institutional contexts on a multiple country basis. Furthermore, few researches have concentrated on the success of entrants in the sub-markets and the factors that reside at its roots. Especially when it comes to combinations with regulation most researchers have concentrated on the incumbents' behaviors. Therefore the telecommunications industry and, in particular, the hotspot industry are a good starting point to research the effects of regulation and institutional differences on the sub-market entry and success of entrants, because the industry is highly regulated.

Typically, regulation sets barriers to entry and forces regulated firms to follow certain rules in order to recreate competitive markets in the end. The regulatory authority has an oversight about market happenings, which leads to differences between the environments in different areas – usually at a country level – which are subject to their authorities. From a strategy perspective, regulation has an effect on the diversification strategies of incumbents (Bonardi 2004, Calzolari 2004, Bonardi et al. 2009). Consequently, these findings corroborate that the decision to diversify and its success depend on institutional settings which support the entrants or incumbents. Newer research has started focusing on these institutional differences which encourage or inhibit market entry but these studies have neglected either the disruptive context or the influence of regulation on incumbents and their strategies (Chesbrough 1999, 2003).

From a regulation perspective, researchers have concentrated on the differences in institutions or regulations per se. Their main focus is to find differences in the regulative framework or theoretical concepts (Thatcher 2004). Anthony et al. (2002) found no disruption in telecommunications until the sector got liberalized. Therefore, the telecommunications industry is a good point to research the effects of regulation and institutional differences on the sub-market entry and success of in-

cumbents, because the industry is highly regulated. In particular, the emerging WLAN (Wireless Local Area Network) hotspot market has been analyzed because this market allows newly entering firms to access the telecommunications market due to specific unconstrained but country-specific regulation. This opens up markets that are highly competitive but embedded into a regulated environment (Hüsig et al. 2005). The incumbent mobile network operators (MNO) have reacted differently on the emergence of WLAN hotspots in the late 1990s and also developed different perceptions about the disruptive potential of hotspots on their data services (Hüsig/Hipp 2009, Christensen et al. 2004).

This paper looks at the specific determinants that reside at the basis of strategic differences from former monopolistic and incumbent MNOs to explain the different diffusion patterns of hotspots. Consequently, this paper represents a cross-country, sector-specific and cross-company analysis of the incumbents' decision parameters to enter the hotspot market in connection with environmental conditions such as regulation. We also take a look at the specific environmental factors that influence entrants in a new sub-market in connection with environmental conditions such as regulation in 17 Western European countries. Finally, our paper combines firm-specific factors and regulative influences on sub-market strategies and success.

2. Theory and hypotheses development

2.1 Theory of disruption

Disruptive innovation theory classifies two kinds of innovations: Disruptive and sustaining (Christensen 1997, Christensen/Raynor 2003). A sustaining innovation improves the existing trajectories and hence targets customers who have not been satisfied by the antecedent technology. Disruptive innovations, on the other hand, are initially inferior in the performance metrics most demanded by mainstream customers and hence break with the performance improvement. What Christensen depicts is that these disruptive innovations can replace the incumbents of the old markets in the end. The initial theory can be broken down into a process of disruption phases from invention over new sub-market entry to the incumbents' replacement (Rafi/Kampas 2002, Hüsig/Hipp 2009). This subdivision helps to assess the potential threat of a disruptive change in advance, and improves the understanding of which phases have to be passed by an entrant in order to succeed over the incumbent. Additionally, Christensen extended the primary understanding of disruption by including institutional settings which can diminish or enhance the chance of disruption depending on the incentives and capabilities that reside at the bottom of each market. These are influenced by market specific factors and by firm specific factors. In the end, all these issues have an influence on the entrants' and incumbents' performance in the market (Christensen et al. 2004). By combining both aspects it becomes evident that entrants as well as incumbents need motivation and ability in every phase of disruption (Anthony et al. 2002, Rafi/Kampas 2002, Hüsig/Hipp 2009). Figure 1 shows the importance of motivation as well as ability of the entrants and incumbents alike from the

first to the last phase – the arrows can be seen as preconditions for both entrants and incumbents in order to succeed.

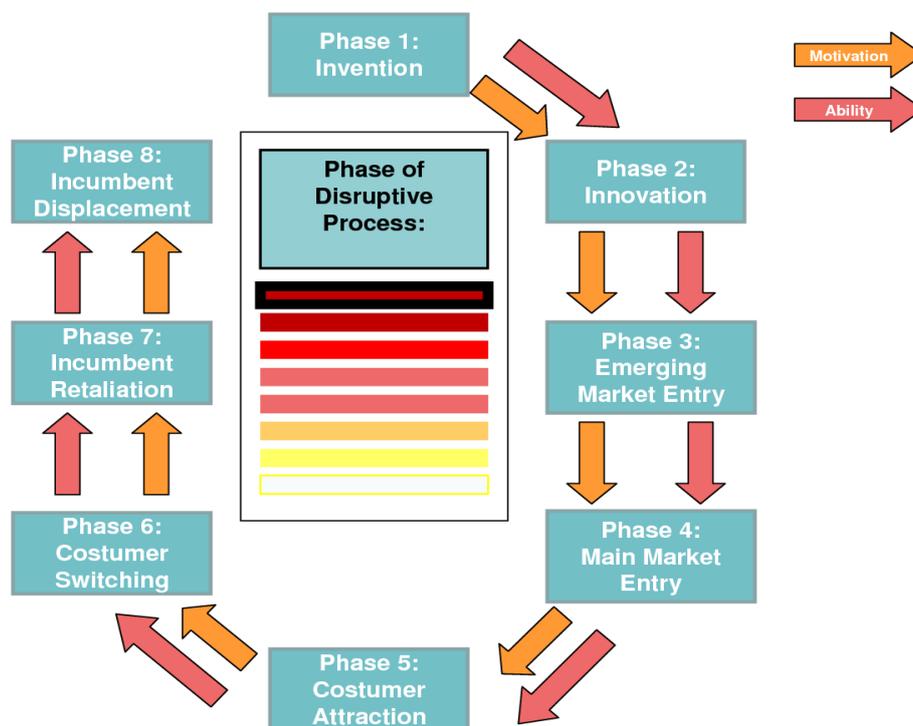


Figure 1: The phases of disruption and the motivation/ability framework (Anthony et al. 2002; Rafii/Kampas 2002; Christensen et al., 2004; Hüsigg/Hipp, 2009)

2.2 The incumbents' decision to enter a sub-market

The reasons for market entry can be firm specific, market specific and technology specific (Bonardi 2004, Garcia-Canal/Guillen 2008, Bonardi et al. 2009, Christensen 1997, Chesbrough 2003). This implies that the incumbents' decision to enter a sub-market depends on several factors, as this new market may or may not have an influence on the main market. Incumbents in this case are those firms that already competed in the main market and provided the previous technology. They can, but do not need to be regulated; and can, but are not required to be former monopolists, whereas regulated incumbents are former monopolists from other countries. These definitions are important for the distinction of strategies.

Studies that refer to diversification strategies of former monopolists reveal that they tend to diversify into other countries and other products more often than unregulated incumbents. This depends on their inability to react to regulation in the core market. Product diversification protects them from regulation if they diversify into non-regulated markets, and diversification into another country helps them gain plausibility towards the regulator (Bonardi et al. 2009). Regulative forces seem to outweigh the risk adversity to enter into new markets. This behavior may protect them from being disrupted in the end. The strategies also differ in terms of home and foreign countries since regulated

incumbents behave ambiguously (Bonardi 2004). This implies that the strategies of regulated incumbents differ significantly from the strategies pursued by non-regulated incumbents. Additionally, the purpose of regulation is to weaken the influence of firms with significant market power (ERG 2006). In the end, this leads to smaller market shares which result in smaller networks and network values for them. As the loss of network value is more serious in network industries, these firms may react to regulation with the entry into new markets (Shapiro/Varian 1999). Therefore, we propose the following hypothesis:

H1(I): A former monopolist is more likely to enter a new sub-market than a non-former monopolistic incumbent.

Moreover, the incumbents' long experience in one industry may cause them to concentrate on current customers' demands, and hence have a negative influence on sub-market entry into technologies which do not fulfil the current customers' needs (Christensen 1997, Chesbrough 2003). Customers' rejection at the very beginning, connected with the underperformance of the technology itself, is considered the main criterion that leads incumbents to disregard the disruptive market (Christensen 1997). In contrast, there are studies which showed that the pioneers in one industry improve their market share by diversification and that mainly large incumbents diversified into small markets (Mitchell/Singh 1993, Fernandez/Usero 2009). However, these studies do not involve disruptive innovations; hence, a positive sign of sub-market entry may also indicate a willingness of incumbents to enter such markets and, therefore, indicate technologies of sustaining character. Also the knowledge about disruptions may have changed the attitude of incumbents in the course of time. They may have become more sensitive considering innovations that initially underperform the trajectory. This fact is indicated by a "disruptive black belt", meaning that incumbents may have learned how to deal with possible disruptive threats and to enter such markets in time (Christensen et al. 2004). Thus, the second hypothesis is:

H2(I): An incumbent is more likely to enter a new sub-market if the innovation is perceived as sustaining

To analyze whether an incumbent is formulating multinational strategies or deciding on a single country's institutional influence is an important issue. With international expansion, multinational incumbents try to bring their strategies successfully into new environments by means of diversification. Consequently, incumbents take their home country specific strategies and bring them into other markets. In addition, managers are exchanged throughout the company with different locations in foreign countries (Garcia-Canal/Guillen 2002). This may lead to an overall international strategy of multinational incumbents, which is not directly connected to institutional circumstances but rather to their headquarters' location and the firms' origins (Darby/Zucker 1996, Chesbrough 2003).

H3(I): An incumbent is more likely to enter a new sub-market if he is entering this type of new sub-market in the country where headquarters is located.

Additional influencing factors on the incumbents' entry decisions have already been tested in other studies and are included as control variables. The market share in the industry has shown to be positively connected with sub-market entry, since the market share serves as proxy for industry-specialized assets (Mitchell 1989). Regulation thereby has an influence on the foreign country's choice (Garcia-Canal/Guillen 2008).

2.3 The incumbents' sub-market success

Whether sub-market entry can lead to successful growth depends on the strength of the single incumbents' motivations and abilities (Anthony et al. 2002; Christensen et al. 2004). This shows that the incumbents' success depends on two factors. The first factor can be influenced by the incumbents as it involves firm-specific factors, whereas the second factor cannot, because it involves the entrants' behaviors. To integrate both factors, market shares are taken into account. They are often taken as a measure for success (Hüsig/Hipp 2009, Fernandez/Usero 2009). Firm-specific factors were developed in the previous section and involve the single incumbents' entry decision on a disaggregated basis. This means that they are important for the capabilities and incentives of each single incumbent. These entry decisions involve factors which describe the incumbents' regulation, the importance of the technology as well as their strategies. Consequently, success can be seen as the aggregated product of the single incumbents' motivations and abilities. Thus, the fourth hypothesis can be summed up as follows:

H4(I): The incumbents' success is the result of the single incumbents' motivations and abilities.

If the result is significant, this implies that the hypotheses not only have a significant influence on sub-market entry but also on success.

Independent variable	Expected sign	Source
H1(I): Firm experience vs. regulation	negative	Christensen 1997/2003/2004
	positive	Bonardi
H2(I): Sustaining character of innovation	positive	Christensen 1997/2003/2004
H3(I): International strategy	positive	Christensen et al. 2004
Control variables	Expected sign	Source
Firms' market share	positive	Mitchell 1989/1993, Fernandez 2009
	negative	Christensen 1997/2003/2004

Table 1: Summary of the hypotheses for the market entry of incumbents in regulated industries

2.4 The entrants' motivation and ability

The following hypotheses are also developed on the basis of the above framework and reveal the entrants' chances to succeed in a regulated industry. In this sense, they address stages three, four and eight (figure 1), in which it is decided whether entrants only create small niche markets or

whether they can develop and create large markets which, in the end, may disrupt the established incumbents (Rafii/Kampas 2002, Hüsigg/Hipp 2009). The motivation/ability framework additionally shows that for successful growth a combination of several influencing factors is decisive (Anthony et al. 2002, Christensen et al. 2004). Therefore, only the combination of the variables may lead to the entrants' success factors.

Strong regulative efforts are connected with falling prices and the loss of market shares from former monopolists in connection with high penetration rates and higher quality products. The overall purpose of regulation is the creation of perfectly competitive markets. In such markets customer penetration is high and the prices are low (Boylaud/Nicoletti 2001). The motivation/ability framework describes the situation in which entrants with disruptive innovations have the best possibilities and incentives to create successful markets (Christensen et al. 2004). This means that one can read off the environmental and regulative circumstances and deduce entrants' behaviors. This indicates that entrant firms behave insofar as the environment allows it. Consequently, entrants in a cross-country comparison would behave according to the different conditions in their home markets.

The first purpose of regulation is to lead to higher customer penetration in a country. Higher penetration rates are the result of a larger customer base and reflect the customers' acceptance. This in the end leads to higher domestic demand. Especially in the case of disruptive innovations entrants are said to have a forward-looking role. They enter into small insecure markets, to which incumbents do not pay attention (Christensen 1997). But in regulated industries low domestic demand points to competitive problems which in the end influence the entrants' chances in a market (Boylaud/Nicoletti 2001). This again implies that the forward-looking capability of entering firms is affected in regulated industries. Entrants hence have difficulties in these markets because low penetration rates are bound to distortions from the competitive environment. This in the end might have an influence on the entering firms' behaviors. Moreover, the disruptive potential of WLAN technology might be limited, and the application as public hotspot translates to a sustaining innovation which would diminish the forward-looking role of entrants (Hüsigg et al. 2005). Therefore, the first hypothesis can be summed up as follows:

H1(E): The higher the penetration rates, as an indication of stronger competitiveness in a market, the more entering firms will behave consistently with the domestic demand structures and create larger successful niche markets.

If the penetration rates are not significant, then entrant firms develop independently from domestic demand. A positive sign of this variable indicates that entrant firms react on the demand conditions, whereas a negative sign of this variable would reveal that entrants think ahead and enter into emerging small markets which are insecure. The last option would also reveal the entrants' independency from regulative efforts. Additionally, a negative sign of this variable would show that entrants have the ability to foresee markets which they are said to do in a disruptive scenario,

whereas a positive sign indicates that they react to given market conditions, and avoid entering into emerging sub-markets, which points to a sustaining scenario.

The above framework also suggests that entrants need the ability of market access in order to compete successfully. In regulated markets one of the main barriers is the access to the monopolistic bottlenecks. These may be one part of the network of the former monopolists (Christensen et al. 2004). If those monopolistic bottlenecks deter entrants from market entry, then the purpose of regulation is to minimize them even at the expense of the former monopolists. But they have learned to resist regulation and hence have developed strategies that protect them from regulation like lobbying (Van Gorp/Maitland, 2009). If one former monopolist is able to resist regulation better than another in another country, then the entrants in the first country may have difficulties to gain foothold in the market. This shall manifest in the entrants' market size in one country. Therefore, the next hypothesis can be summed up as follows:

H2(E): If the former monopolist can successfully resist regulation, then entrants will behave in accordance with the given circumstance and avoid sub-market entry, which in the end means the creation of small markets.

High incumbents' percentages stand for high barriers to access for entrants and for strong incumbents' resistance to regulation. A negative significance of this variable would indicate that the former monopolists' market share plays a vital role for entrants. If the variable is not significant, this would indicate that the former monopolists' behavior in the access does not play a significant role. This last option would reveal highly competitive markets.

The third purpose of regulation is falling prices. From the market perspective, an incumbent feels strong competition in a market which results from many competitors. The low barriers to entry attract many newly entering firms, which on their own try to set the prices below the ones of incumbent firms. This lowers the price to a minimum, which results in low margins for each incumbent. Entering firms can now invade the markets; thereby even the threat of entering is sufficient (Knieps 2005). This indicates that lower prices are connected to strong competition. But low prices are only the result of competition. Entrants need a chance to undersell the incumbents' offerings in order to create successful disruptions. The theory of disruption proclaims that entering firms invade those fringe markets, for which the incumbents don't fight because they are not attractive enough, by offering low priced products (Christensen 1997, Anthony et al. 2002). This would indicate that entrants enter into markets where the price of the competing, potentially disrupted product, is high. As regulation lowers prices, this factor may also affect disruption and force entrants to create sustaining innovations. So regulation can influence the entrants' behaviors and hamper disruption in the end. Entrants would potentially invade those markets where the price-performance ratio is not perfect. The structure of network industries allows incumbents, in contrast, to sell their products very cheaply in order to gain market share and the necessary customer base, especially in industries in which the additional cost of the product is very small but entry costs are high (Shapiro/Varian

1998). This confirms the entrants' chances in markets with high prices but reveals that in the end disruption may be harder to achieve because of the incumbents' retaliation.

H3(E): If the price of the competing technology is high, then entrants will have the incentive to undersell this price and will create larger successful emerging markets.

If this variable is significant and positive, it would show that high prices have a positive influence on entrants. This would reveal that high prices attract more entrants. If the variable is negative and significant, this would indicate that low prices lead to large entrant markets. If the variable turns out not to be significant, this would show that price does not have an influence on the entrants' market behavior because they behave independently. The variables and the expected signs are shown in table 2.

Independent variables	Expected sign	Source
H1(E) Domestic demand condition	positive	Christensen et al. 2004, Hüsigg et al. 2005
H2(E) Monopolistic bottleneck	negative	Anthony et al. 2002
H3(E) Price	positive	Christensen 1997, Adner 2002

Table 2: Summary of hypotheses for the entrants' abilities and motivations

3. Methods

3.1 Data collection and sample

The data for the analysis contains 104,632 hotspots in 17 Western European countries taken from jiwire and from the incumbents' homepages, of which about 39% belong to incumbents and 61% to entrants. Incumbents are defined as MNOs which provide the previous, in this case potentially disrupted technology. These are operators with UMTS (Universal Mobile Telecommunications System) licenses which already rolled out their networks. Entrants are defined as all other hotspot providers. These can either be MNOs which do not have UMTS licenses at all or which do not own UMTS licenses in that specific country. Hence 62 MNOs were defined as incumbents. The data was collected in 17 Western European countries, namely, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK.

3.2 Operationalization of variables

The first dependent variable measures the likelihood of the individual incumbents' sub-market entry as a binary encoded variable, i.e. 1 represents sub-market entry and 0 the contrary. The second independent variable measures the single incumbents' success in terms of market share in one country. Ex_mon is a binary encoded variable which measures whether the incumbent is a former monopolist in that specific country or not. It can hence be seen as a regulative factor and tests H1(I). UMTS_dat and HSDPA_dat (High Speed Downlink Packet Access) are date variables that represent the single incumbents' technology strategy in a regulated environment to test H2(I). Int_Strategy is a variable which shows the international strategy in terms of hotspots according to

the decision made in the headquarters' location to test H3(I). The independent and control variables have been encoded as follows in table 3. H4(I) was tested by combining the independent variables.

Variable	Description	Encoding	Expected sign
Ex_mon	ex-monopolist or not	binary	positive
UMTS_dat	date of UMTS launch	date	positive/negative
HSDPA_dat	date of HSDPA launch	date	positive/negative
Int_Strategy	decision of incumbent in home country	binary	positive

Table 3: Summary of the independent variables for the incumbent MNOs

The dependent variable "EntrantsInh" measures the motivation and ability of entrants in the countries. "Ln_EntrantsInh" is calculated using the logarithm of "EntrantsInh". For this reason, the total number of hotspots by entrants has been divided by the total number of inhabitants and multiplied by 100,000 for more convenient results. The data for inhabitants have been taken from the OECD and correspond to 2009.

The following independent variables have been specified for the hypotheses regarding the entrants: "BB_subscription" represents a variable that serves as proxy for the domestic demand on broadband services and hence for hotspots as well. This variable thus serves as test of H1(E). It also shows in which markets entering firms go into. The data refer to 2008 and have been taken from the ITU statistics. Hotspots underlie domestic demand structures because they cannot be traded with. "Ln_BBsubscription" is calculated using the logarithm of "BBsubscription". "Exmonshare" represents the ex-monopolists' market shares in the total broadband access lines. Hence it serves as proxy for the ex-monopolists' resistance to regulation, as suggested by Bonardi et al. (2009), and their power in this market as well as the access possibilities for entrants into the fixed broadband market. "L_Exmonshare" is calculated using the logarithm of "Exmonshare". The data have been taken from the European Commission and refer to July 2008. Data for Switzerland refer to January 2009 and have been taken from the BAKOM's annual report. Due to the fact that Norway is not in the EU and does not provide any information on the former monopolist' market share in terms of the lines in percentage, Norway had to be excluded from further analyses. This variable is used for H2(E). "Mob_Price" and "BB_Price" each represent the countries' average. These variables serve as independent variables to test H3(E). The data have been taken from FICORA and represent data from the year 2008. The data for mobile telephony represent the small basket from modest mobile phone users, which are a relevant market segment in case of potential disruption, because these prices represent the low demanding customers' costs (Christensen 1997, Adner 2002).

3.3 Model specifications and tests

For the statistical testing, different regression models were used. For the models 1-5, binary logit regression was applied. There are altogether 62 observations, from which 34 providers have been

encoded with "0" and 28 with "1". In order to measure incumbents' entry success, tobit regression models were used in model 6-10. Tobit regression models are a good way to adapt regression on censored independent variables, whereas logit regression is used when the dependent variable is binary encoded. The independent variables were also tested for collinearity and heteroskedasticity.

To test the hypotheses regarding the entrants, a linear regression model (1E-3E) was used. Due to the few observations, all model assumptions were tested. The models were tested for heteroscedasticity, non-linearity, collinearity, and normality of the residuals. The significance level for all tests is $\alpha = 0.05$. As all the test results indicate p-values which are higher than $\alpha = 0.05$, none of the model assumptions can be withdrawn. Therefore, all models have been proved to be correct and hence can be applied. Additionally, all variables have been tested for collinearity. Collinearity problems did not occur.

4. Results and discussion

4.1 Descriptive results

The central finding is that in 8 of the 17 countries analyzed, incumbents could take advantage of the arising markets. In the other 9 countries entrants remained ahead of the incumbents. Austria, Belgium, Finland, Italy, Greece, Luxembourg, Norway, Switzerland, and the UK are dominated by entrants; and Denmark, France, Germany, Ireland, the Netherlands, Portugal, Spain, and Sweden are dominated by incumbents. Figure 2 summarizes the developments in the observed countries. In this sense a country is seen as entrants' dominated if the relative percentage of entrants exceeds 50% and as incumbents' dominated if the relative percentage of incumbents exceeds 50%.

Incumbents dominated countries 
Entrants dominated countries 

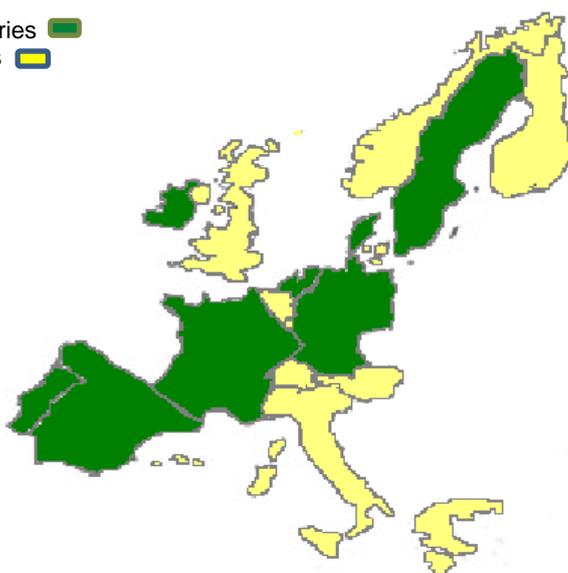


Figure 2: Incumbents' and entrants' dominance in the Western European hotspot market

The countries vary in their level of dominance. "ShareInc" represents the total market share of incumbents (percent) and "ShareEnt" the market share of entrants (percent), respectively. To calculate the market shares, the total sum of incumbents' or entrants' hotspots was divided by the total sum of hotspots in that specific country and multiplied by 100. The results are shown in figure 3.

In the UK incumbents have 2.85% of the market share and in Greece incumbents have 5.08%. In Denmark, on the other hand, incumbents have 70.65% of the market share and in Ireland they have 66.15%. Whereas Greece and the UK represent countries of strong entrant domination, Denmark and Ireland are definitely dominated by incumbents. On average, incumbents have a market share of 41.82% whereas entrants 58.18%.

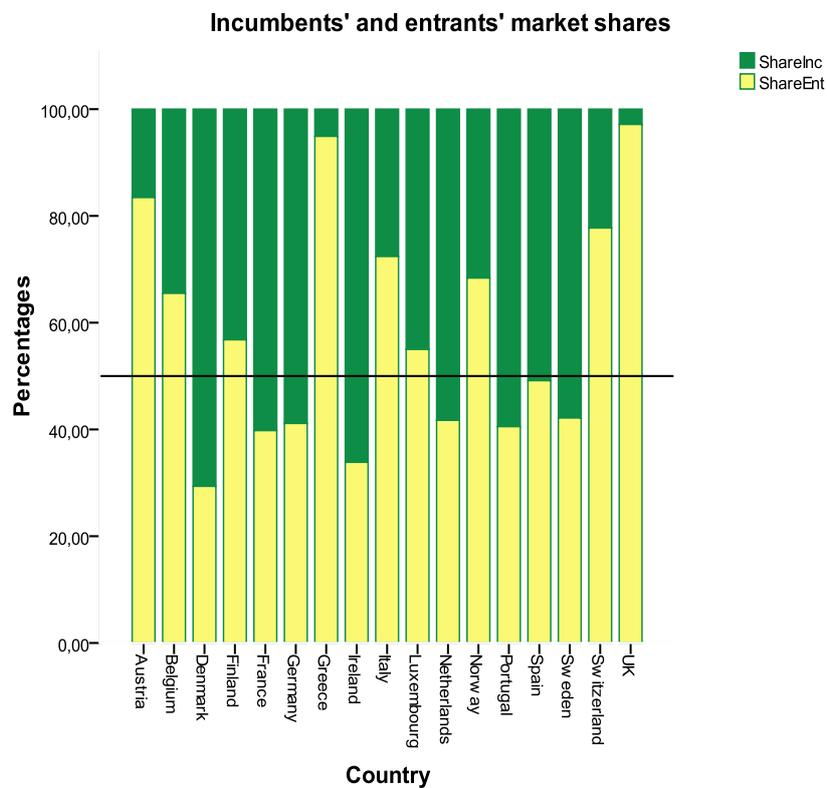


Figure 3: Entrants' and incumbents' market shares

Not only the market shares of the entrants and incumbents differ but also the thereby resulting market sizes. To be able to compare the different market sizes, three new variables have been computed, namely "TotalInh" "IncumbentsInh" and "EntrantsInh". These variables allow for a cross-country comparison of the market sizes.

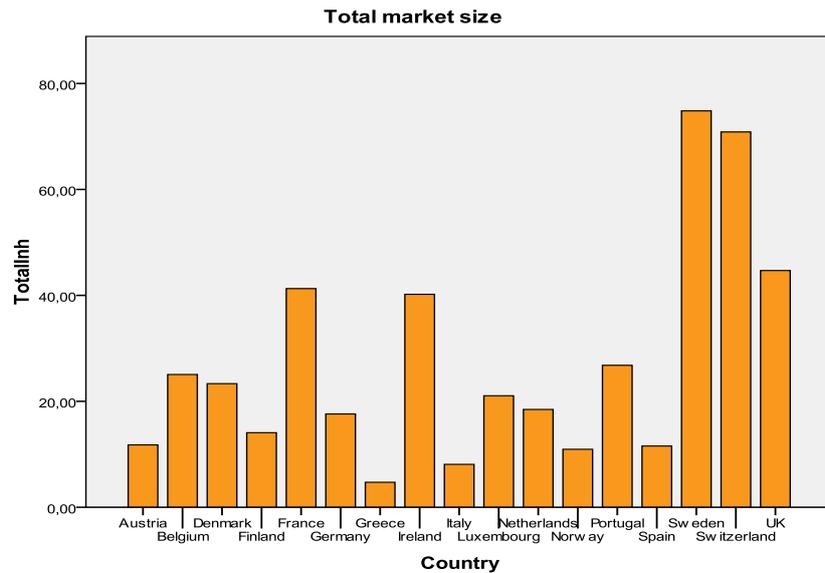


Figure 4: Total market sizes in a cross-country comparison

The result indicates that different market sizes have developed throughout time. Whereas the largest markets have developed in Sweden and Switzerland, the smallest hotspot markets can be found in Greece and Italy. Additionally, “EntrantInh” and “IncumbentInh” represent the market sizes for entrants or incumbents, respectively, in relation to the total number of inhabitants.

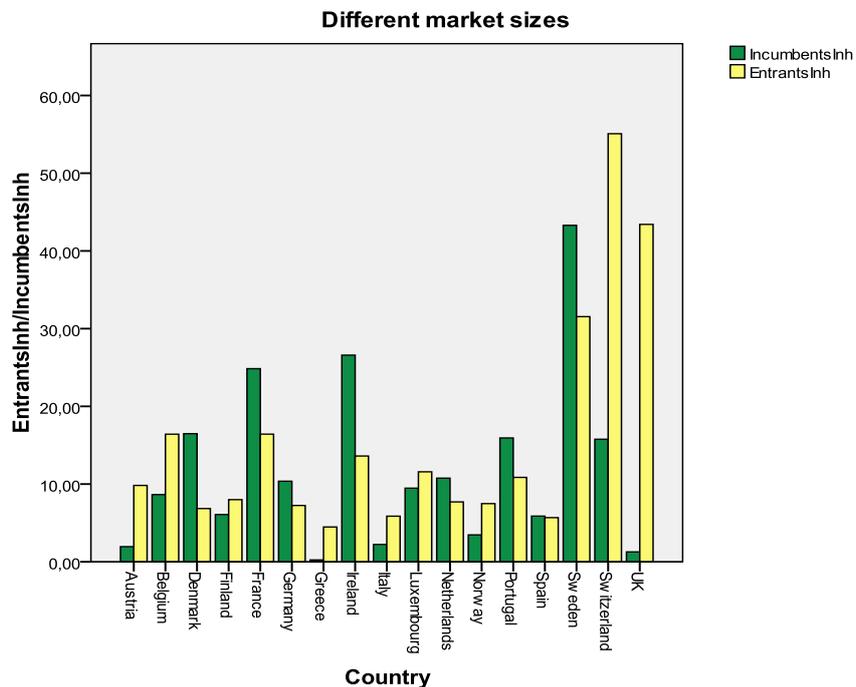


Figure 5: Differences in market sizes for entrants and incumbents

Entrants and incumbents have created different market environments. The descriptive analysis reveals that Switzerland has created the largest market for entrants with a market size of 55.08 and Greece the smallest market for entrants with 4.48 entrant hotspots per 100,000 inhabitants. Whereas in Switzerland and the UK entrants have created huge markets, entrants in Greece, Italy

and Spain have not. On the other hand incumbents in Sweden have a market of 43.29 hotspots per 100,000 inhabitants, whereas in Greece they have 0.24 hotspots per 100,000 inhabitants.

For the analysis of the providers with most hotspots in the Western European hotspot market, all hotspots which belong to one provider have been added. The results are presented in figure 6. All providers that own less than the mean have been filtered out. The mean is approximately 567 hotspots. Hence, providers with less than 567 hotspots in Western Europe have been filtered out. "Rest" and "Independent providers" have been filtered out because this variable represents many single providers. Success in this specific context refers to the total number of hotspots in Western Europe.

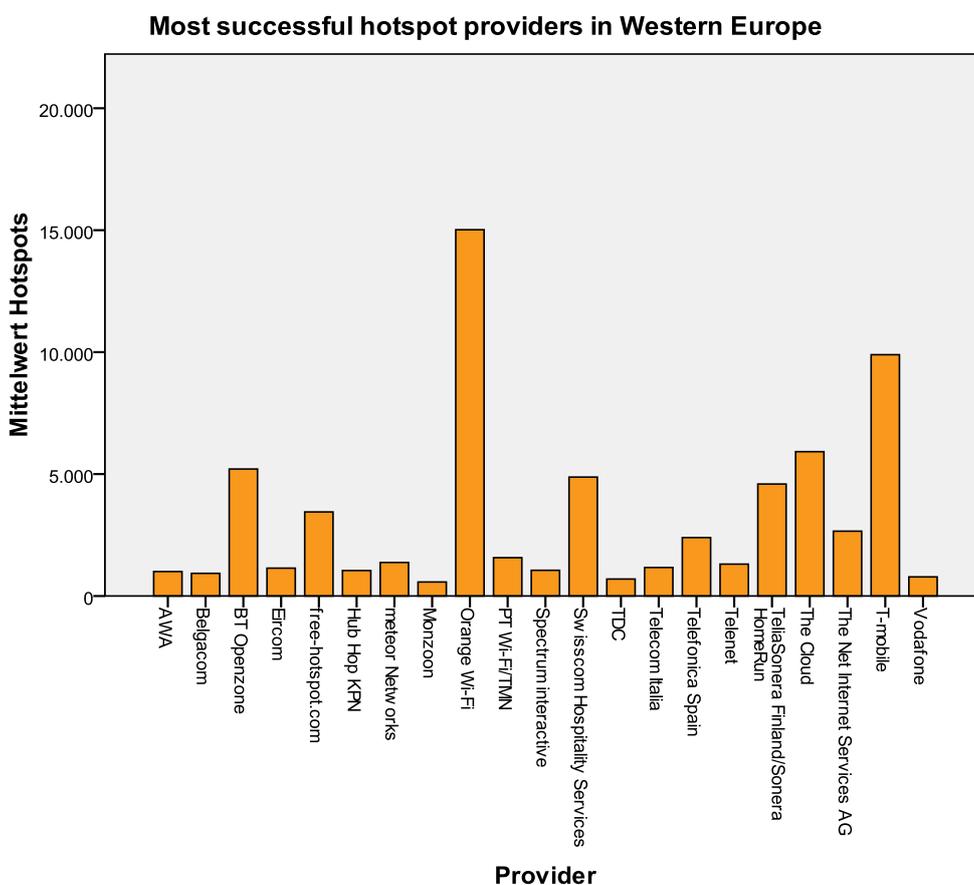


Figure 6: The most successful hotspot providers in Western Europe

As the analysis reveals, Orange has 15,019 hotspots, followed by T-mobile with 9,895 and BT, TeliaSonera and Swisscom. The most successful entrant is The Cloud with 5,919 hotspots in several Western European countries, followed by free-hotspot.com with 3,448 hotspots. Orange in France has developed the biggest hotspot network in Western Europe. Though Orange has hotspots in several Western European countries, most hotspots can be found in France. T-mobile/T-com owns about 10,000 hotspots in Western Europe. T-mobile has hotspots in every country where it operates, so it has hotspots in Austria, the Netherlands, and the UK. BT, which is classified as entrant, has a network of about 5,000 hotspots in GB. With that, it has about 20% of the

market share in GB. It also owns hotspots in Ireland. In GB it has partnering contracts with FON and Kezone. This allows customers to access these hotspots, too. Swisscom is the only hotspot provider that has hotspots in nearly all Western European countries, even in those where it does not have a mobile network. The Cloud has several hotspots in many Western European countries and is hence the leading new entrant in that market. Its strategy is to have contracts with many providers. Consequently, one hotspot can be operated by several partners. This implies that The Cloud profits from huge networks. Free-hotspot.com offers hotspots in nearly all Western European countries. Its strategy is to offer hotspots free of charge. It finances its hotspots through individual advertisements. Therefore, free-hotspot.com does not need a huge network.

4.2 Results on incumbent strategies

According to the analytical results of the logit and tobit models, none of the hypotheses can be withdrawn. The variables had the expected directions and remained robust. So, hotspots are used by former monopolists due to regulative forces in the main markets. They are also used to improve the incumbents' presence in the mobile broadband market due to UMTS launch delays. The significance of Int_strat reveals that incumbents adapt international strategies of market entry, which also leads to their success.

Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5
Ex_mon	2.49889			1.98286	
	2.068**			1.455	
UMTS_dat		3.6577E-08		2.7064E-08	2.6555E-08
		2,423**		1.671*	1.656*
HSDPA_dat		-2.18378e-08		-4.11309e-08	-3.40254e-08
		-1.240		0.0644*	-1.706*
Int_strat			2.57717	2.25669	2.5016
			3.126***	2.272**	2.646***
Control variable					
Marketshare_Mobile	0.0600271	0.13158	0.115405	0.0855662	0.125869
	1.836*	3.56***	3.246***	1.814*	3.118***
const	-2.34968	-198.879	-5.22804	185.572	96.2422
	-2.652***	-0.9771	-3.870***	0.7146	0.4098
Observations	62	59	62	59	59
McFadden's R ²	0.314147	0.333685	0.398589	0.464987	0.435024
*** p-value < 0.01					
** p-value < 0.05					
* p-value < 0.1					

Table 4: Logit regression results for model 1-5

Independent variables	Model 6	Model 7	Model 8	Model 9	Model 10
Ex_mon	43.973			36.667	
	4.5358***			3.754215***	
UMTS_dat		0.000000434		2.44E-007	2.76E-007
		2.53**		1.920180*	1.718*
HSDPA_dat		-4.57E-08		-2.06E-07	-1.45E-07
		-0.228		-1.295	-0.7745
Int_strat			36.7861	18.415	30.7591
			3.7113***	2.070357**	2.854***
Control variable					
Marketshare Mobile	0.185322	1.7324	1.2139	0.238702	1.3873
	0.5594	4.7450***	4.07225***	0.651259	4.132***
const	-17.5289	-5229.193	-63.9570	-523.966	-1799.24
	-1.841*	-2.073704**	-	-0.253239	-0.7113
			4.576938***		
Observations	62	59	62	59	59
R²	0.5379	0.3091	0.388593	0.61439	0.392869
Adjusted R²	0.514	0.2579	0.356968	0.569896	0.335592
*** p-value < 0.01					
** p-value < 0.05					
* p-value < 0.1					

Table 5: Tobit regression results for model 6-10

The variable for H1(I) "Ex_Mon" was used in model one, four, six, and ten. It was significant in all models except for model 4. It is robust throughout all model specifications and has a positive sign. This means that being regulated has an influence on the sub-market strategies and success. So the first hypothesis is supported.

The second hypothesis (H2(I)) was supported by two different variables: UMTS_dat and HSDPA_dat. The first one is a significant predictor of the incumbents' sub-market entry. These variables were used as independent variables in model two, four, and five for market entry and in seven, nine, and ten for success. The significance and the direction of UMTS_dat indicates that incumbents tend to diversify into the hotspots market if they launched UMTS later. Hence hotspots can be seen as a sustaining innovation for UMTS. Delays in UMTS launches also have an influence on the incumbents' motivations and therefore have an influence on the success in the hotspot market, too. HSDPA_dat was only significant in some model specifications which consider the entry decisions. Only in combination with international strategy and regulative forces it is significant.

International strategy (H3(I)) was robust and significant in all model specifications and proved to be a good predictor of market entry. In this case, the boundaries between countries are already blurred and international strategies proved to be a main factor of sub-market entry and success. Thereby the control variable market share had also a positive influence. This shows that the more market shares incumbents had in the main market, the more they invested into the arising hotspot

market. Model 9 combines all the hypotheses and has also the best model fit. With the adjusted R^2 about 57% of the variance could be explained.

4.3 Results on entrant strategies

Table 6 shows the results of the linear regression models 1(E) to 3(E). All variables are robust throughout all the models. The results show that "Ln_BBsubscription" is significant throughout all the models as well as "Exmonshare"/"Ln_Exmonshare". The variable which represents the domestic demand „BB_subscription“ is robust and significant throughout all the model specifications. This variable has a positive direction, and thus supports the first hypothesis (H1(E)). The former monopolists' market share in the respective market has a negative influence on the entrants' entry behavior. The negative and robust variable "Exmonshare" shows that the former monopolists' market share plays a vital and limiting factor for the entrants' success in the hotspot market, supporting H2(E). "BB_Price" was not significant but "Mob_price" was significant and had a positive sign as expected. This result indicates that the price only plays a vital role for the entrants' success in the case of the mobile communication service prices, whereas prices of broadband services did not. This shows that high prices increased the market size of entrants, and thus only partially supports H3(E) for the mobile communication service prices.

Independent variables	Model 1(E)	Model 2(E)	Model 3(E)
Ln_Bbsubscription	1.0325	1.0437	1.3926
	0.4463**	0.5619*	0.4219***
Exmonshare	-0.0343		
	0.0127**		
Ln_Exmonshare		-1.7034	-1.7001
		0.6305**	0.5000***
BB_price		0.0133	
		0.0138	
Mob_Price			0.0293
			0.0135*
const	0.8543	5.3289	1.7815
	1.6197	3.0066	2.5215
Observations	16	14	16
R ²	0.507	0.51	0.664
***p-value<0.01			
**p-value<0.05			
*p-value<0.1			

Table 6: Regression results for model 1 to 3¹

¹ It has to be emphasized that the decision to take „Exmonshare“ instead of „Ln_Exmonshare“ for model 1 only results from the model assumption of linearity, which could be withdrawn in case of "Ln_Exmonshare". The logarithm did not change the interpretation of the results.

The overall result indicates that if the institutional environment does not offer the right possibilities for entrants, the resulting markets will be small. Hence entrants will create niche markets. This is the situation which can be seen as the “dilemma” situation, according to Christensen et al. (2004). In contrast, if entrants get the right possibilities, then relatively large markets will develop and entrants will be able to proceed closer to the next stage in the disruption process. These markets are declared as “hotbed” or “panacea” situations (Anthony et al. 2002).

5. Conclusions and implications

This paper investigates the incumbents' and entrants' strategies in a new sub-market created by a potentially disruptive innovation and their subsequent success. Thereby the special environmental forces of a regulated setting have been analyzed. The results reveal that for both entry and success different influencing factors were important

The disruptive theory predicts that an incumbent is less willing to enter into disruptive markets because of the “failure framework” (Christensen 1997). However, the prototype of “disruptive technology” was the HDD industry, which exhibits huge differences to the telecommunications industry. The latter is characterised by network effects and regulation. Network effects cause an incumbent to feel a greater loss when losing customers. This enhances the worth of one single customer even if he may not be a high demanding customer. According to this, a sustaining innovation could be broader defined than in the HDD industry, because anything that additionally supports an increase in the customer base can be seen as sustaining in a network industry.

Due to regulation, former monopolists lost market shares in every country. This loss of the important customer base led them to enter this sub-market. Hotspots are not regulated and therefore former monopolists cannot be regulated in this market, neither. Hence their market share in the hotspot market cannot lead to competitive problems. This causes firms to develop different strategies to protect their customer base, and their market shares because the sum of customers is more precious to the firms even if the individual customer pays less (Shapiro/Varian 1999).

Additionally, incumbents with delays in their UMTS launch entered into the public hotspot market. This supports the findings by Hüsigg et al. (2005) that hotspots are sustaining for industry incumbents. Hence, in this industry the need to maintain market shares because of network effects had an influence on sub-market entry. Incumbents in the network industry could not wait for the next generation and leapfrog a technology because the loss of market share was more critical for them. Additionally, incumbents which already entered into the hotspot market used it as a means to test the customers' acceptance of broadband applications. This in the end could advance the HSDPA launch date as the incumbents had a cost-effective feedback on the acceptance of broadband applications from their customers. Also, the larger incumbents entered into this market. This points to a sustaining character of hotspots in western Europe, as stated by Hüsigg et al. (2005), since the disruptive theory would suggest that large incumbents are not motivated to enter into small emerg-

ing markets based on a potentially disruptive innovation if their market share is large in the established market (Christensen 1997).

In sum, incumbents in a regulated environment, especially former monopolists are shown to strategically decide in an area of conflict between regulation, internationalization, and technological strategies.

The entrants' chances in the hotspot market were tested on the grade of regulation, such as the possibility of the monopolistic bottleneck, to the degree of customer penetration, and on the prices of the "competing technology". So far, the research focused on the incumbent entry behavior and did not investigate the influencing factors on the entrants in cases of industry changes due to potential disruptive technologies. Therefore, the entrants' possibilities for market success have been analyzed and tested. The results show that high penetration rates and low control of the former monopolists over the access lead to better chances for the entrants in the Western European hotspot market. In comparison, the role of prices hence can be seen as an inferior influence on entrants' behaviors. Although hotspots are projected to have a sustaining impact on incumbents as Hüsigg et al. (2005) claim, there are still countries where entrants dominate the markets. This finding reveals that in some of the analyzed countries, incumbents did not use hotspots as sustaining innovation, although they could. In these countries entrants have advanced into the next phase of the motivation/ability framework. This finding supports the "relative" character of disruptive innovations (Christensen et al. 2004). Therefore, in the end it depends on the individual markets and firms whether to consider a technology as sustaining or not.

The results show that the entrants' behaviors in the hotspot market underlie domestic demand structures. This means that hotspots are only built for home market purposes and hence entering firms could behave in accordance with the institutional settings. Other innovations may lead to different outcomes because they may be produced for other countries, which may lead to distorted results. The results indicate that entrants' cumulative behavior is consistent with the environment where they live. This means that entrants and their sub-market success could be predicted. In environments where entrants had difficulties to enter or to find the suitable markets, entrants collectively shied away from market entry and the resulting market sizes are not large. After 10 years of WLAN (Wireless Local Area Network) and years of regulation, the former monopolists' market share still plays a vital role for entrants. The domestic demand plays a supporting role for entrants.

This implies that entrants react to certain circumstances instead of anticipating. Entrants entered into those markets with relatively high demand. Consequently, they avoided small and uncertain sub-markets in this case. They entered into markets that already promised to be successful. This would suggest that WLAN hotspots have been a sustaining technology; otherwise it would contradict the disruption theory (Hüsigg et al. 2005, Christensen 1997). Another possible explanation for this divergent behavior could also be rooted in the effect of regulation, which impedes market entry. Interestingly the relative mobile broadband prices were not significant, whereas the mobile

phone service prices were. The price, however, had a positive but not significant influence on the entrants' market size, which points to the fact that entrants can create successful markets in which they have the chance to underbid incumbents, especially in the case of the mobile communication services. This result puts Adner's (2002) findings into perspective, since the price effect might be a less important influencing factor for innovations with disruptive potential.

These findings have several interesting policy and strategy implications, since many regulative comparisons concentrate on prices, which shall reveal the competitiveness of the market. But the above results show that the former monopolists' power over the relevant network still plays a vital role for entering firms. This factor seems to be even more relevant than price. The latter only plays a role in a broader context with many other factors. Therefore, it would be more suitable to concentrate on the input factors of regulation like the former monopolists' might of a bottleneck instead of the prospective output factors of competition. This may be difficult to pursue because the extent of "power" is hard to measure. But this only really reveals the true bottlenecks of competition in a market. One possibility could be structural separation. This in the end is one of the most radical market interventions, but also the most effective as this would take away the former monopolists' power over the networks.

In this case, the analyzed market might be predominately sustaining, but these finding can also be applied to disruptive innovations as they reveal that knowledge about technologies and making the "disruptive black belt" in terms of reacting with a strategy alone is not enough (Christensen et al. 2004). It also sheds light on the entrant perspective in markets where network effects and regulation also play in technological transitions a major role.

Especially the latest developments in the mobile broadband market with HSDPA speeds up to 21000 mbit/s and the launch of LTE (Long Term Evolution) show up new fields for further research about the future of public hotspots. During the time of the empirical results HSDPA rollouts were not completed yet. The influence on entering firms' hotspots could be observed over a longer period of time. Furthermore, the analysis does not entail whether incumbents built a separate organization for hotspots or whether they integrated it into their main organization, which represents a limitation due to the character of an industry level study. The structural and strategic choices on the individual firm level in the case of WLAN hotspots should be subject for future research.

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