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The Unprecedented Assimilation of Mobile Telephony in Ireland: a Phenomenon of the Celtic Tiger Era or a Result of Cultural Traits?

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"*Mobile phones could soon replace the pint of Guinness as the quintessential symbol of Ireland.*"

Jamie Smith, Irish Times, Aug. 14, 2000

Declaration

I certify that this thesis which I now submit for examination for the award of Master of Philosophy, is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

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Abstract

Following the universal acceptance of mobile telephony the once elitist gadget has become an indispensable democratic tool of everyday communications over the last three decades. Controversially, this thesis illustrates that its level of both adoption and usage did not develop in a similar homogenous pattern in selected OECD countries. In particular, the Irish performance is rather astonishing given the speed of adoption as well as the exceptional high revenue figures achieved by the wireless operators. Consequently, this work determines a selection of factors that drive and encourage both the adoption and usage of cellular telephony in Ireland.

The Irish experience is examined in the light of Rogers' theory of adoption and diffusion of innovation and demonstrates that domestic socio-economic factors such as the traditional Irish family structure helped the adoption process as did its young demography following the launch of prepaid services. Similarly, historic events such as emigration and the policy of attracting overseas companies to settle in Ireland created traits of a cosmopolite and open economy society whereas the civil war and governmental policies hindered the adequate rollout of the PSTN which resulted in a migration towards cellular telephony.

Significantly, by deploying a linear regression model this thesis showed that Hofstede's cultural dimension of uncertainty avoidance correlates the most with mobile telephony adoption. Controversially, while this dimension is generally link with protestant cultures this finding is rather contradictive when recalling Ireland's tradition of Catholicism and puts a long-cherished stereotype associated with Ireland into question. It was further demonstrated that the Irish benefited from their selection of the global TACS standard that promised economies of scale and subsequently reasonable-priced equipment. Due to this selection the incumbent establish some form of international roaming, which was a novelty outside the NMT system sphere at the time.

With regard to the exceptional revenue figures which were seen as a result of a '*rip-off*' policy by the wireless carriers this thesis found proof that they were in fact a consequence of the Irish's enthusiastic mobile phone usage rather than a product of over-charging. It was further demonstrated that the stereotype of the talkative Irish is profound in their legacy of story-telling as well as a consequence of the British suppression when the mother tongue was used to both conserve and keep their culture alive. Following the independence from their occupiers this regained freedom can easily be observed by the extensive rate of speech and 'pirate' radio broadcastings.

Altogether, it was shown that the Irish society resonate most fortune with the adoption of an innovation such as mobile telephony. Therewith, underpinning the relevance of cultural and social factors in addition to traditional solely economic and marked-orientated models.

Acknowledgement

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None of these individuals are responsible, of course, for any errors.

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1 Introduction

"*Horses being swapped for mobile phones in Dublin*"

Sean MacConnell, The Irish Times, Sep. 30, 2010

The above headline can only vaguely capture the extend and profoundness that the mobile telephone had gained within society in the last three decades[1]. While innovations such as the internet underpins the traditional and ongoing debate about getting the world *wired* individuals around the globe developed an affection for becoming *unwired*, indicating a similar revolutionary social change which serves the contradicting challenges for greater mobility in the networked society alongside establishing an yet intimate atmosphere of personal freedom[2].

Hence, the mobile phone has very rapidly gained universal acceptance, mobile telephony has not diffused consistently; the path of market development varies significantly between different countries and continents as depict in Figure 1-1.

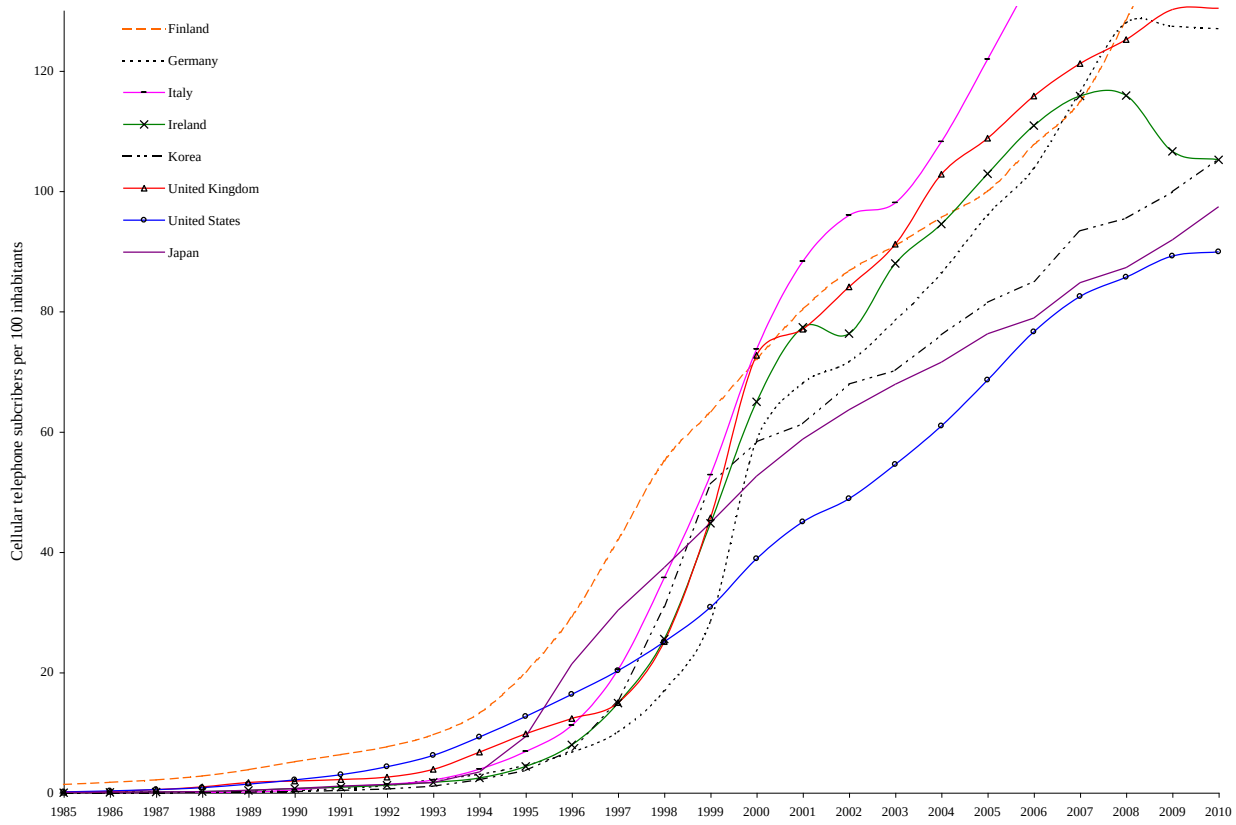


Figure 1-1: Mobile telephone diffusion in selected countries, 1985-2010 [ITU1999a], [ITU2012].

[1] The author can be contacted at scheibelhut@gmx.de.

[2] Also be observed in its deployment since many utilize it as an alarm clock or flash light in the dark [GSMA2011] whereas deaf people recognize video phones such as the iPhone for sign language communications [Wink2011].

Obviously, national markets have developed from different bases, at different rates, in different ways and for apparently different reasons. The surge in mobile phone density witnessed in the Nordic countries earned them an early reputation for their almost ubiquitous adoption of mobile telephony. In contrast, the large economies of the US and Japan experienced a more gradual growth in their mobile subscriber base. Quiet remarkable is Ireland's level of cellular telephone diffusion which supersedes that of far richer countries such as Germany, the UK and the US and even Finland at the turn of the century which contradicts the long-cherished assumption that the level of adoption is directly related to wealth. In general, most countries experienced unexpected strong growth in the late 1990s due to the launch of prepaid services, which "*was the most significant product innovation since the development of the initial cellular radio concept*" [Kalb2008] since the concept account for 75 per cent of global connections [RCRW2011] most prominently observable in Italy. Controversially, penetration rates of more than 100 per cent point to the phenomenon of multi-SIM usage which does not only question the link between subscriber growth and operators' economic performance but may also blur the underlying factors in place that contribute to the depict levels of diffusion[3]. Consequently, [Zhu2005] confirms the "*difficulty to evaluate the factors associated with accelerating the rate of diffusion*"[4]. Consequently, it must be questioned why certain societies have adopted cellular telephony far quicker than others and what factors are in play when considering the Irish performance.

Hence, a more unequivocal indicator was chosen which may put a different light on mobile telephone diffusion that hopefully will highlight some crucial elements responsible for diffusion characteristics. Following the significant increase in personal mobility in recent years which has been matched by a corresponding need to maintain group and individual connectivity, mobile telephony has shown dramatic volume increases, both in terms of subscriptions and generated

[3] The strong diffusion in Finish is an result of market entry of mobile virtual network operators (MVNO); as of Jan. 1, 2011, there were 17 MVNO active in the Finish market [MVNO2011].

[4] A report by Akio Oishi, of Japan's Ministry of Posts and Telecommunications, asserts that the demand for mobile telephones arises from factors other than cellular phone rates. It appears that adoption barriers such as handset costs and monthly subscription charges exert a greater influence on adoption than the actual call rates [Oish1997]. Hence, this would explain the success of prepaid services that eliminates the high costs of mobile phone ownership and monthly subscription charges against high call rates. In countries such as Finland service providers make little use of prepaid services which may help to explain their relatively slow adoption growth rates and disparity in diffusion performance and reflect a missed marketing opportunity. The OECD Communications Outlook 2003 reports that in Finland just 2 per cent of the overall market was pre-paid in 2001. Japan recorded a marginally greater proportion of prepaid subscribers (2.5 per cent) while the US recorded a somewhat higher figure of 9 per cent [OECD2003].

revenue. Expectable, countries exhibit marked differences, not only in their rates of adoption, but also in their levels of usage, measured as average revenue per user[5] generated (Figure 1-2):

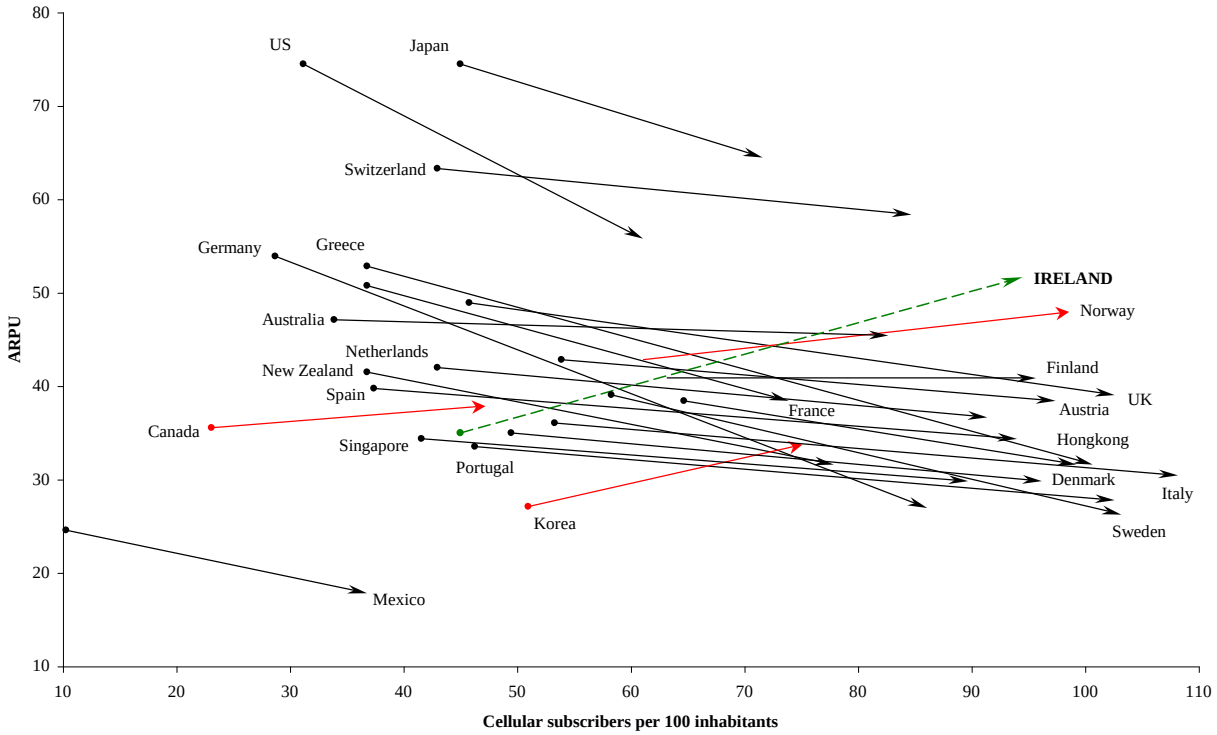


Figure 1-2: Mobile telephone penetration vs. ARPU, 1999 and 2004 [ITU2006], [GWM2004].

The development trajectories shown clearly indicate very strong global growth in mobile penetration rates over the recent period (1999 to 2004) for which reliable comparative data were available[6]. However, the picture for the corresponding revenue figures (ARPU) is less homogenous. Whereas countries such as Canada, Norway, Korea and Ireland remain the only countries which managed to sustain a growth in ARPU (in real terms), the other economies, in general, exhibit a marked downward trend. The extent to which this may be specifically attributed to price competition, market maturation or even regulatory influences is impossible to establish at present with any degree of certainty. Most astonishingly, against the European trend, ARPU in Ireland increased significantly (+46%), at a rate only matched by Korea (+26%). Although Ireland is a relatively mature market it records a revenue figures over twice as high as its European neighbours[7] which a volatile examination would trace down as a result of the 'Celtic tiger' phenomenon in the style of the growth rate achieved in the youngest 'Asian tiger'

[5] The term is further referred to as ARPU which is stated in current value terms and is calculated on a monthly basis.

[6] It was decided to concentrate on foremost OECD member countries depending on the availability of data.

[7] Notably, there is broad (per unit) revenue convergence within the main EU group and it may be argued that ARPU is substantially independent of the attained penetration rate on the basis of international comparisons. It may also be (counter) argued that demand is price-elastic in most European markets but inelastic elsewhere.

economy of Korea. It can easily be asserted that the Irish usage levels may be a reflection of an affluent economy exhibiting low price sensitivity. Indeed, there is little evidence of the later in a rapidly expanding economy and service provider revenues and profitability may be assumed to have grown dramatically to a level many times that of EU average. This may be as much a function of demographic factors and the values of the national youth culture as it is of national affluence. It may also reflect a lack of real competition in the market or a failure on the part of government to (de-)regulate or police prices[8]. Deregulation is a key factor that has contributed significantly to the mobile telephone boom[9]. The underlying argument was that new operators entering a formerly monopolistic market would force the incumbent to lower tariffs what should amount in declining rates. Ironically, the positive correlation between competition (number of operators) and penetration rates is put into perspective as depict in Figure 1-3.

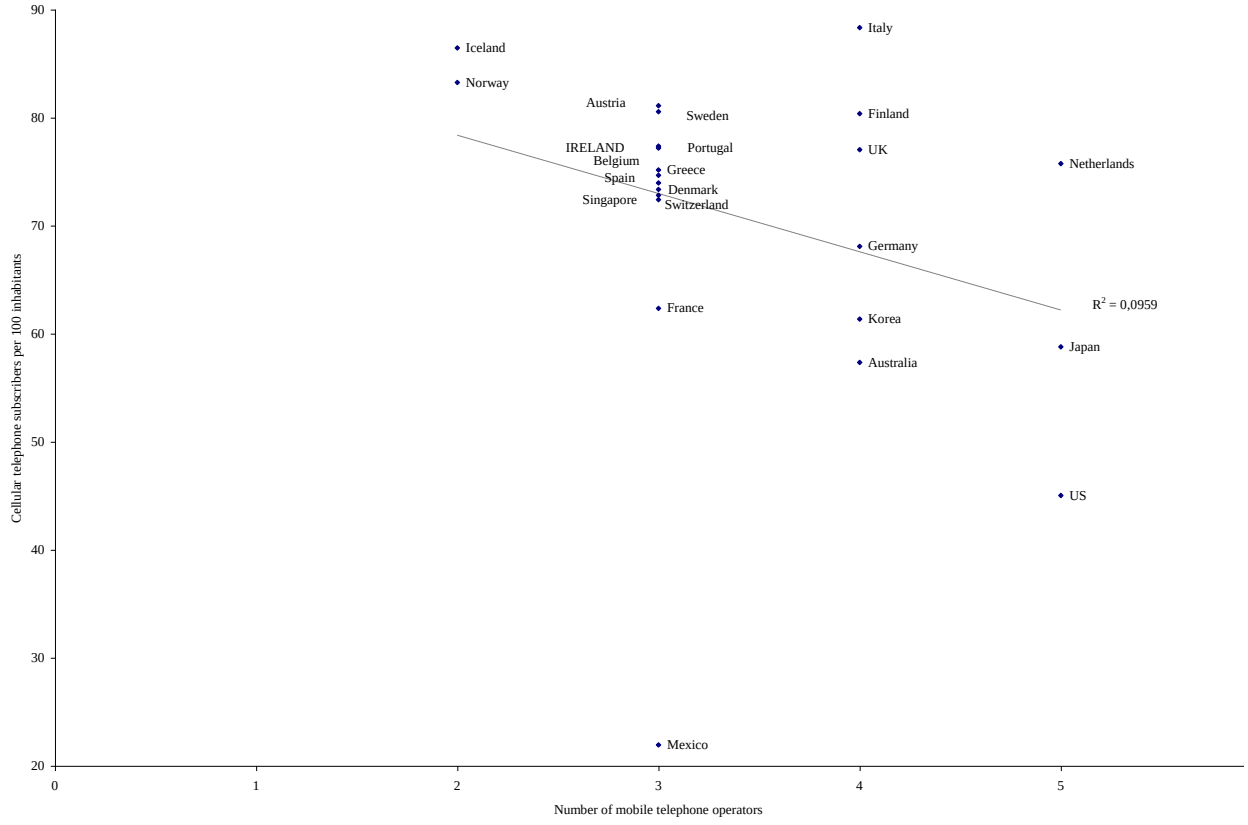


Figure 1-3: Number of cellular telephony operators[10] vs. cellular density, 2001 [ITU2005].

Surprisingly, countries with only two or three operators exhibit similar or even higher penetration levels as countries with four or more networks; in particular, Ireland's three mobile

[8] The unique performance of the Irish mobile telephony market gained also political recognition by Deputy Eamonn Ryan TD who claimed that the conduct of Vodafone Ireland (V-IR) and O2 was a '*rip-off*' [Parl2003].

[9] Since the complexity of deregulation merits extensive investigation it not a topic of consideration in this thesis.

[10] The number '5' on the x-axis indicates 'five or more' operators.

telephony operators achieved a level of cellular density between them which is higher than in those markets with five or more cellular carriers therewith indicating a negative correlation between mobile telephony density and competition.

These two examples serve to illustrate that it is far from easy to determine specific criteria or a simple formula to describe the adoption profile of mobile telephony in a country. Consequently, a broader view on technology adoption as such may deliver a valuable insight into a nation's propensity to accept or reject innovations and the unexpected admiration of the mobile telephone in Ireland. Further, since consumers must be willing or have a desire to use new products it is important to examine the factors that contribute to the decision-making process of an individual in a given society. This belief is also expressed by [Cate1999] who argue that there is a relationship between specific cultural values and certain aspects of behaviour. [Haap2007] confirms that "*the dynamics of adoption must be analysed not only as a technological phenomenon but also as a socio-cultural issue*". Moreover, despite the fact that culture is widely considered to play a significant role in the adoption of innovations, Bagchi et al. assert, "*national culture has rarely been treated in Information Technology (IT) adoption studies*" [Bagc2001].

Most vital, as national markets follow the trend of convergence due to the phenomenon of globalisation and with penetration rates exceeding saturation levels it was decided to put a large emphasis on the early phase of cellular telephony deployment and the era until the launch of the analogue prepaid card service in 1997. Consequently, domestic features should be able to surface which could determine the drivers of the Irish mobile telephony phenomenon. Coincidentally, given that cultural values were found to persist against the globalisation movement [Wats2002] it was decided to investigate cultural attributes that may resonate with the experience of cellular telephony against the Irish backdrop. Significantly, when recalling [Tria2002]'s statement that "*the cultures that emerge in different parts of the world often reflect the availability of flora, fauna, and other resources, as well as historical factors, such as migration, wars, revolutions, and inventions*" it is clear that many of the cited aspects do not only touch on the Irish nature but precisely match the formation of the country's cultural profile as illustrated in the following paragraph.

With regard to the ecologic parameters [Madd2010] argues that due to the "*absence of significant natural resources*" the Irish invested heavily in education resulting in one of the most highly skilled labour forces which coincided with the change from a predominantly agricultural economy to that of a knowledge-based one. Unfortunately, the dominant role of flora was disastrously examined on the Irish in the years of the great famines which caused a generation of

Irish people to flee their home country and emigrated towards overseas destinations such as Australia, New Zealand, the UK, and the United States.

As a matter of fact wars and revolutions represented painful periods in Irish history due to the domination by its British neighbour. As a consequence of the conflicts with and final independence from Great Britain in 1921 the Irish government turned to the program of 'self-sufficiency' to reduce the level of dependence on imports, foremost from the UK. Unfortunately, this philosophy escalated in the adoption of an "*inward-looking, protectionist policy*" [Brun2003] resulting in economic stagnation, unemployment und emigration. Following these disastrous results the government introduced a new economic development plan in 1958 that most importantly foresaw capital grants (partly non-refundable) and tax concessions to encourage export-led manufacturing and the establishment of the Industrial Development Authority (IDA) to attracted foreign firms, particular multinationals[11]. These initiatives coupled with the entry into the Common Market in 1973 "*set in motion important structural and psychological changes for the country at all levels*" [Brun2002] and installed a new sense of Irish openness. When recalling [Tria2002]'s historical factor of 'inventions' it is not to exaggerated to claim that the IDA can be anticipated to be such an innovative venture according to [ibid.] who states that "*the activity of the IDA amounted to first mover advantage in this policy area: no other country was making such a concerted, large-scale effort to attract inward investment: the IDA was out there on its own*."[Ruan2004]. Coincidentally, IDA and Forfas asked for a rapid expansion of third-level provision, mainly in the form of Institutes of Technology which resulted in one of the highest number of science and engineering graduates amongst the labour market. The large pool of young, highly-skilled, and English-speaking stock of human capital was another incentive for (mostly US-American) companies to locate their business in Ireland [Teag2009].

Surely, the Irish's strategy of attracting overseas companies was helped by the 'death of the distance' thanks to major progresses in transmitting technologies in the 1980s which eliminated distance as a major cost factor[12] which is a crucial factor when considering that about 50 per cent of new jobs have been from international trading and financial services during the 1990s[13] [Burn2003]. Understandable, following the lobbying of the IDA the Irish government decided to upgrade its inefficient and unreliable telecommunications network during the early 1980s to

[11] Not only did multinationals benefit from a 10 per cent corporate tax on all profits from export if they establish a subsidiary in Ireland but also enjoyed a large pool of young, English-speaking and low-cost labour [Teag2009].

[12] The significance of an efficient telecommunications infrastructure has already been recognized since the out-dated, unreliable and expensive was starting to distract foreign investors in 1980.

[13] Fofas suggest that about 70 per cent of employment gains took place in foreign-owned companies in the 1990s.

achieve ‘state-of-art’ service alongside most reasonable rates for international calls transforming Telecom Eireann’s into a leader among European telecommunications entities[14] [ibid.]. The [ITU2002] attests that the country was positioned as telecommunications hub within Europe as well as a home to call centres. Coincidentally, from a domestic viewpoint it can easily be assumed that the legacy PSTN formed a negative impression of fixed-line communications which surely positively influenced the migration towards mobile telephony services in Ireland.

Altogether, it can be anticipated that the above illustrated initiatives had a profound impact on the Irish society since the country moved from “‘*protectionist Ireland’ to ‘global Ireland”*” [Teag2007] resulting in one of the most open economies in the world and contributing to the unexpected emerge of the ‘Celtic tiger’ success story[15]. Indeed, in retrospective it appears that this change stimulated Ireland to conquer both the European as well as the world stage most prominently evident in its seven wins of the European Song Contest (with three successive wins in the period 1992-1994), the global admiration for U2, the establishment of the first low-cost airline Ryanair or the remarkable Formula One performance of Jordan Grand Prix in one of the world’s most global sports.

Finally, although the public’s traditional recognition of Ireland as the green and friendly mystical Emerald island has rapidly change towards a focus on the negative aftermaths of the ‘Celtic tiger’ phenomenon people steadily question the century long ambivalent relationship with its British given the large and massive amount of conflicts, troubles and suppression exercised on the Irish. Hence, for completeness, and due to a foreigners limited view on the former mentioned issues, it was decided to let an Irish person report about this two-edge affair which once again highlights the Irish’s hands-on approach in finding an Irish solution for an Irish problem[16]:

“Aerial warfare”

John Waters, Irish Independent, Apr. 21, 1997

“*When we were growing up in the west of Ireland in the 1970s, a house with a BBC aerial was an exotic and advanced phenomenon. There were only two of them on our street, houses with chimneys towering above their neighbours and parents who had not absorbed the official*

[14] The advanced communications infrastructure coupled with a high-skilled and literate youth paved the way for tele-services such as back-offices or finance services and earned Dublin the title of ‘call-centre capital’ [Tele1998].

[15] [Redm2006] found that in a more fanciful the Irish success was “*a product of a shift in the nation’s zeitgeist brought about by the visit of Pope John Paul II in 1979, or, even the boost in national self-confidence engendered by the success of homegrown rock bands like U2*”

[16] Appendix A provides a short discourse on the particularities surrounding the history of broadcasting in Ireland.

antipathy to the pernicious cultural influence of perfidious Albion. Although the vast majority of Irish people living along the east coast could pick up the signals without difficulty, for those of us who lived in what is now called 'rural Ireland', there was something deeply magical, a combination of the forbidden and the next-to-impossible, about being able to receive British television. On a Saturday night, living rooms of these two anointed families would be filled with the male youth of the street, their eyes glued to the flickering snowy image on the box perched high in the corner, for Match of the Day." [Wate1997].

Following this introduction chapter the thesis will build on E.M. Rogers' theory of adoption and diffusion of innovations and its interpretation against in the Irish context in Chapter 2. The focus is set on determining these aspects of Rogers theory that resonate favourable with the Irish social and cultural environment. Foremost, aspects such as family structure or the legacy of emigration were examined against the background of Rogers' elements such as communication channels and innovativeness. Additionally, the impact of culture was examined using Hofstede's cultural dimensions. Surprisingly, Irelands low level of uncertainty avoidance, which has emerged as the most relevant dimension in the adoption process, required to expand the investigation to include religion given that the cultural dimension is closer associated with Protestant regions.

Chapter 3 then investigates the imprint that the poor legacy telephone network had on the people's decision in favour of switching towards it mobile counterpart. In particular, historic events such as the British ruling and civil war as well as the faulty appraisement of the telephone's future potential by the Irish government were found to be of determine character.

The selection of the Irish cellular system standard had similar significant implications for the likeliness of later uptake and diffusion as discussed in Chapter 4. Examination revealed the importance of choosing a global standard since it provided for economies of scale that translate into reasonable priced equipment. Besides, the potential of both establishing international roaming and sourcing handsets from overseas markets were found to represent a peculiarity at the time underpinning the Irish's unique nature.

Chapter 5 highlights the importance of establishing mobile telephony as gently as possible in the existing PSTN for wireless operators. Meanwhile, tariff options helped to lower the cost of ownership which represents the largest adoption barrier for low-spending or less affluent members of society. This was done in the Irish context by means of prepaid card services that perfectly address the large share of the young population of Ireland.

Finally, Chapter 6 focuses on the revenue and underlying usage levels of mobile telephony services and Ireland's astonishing performance. OECD tariff data was used to examine the possibility of over charging, whereas national usage profiles showed large deviations between the different OECD countries. Here, culture and language was found to be of relevance as an impetus for a talkative behaviour.

2 The Adoption and Diffusion of Innovations and Culture

"*There are important historical, social, cultural and economic reasons for computing and telecommunication disparities (among nations) and, for better or worse, these differences make the world a more complicated and interesting place.*"

S.E. Goodman, 2001

Given the Irish particularities with regard to mobile telephony adoption and usage levels as illustrated in Chapter 1 this chapter will now examine the socio-cultural reasons that drive the Irish performance using Rogers' adoption and diffusion of innovation theory. Featuring elements such as communication channels and the social system it emerged that the Irish benefited from their legacy of emigrations since it created a communication channel from cosmopolite source while its family and household structure were a fertile base for inter-personal word-of-mouth communication resulting in a rather cosmopolite and world-open society Surprisingly, it was found that wealth and level of living did not play a significant role since the introduction of prepaid services, which was particular vital in a country with a young demography. It was shown that the scope had to be widened to include cultural as well as religious attributes also. Most importantly, uncertainty avoidance emerged as the most influential cultural dimension in the adoption and diffusion process of mobile telephony among Hofstede's cultural dimensions as evidenced by means of a linear regression model. Ireland's unexpected low level of uncertainty avoidance, which puts in on a level playing field with the UK or the US, contradicts the common stereotype associated with a non-protestant country and emerged as an influential factor with regard to mobile telephony adoption and diffusion.

Due to the dramatic technological changes over the last three decades people adopted new modes of communication and related technological innovation. Clearly, societal adoption of new ideas is not a homogenous process since the use of new technologies, and the likelihood of their acceptance, depends on a variety of variables. The sociologist E.M. Rogers, perhaps one of the most significant diffusion researchers, attempted to identify the factors that act to promote and influence adoption and postulate that although "*wealth and innovativeness is highly related, economic factors do not offer a complete explanation of innovative behaviour*"[17]. His theory

[17] Given the limits of this thesis it will only feature a very brief presentation of the theory of diffusion.

attempts to explain the reasons and rate at which new ideas are spread through cultures [Roge1995]. He defined the rate of adoption as the length of time required by a certain percentage of the population to adopt an innovation (in this case mobile telephony) and found that the adoption rate followed the familiar S-shaped diffusion curve as seen in Figure 1-1. Although individual S-curve diffusion responses may be readily observed in the international comparative data for mobile phone diffusion there are clearly distinctive national modes of adoption and associated adoption profiles which reasons are discussed in this paragraph.

2.1 Diffusion Theory

Given the remarkable rate of adoption of mobile phone technology it is important to gain some understanding of the process of diffusion and of the factors, which influence it. The creation of any new product or service is based on a set of explicit or implicit assumptions about how and why people will use it. Of the large number of inventions only a few make it to the market where even fewer are successful. There are many instances of what were seemingly good ideas, beneficial scientific advancements and product developments that, despite their obvious utility, failed to be adopted in the volume and profitability necessary for commercial success while other, often technologically inferior or sub-optimal, products have had immediate success[18]. While criteria such as quality and value are important determinants of successful innovation, other factors within the marketing mix, such as timing, presentation, functionality, relative pricing and distribution channels also play a vital role. Underlying these are social and societal factors that impact on product perception and exert a powerful influence on new product adoption. Many independent institutions, research groups and individual researchers have attempted to determine why some innovations succeed while others fail.

Rogers attempted to identify the factors that act to promote and influence adoption and understand the nature of the diffusion process itself. [Roge1995a] defined diffusion as "*the process by which an innovation is communicated through certain channels over time among the members of a social system*," a view that many marketing analysts have embraced. For the sake of clarity the following paragraphs will provide excerpts of Roger's findings; followed with a discussion on those aspects that may prove of relevance against the Irish background.

[18] Apple's *iPad* represents one of the best examples of a perfect marketing mix that encourage the adoption of a novelty adoption. In contrast, its technological forerunner *Newton* – which was one of the first personal digital assistance (PDA) and tablet platforms – failed to attract a similar recognition when it was launched in 1987.

Rogers defines diffusion as follows: "*Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system. Diffusion is a special type of communication concerned with the spread of messages that are perceived as new ideas. Communications is a process in which participants create and share information with one anther in order to reach mutual understanding. Diffusion has a special character because of the newness of the idea in the message content. Thus some degree of uncertainty is involved in the diffusion process. An individual can reduce the degree of uncertainty by obtaining information. Information is a difference in matter-energy that affects uncertainty in a situation where a choice exists among a set of alternatives.* [Roge1995b].

2.1.1 Innovation

Rogers: *The main elements in the diffusion of new ideas are: (1) an innovation, (2) which is communicated through certain channels (3) over time, (4) among the members of a social system. An innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption.* [Roge1995b]

It can be assumed that while the (fixed-line) telephone was already an established technology its cellular counterpart was different enough to be recognized as a new way of communications. [Robe2012] further reminds that this difference resembles a change in people's way of doing things and that it is naturally rejected unless people "*have a compelling reason*". It can surely be confirmed that the Irish were looking for an alternative means given the poor state of the PSTN and openly welcomed the launch of cellular telephone services.

2.1.2 Communication Channels

Rogers: "*A communication channel is the means by which messages get from one individual to another. Mass media channels are more effective in creating knowledge of innovations, whereas interpersonal channels are more effective in forming and changing attitudes towards a new idea. Most individuals evaluate an innovation, not on the basis of scientific research by experts, but through the subjective evaluation of near-peers who have adopted the innovation. These near-peers thus serve as role models, whose innovation behaviour tends to be imitated by others in their system.*" [Roge1995b]. Further, "*Mass media channels are relatively more important than interpersonal channels for earlier adopters than for later adopters.*" [Roge1995d].

An example, which illustrates both the importance and advantage of appropriate media deployment, is to be found in the launch of the first large-scale direct sales initiative of Vodafone UK (V-UK) in early 1995 [Hand1995a]. The operator placed advertisements for its consumer GSM tariff on TV, in newspapers and in magazines to bypass its service providers and high-

street retailers[19]. Industry experts pointed out that the route taken by the UK cellular industry, from service provision to high-street outlets and now to direct sales, is very similar to the one adopted for the promotion of the personal computer (PC). One observer judged that "*the* '*off-the-page*' *industry develops when users no longer need to be persuaded to buy a product by a sales executive. This tends to happen only when they are comfortable with a product – such as when they see all their friends using it. This is now happening with cellular*" [Hand1995a]. Interestingly, off-the-page sales were the fastest-growing sales channel in the UK and provided a way to cash in on the widespread awareness of cellular telephones in 1995. Roger Frye, of service provider Talkland, described the phenomenon[20] as follows: "*Off-the-page would not have worked a few years ago. You can't educate people with this type of approach. They have to be sure they want to buy a phone before they ring up*"[21] [Hand1995b]. It can be assumed that the Irish media market and access to it is not different from any other European nation.

In contrast to mass media, the most prominent example for an interpersonal channel is word-of-mouth (WOM) style communication. Credible personal testimony, WOM, is widely recognised to be by far the most powerful influence on buyer behaviour although companies rarely rely on this mechanism. This view finds support by [Roge1995d] who found that "*Mass media channels are relatively more important at the knowledge stage and interpersonal channels are relatively more important at the persuasion stage in the innovation-decision process.*" [Roge1995d]. George Silverman, of Marketing Navigator Consultancy, found that the most important factor regarding the WOM is that "*customers are talking over that information and helping each other decide what to do*" since this information "*[…] is more credible, objective and honest than a salesman since it originates from an independent third party and […] is the purchase trigger.*" [Silv1997]. Clearly, people are motivated to make purchases on the advice of trusted peers[22], the importance of peers is expressed by a marketing manager: "*Even those deaf to the bragging cries of the marketplace will listen to a friend*" [Silv1997].

[19] Potential customers could call a free-phone number and buy a GSM phone using their credit card.

[20] Frey wanted to emulate the success of other industries, i.e. direct-line insurance and on-line banking.

[21] These kind of media requires the potential customer to have obtain literacy skills, a feature that was still not common even in Europe at the turn of the century. A discussion on literacy levels is featured in Appendix B.

[22] Forrester Research found that young consumers in particular are very susceptible to opinion-based marketing. Young people in North America rely on family members and peer groups when making a decision; 52% rely on recommendations from friends or family when making a purchase, compared with just 34% of adults [Buck2005b].

2.1.3 Communication Channels from Cosmopolite Sources

Rogers: "*We categorize communication channels […] as originating from either localite or cosmopolite sources. […] Early adopters are more cosmopolite than are later adopters. […] Innovator's interpersonal networks are more likely to be outside, rather than within their system. They travel widely and are involved in matters beyond the boundaries of their local system. Cosmopoliteness is the degree to which an individual is oriented outside a social system*." [Roge2003]

Given the large share of Irish immigrants around the world[23] (outside the Irish social system) that stay in contact with relatives and friends in their home country (inside the Irish social system) it can easily be assumed that the former exchange a significant share of knowledge on new routines, practices and technologies deployed in their host countries. Hence, the immigrant established a communication channel that originates from a cosmopolite source. [Jeff2004] argue that cosmopolitan individuals can be "*expected to have a greater interest in international issues, other cultures, and events occurring in other countries.*" Additionally, they are assumed to travel more extensive, particular outside of their region and country. Altogether, they appear to identify themselves with a broader culture [Sass2002] [Jeff2004]. It can be accepted that the Irish immigrants and their relatives were required to form an interest in the cultures of their host country and their way of living. Coincidentally, immigration requires travelling not only but also between the home country and the country of immigration. [Ihde1996] found that 'world openness' was influential in the global diffusion of mobile telephony. As a metric for this criteria the amount of 'air miles' was selected given that it represents an indicator for trade between countries and knowledge transfer between people. [Chan2007] argues that "*trade, foreign direct investment and technology flows help in knowledge spill-over across countries leading to awareness about new products and greater availability, which in turn lead to faster [innovation] takeoff*". This finding perfectly matches some of the most crucial ingredients of Ireland's economic boom and contributed to its status as one of the most open and globalized economy in the world[24].

[23] [Madd2010] states that some 70 million people worldwide claim to come from Irish heritage, the largest communities being in Great Britain and the US.

[24] Several indexes try to measure the openness of an economy. However, given the focus of the thesis which covers the 1980s until the late 1990s it was possible to identify one index only that illustrates Ireland's performance at the time – the Global Competitiveness Report of the World Economic Forum. The ranks are as follows: 1996: 26, 1997: 16, 1998: 11, 1999: 10, 2000: 4 [Mart2007]. More current indexes such as the Ernst & Young Globalisation 2011 Index ranks Ireland as the 2nd most globalised economy in the World (2010: 2rd place) [Erns2012].

2.1.4 Social System

Rogers: "*A social system is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. A system has structure, defined as the patterned arrangements of the units in a system, which gives stability and regularity to individuals' behaviour in a system. The social and communication structure of a system facilitates or impedes the diffusion of innovations in the system.*" [Roge1995f].

Given Rogers' definition of a social system it was assumed that the family could be regarded as the smallest system that has a structure and hence provides stability. It was decided to use 'persons living in a household' as metric[25]. Moreover, this dimension more accurately reflects the living structure, and to an extent their level of social interaction as presented in Figure 2-1:

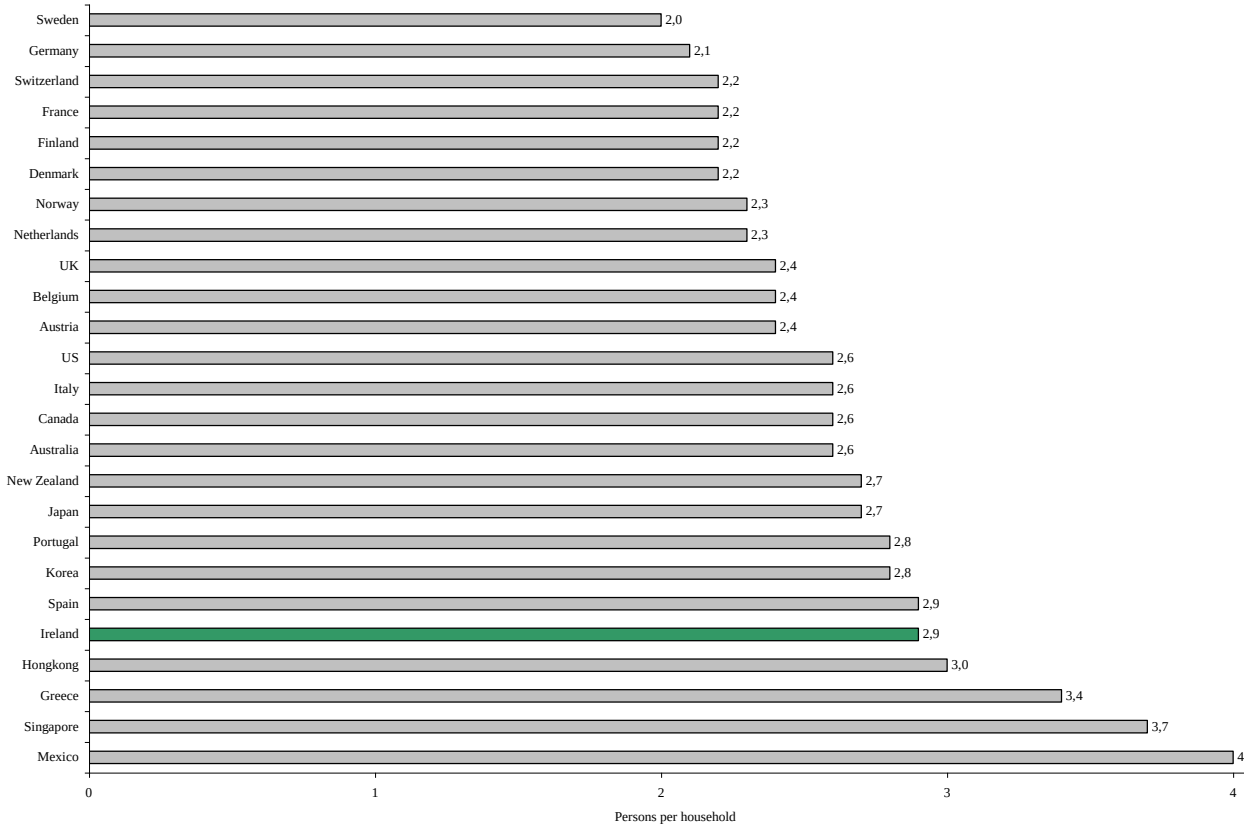


Figure 2-1: Number of persons living within one household, 2000-2004 [Stat2006].

From an European perspective, in general, southern European countries have the largest household occupancies given their traditional strong family ties while central and northern countries tend to have the smallest[26]. Interestingly, Ireland ranks second while the closeness of

[25] A discussion on macro-economic factors such as population density and urbanisation is featured in Appendix K.

[26] Expectable, cellular operators such as TIM launched "*highly attractive service tariffs*" [Espi1999] particular focused at families such as its 'Family Plan' or its prepaid SIM card service which allowed each families members to have its own SIM card and number which can be used by one mobile telephone [Zoll1996a].

the (extended) family social structure should help to effectively educate and influence potential customers through WOM. Furthermore, a survey of the German statistical office concludes that households with children have a greater propensity to adopt technology as stated in Table 2-1:

Table 2-1: Ownership of PCs and cellular phones in German households, 2002 [zdne2002a].

Ownership in households	with two children	with one child	with one person	total
PC	88%	79%	34%	53%
Mobile telephone	75%	83%	65%	56%

The following Figure 2-2 depicts the share of households with children in selected countries:

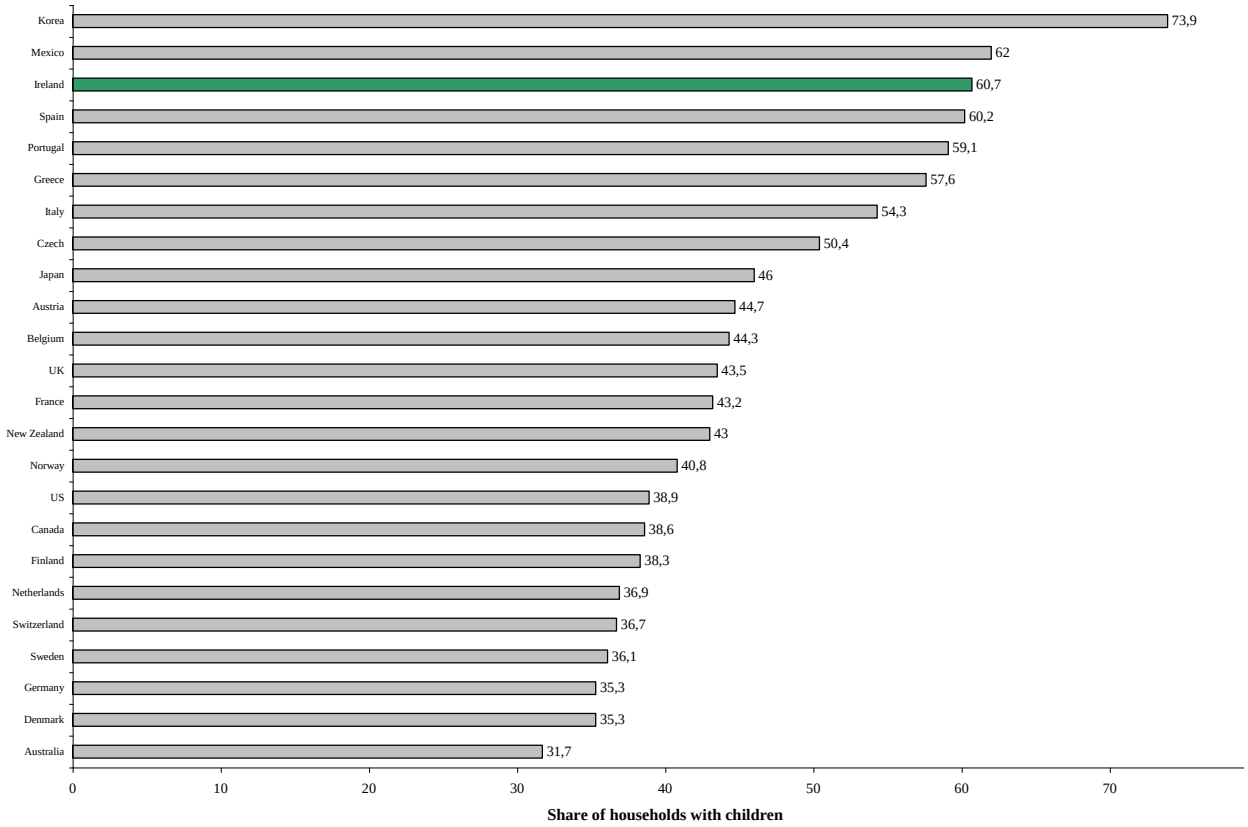


Figure 2-2: Share of households with children, latest year[27] [OECD2010].

Surprisingly, Ireland is leading the European cohort, followed by its Mediterranean counterparts while the Central and Northern European countries rank at the bottom of the scale. Is can be assumed that the combination of a young population and a high number of households

[27] Data concern 1999 for France; 2000, Finland, Korea, Switzerland, Turkey, the US; 2001: Austria, Belgium, Czech Republic, Denmark, Greece, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, the UK; 2002: Ireland, and Sweden; 2005: Iceland, Mexico and Japan; 2006: Australia, Canada, and New Zealand; 2006: US; 2008: Iceland

with children create a close-knitted social system which members resonate very effective to WOM since it is spread within such an exceptional sensitive system. It can be assumed that it is also helped by the human orientation of the Irish culture as found by [Sper2001] which values friendship, sensitivity, tolerance and harmony creating trustful high atmosphere.

2.1.5 Attributes towards Innovation

Rogers "*The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovations are (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability*." [Roge1995c]

Clearly, the advantage of a cellular telephone over its fixed-line cousin lies in its portability that allows for making calls wherever and whenever wanted. Simultaneously, it serves individual's comfort in that one has not to track down the location of the next public telephone. Then, the operation of a wireless phone replicates the one of its wireline counterpart, which surely helped reducing provisos since compatibility and complexity proved not to be such a high barrier of adoption. Finally, given its small size and weight the user was able to exploit the innovation in public places or at home which ensured its observability. From a wider perspective, it could be assumed that the Irish could observe developments in their neighbouring countries such as the UK and North America better than any other European population due to their close historical links and their geo-strategic location. Indeed, whereas the cellular concept was developed in the US the British market featured the first liberalised telecommunications market within Europe – both events being innovative experiences at the time.

2.1.6 Degree of Heterophily and Homophily

Rogers: "*A distinctive aspect of diffusion as a sub-field of communication is that some degree of heterophily is present. Heterophily is the degree to which two or more individuals who interact are different in certain attributes, such as beliefs, education, social status, and the like. The opposite of heterophily is homophily, the degree to which two or more individuals who interact are similar in certain attitudes. Most human communications takes place between individuals who are homophilous, a situation that leads to more effective communication. Therefore, the heterophily that is often present in the diffusion of innovations leads to special problems in securing effective communication.*" [ibid.]. "*So homophilous may be frequent and much easy but may not be so crucial as the less frequent heterophilous communication in diffusing innovations.*" [Roge1995e].

In the face of Rogers' rendering there seems to be a contradiction at play regarding the best way of communicating an innovation through a social system given that individuals should

feature some degree of heterophily alongside a certain share of homophily. Given the cultural emphasis of this thesis a hypothesis could be constructed; given the large migration movements of the Irish towards overseas destination (foremost the US and the UK) which caused them to mix with the domestic cultures i.e. by means of inter-marriages, education, etc. The emigrants had to adapt to new conditions and lifestyles and learned new routines which expanded their knowledge base. Simultaneously, they had to adjust their traditional value system and had to be open to new ideas and practices therewith giving birth to a new flavour of Irishness (heterophil) yet still being accepted as to belong to the genuine Irish tribe by their native (homophil). It can be assumed that this constellation helped the diffusion of innovations from the 'new world' (US) to the 'old world' (Europe).

2.1.7 Innovativeness

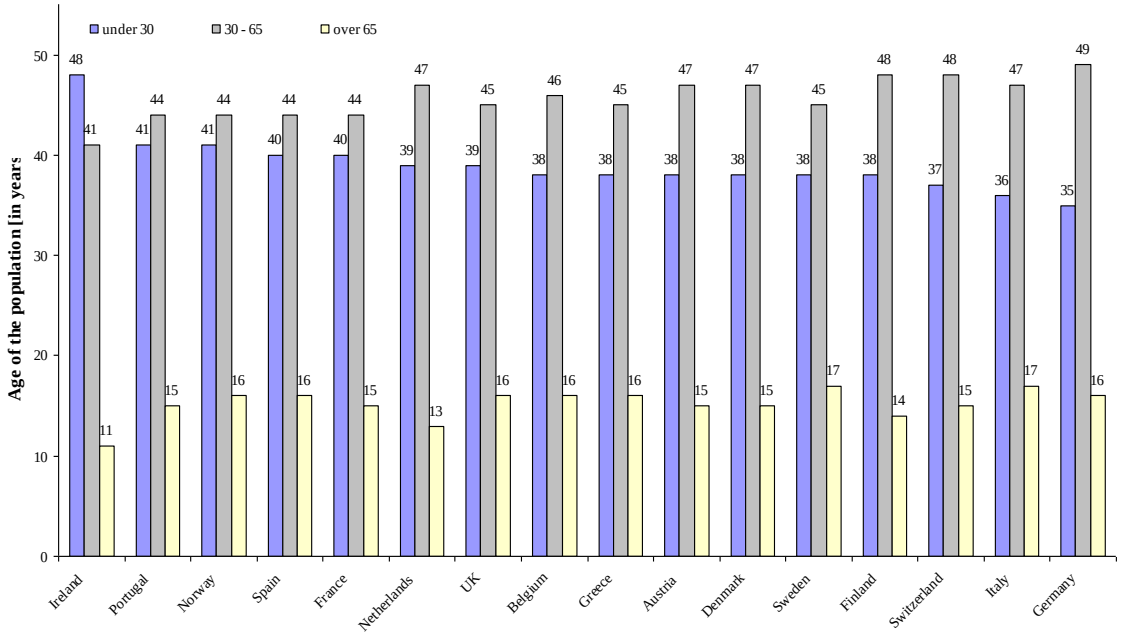
Rogers: "*Innovativeness is the degree to which an individual or other unit of adoptions relatively earlier in adopting new ideas than other members of a social system. We specify five adopter categories, classifications of the members of a social system based of their innovativeness: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards. Rate of adoption is the relative speed with which an innovation is adopted by members of a social system.*" [Roge1995f].

Given the high levels of internet and cellular density in the Nordic region it can be confirmed that the people seem to be more enthusiastic adopters of technology than other Europeans. Therefore, Finland is taken as a test market[28] due to its unusual and unique language which acts a barrier that limits the diffusion of untested (beta) technology before moving on the world market therewith representing a "*a world in miniature*" as described by Prof. Jukka-Pekko Puko of University of Turku [Puko2000]. This view finds support by Rosalie Nelson, analyst at OVUM: "*Finland's market consists of a high percentage of data subscribers, forward-thinking operators, and a small population. All these factors make it interesting as a test site.*" [Rend2002]. Donald Bellamy, of consultancy IDC, summarises: "*As a whole, Scandinavian countries continue to show a strong willingness to be early adopters of technology. In many respects, that distinction is now further underscored by the extreme conservatism, not to mention stagnation, of continental Europe below Scandinavia.*" [Clay1997]. Although technological entrepreneurs in Scandinavia have less access to capital, "*they have consumers, which is a tremendous first step. In the current environment, a lack of consumers is almost an insoluble problem for high-tech*

[28] Individuals are "*so enthusiastic about new services that they pay to participate in trials*" [Rend2002].

players in continental Europe.“ Consequently, Sweden and Finland emerged as an experimental laboratory and ideal test market for new technologies [ibid.].

With regards to the mobile telephony market Enda Hardiman, of Hardiman Telecoms, found that Ireland shows the characteristics of a “*classic early adopter scenario*”[29]. Paul Donovan, chief executive officer V-IR, stresses the Irish innovativeness: *“[Ireland has] a high propensity to adopt new technology if appropriated priced and marketed, with the highest penetration of SONY play stations outside Japan, the second highest penetration of digital TV in Europe*” [Parl2003]. This innovative adopter characteristic is further explained by SONY’s Computer Entertainment Europe president Jim Ryan at the launch of its latest handheld gaming device ‘PlayStation Vita’: “*It’s one of those early-adopter markets, and it’s always good to get traction in those markets. It tends to go very fast early on, because consumers get into stuff very early and hit maturity just as places like Italy and Spain are just waking up to what’s going on.*” [OBri2012]. Ryan adds that “*these markets are sort of bellwethers because…clearly it’s not one of our bigger markets, because it’s governed ultimately by population size, but it is important, and we do look at it in the early periods of the platform – and because it’s one of those markets that if all is not going well, it’s places like Ireland where you get a sense of that very quickly.*” [ibid.]. From Ryan’s comparison of Ireland with countries such as Italy or Spain it can be concluded that the difference in either demography plays a major factor in the adoption process. Evidentially, Ireland features the youngest population in Europe as depict in Figure 2-3:



[29] Factors being that Ireland is the fastest growing economy in the OECD, a youthful demographic structure, high standards of education and high levels of participation in pre- and post-graduate education.

Figure 2-3: Age of the population by age groups in Europe, 1998 [Stat2006].

Obviously, the cellular phone is a 'must have' device among pupils, teenager and students as claimed by [Fran2001]: young people were "*currently high users of mobile phones which appear to be an intrinsic part of their life.*" While confirming previous findings the study noted the key use of mobile phones for peer-to-peer communications, particularly given that the need to belong to a peer group tends to be strong among the young and adolescents [ibid.].

Interestingly, while Rogers notes that "*there is inconsistent evidence about the relationship of age and innovativeness; about half of the some 228 studies show no relationship […]*" [Roge1995g] the study of Gordon Brooks and Farhat Yusuf on 'Rogers' 'earlier adopter' in the Australian mobile phone market a five-year study of two innovator characteristics' based on household surveys found that "*propensity to own a mobile phone was higher among younger household heads, and seemed to increase with the household income and the number of credit cards.*" [Broo2007]. [Fran2001] confirms Rogers finding that relatively early and late adopters do not differ in age implying that "*we have keen young potential adopters whose adoption decision is restricted by their low income together with relatively high prices of mobile phones or wireless services*.". [Dobr2009] argues that this contradiction "*may be explained by the type of the product: complex innovations, implying a higher financial risk, are adopted by consumers with higher income and a better social status. All these are reached at an older age. On the contrary, technological innovations, which are not implying a high financial risk, are more likely to be adopted by younger consumers*." Hence, the inventions of the prepaid phone lower the financial risk for those young customers that were not so affluent like older demographics.

2.1.8 Wealth, Level of Living and Psychological Consequences

Rogers: "*Early adopters have a higher social status than do later adopters. Status is indicated by such variables as income, level of living, possession of wealth, occupational prestige, self-perceived identification with a social class, and the like. However measured, social status is usually positively related with innovativeness.*" [Roge2003].

This larger sub-section provides an examination of the adoption and diffusion of cellular telephony in relation to a country's wealth. Firstly, it demonstrates that wealth measured as GDP does not tell the whole story given that it is not directly linked to a country's real income potential and distribution as obvious in the Irish case. Secondly, it demonstrates that pricing options were a key driver for lowering the costs of ownership as an entry barrier formerly associated with mobile telephony changing cellular phones image from a business tool to a

democratic daily life device. Thirdly, it demonstrates that the most remarkable innovation in the last two decades was the launch of prepaid card services that caused a paradigm change that did not ask for monthly service charges which was a real obstacle for many not so affluent societies, which did not qualify for sufficient credibility.

Rogers established in his diffusion theory that diffusion originates from individuals in a society that have a great financial lucidity [Roge1995]. It is commonly known that the latest technical gadgets are priced prohibitive at the top end of the market to function as a status item not only for its inventor but also for the owner. Controversially, the latter in large parts wishes to express his or her success by means of using it in public places what results in a mixture of envy, recognition and a feeling of exclusivity in return[30]. From a historical point of view it can be anticipated that the appearance such as the first automobile or television sets caused similar reaction. Altogether, these innovations came at a price that only the wealthier of the population could afford. Indeed, new consumer technologies e.g. HD displays, DVD players, game consoles are initially launched at premium price since the targeted innovator and early adopter group tend to be relatively price-insensitive. This is also audible with regards to telecommunications, in particular when considering the era of the introduction of consumer telecom equipment such as answering machines, telephone or its cordless counterpart. Although these items are nowadays regarded as ordinary tools in everybody's life they appeared excessively priced when they were introduced[31]. Their increased affordability enabled mass adoption and successful diffusion while causing a fundamental change in the perception of technology and the society's relationship to it.

As a matter of fact, the OECD postulates that the development of information and communication technology (ICT) in a country correspondents to the level of economic development of that country[32] [OECD1995]. Additionally, [Mait1998] concludes that differences

[30] One of the most prominent example is the launch of Apple's iPhone in 2007 which not only caused a hype among members of the traditional community (which regard themselves as '*followers*') but also in the general public – replicating the hype caused by Apple's iPod launch in 2001 [Quai2010]. Moreover, "*In its first three months, Apple said it sold 1.4 million iPhones, and that the rate of consumer acceptance of the iPhone exceeded the iPhone, which took two years to reach the same level of cumulative sales*." [Wing2007]. Understandable, In July 2009, Apple announced that "*it was unable to produce enough iPhones quick enough to meet consumer demand*" [Prys2009].

[31] It has to be noted that the launch of finance schemes such as leasing and credit or loan arrangements offer the possibility to purchase products for customer segments which could not afford to pay them in the first place. Therewith, both the adoption barrier and the above mentioned link was virtually eliminated or weakened at least.

[32] Recent research of the impact of mobile phones on the economic development in India stirs considerable speculation about the correlation between investments in telecommunications and economic development. A survey among mobile phone users in the fishing industry that asked which technological improvement made the most

in rates of diffusion between countries or regions are most frequently explained in terms of economic variables. Controversially, the parameters that represent economic variables and level of economic development or Rogers' expression of great financial lucidity are subject to much debate and various interpretations [Roge1995].

The macro-economic scholar uses gross domestic product (GDP) as a means to describe the former mentioned terms which made it the most prominently used synonym. Indeed, comparisons of GDP growth and levels of GDP per capita are two of the most frequent ways in which countries' economic performance is judged. It reflects economic wealth, national income-level and productivity and is widely used as a valid estimator or predictor for the national diffusion of innovations and as a basis for the evaluation of international comparative performance. Importantly, GDP per capita is not a measurement of the standard of living and prosperity in an economy[33]. Further, international comparisons of monetary amounts are highly dependent on the method used to convert data into a common currency. The most obvious method is to use market exchange rates. In many contexts, however, this has limitations: exchange rates can be volatile and do not necessarily reflect relative price levels. To make comparisons of real output it is common practice to use purchasing power parity (PPP) as an alternative to exchange rates[34.] It is based on the law of one price. This theory states that in ideally efficient markets, identical goods should have only one price[35] which makes it arguably

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difference to them revealed that the mobile phone came third to mechanization and improved roads and transportation. This result puts the role of the cellular phone into perspective given that in a country where general infrastructure is still less developed and the basic needs of inhabitants are waiting to be satisfied. Nevertheless, the study manifests that the importance of the mobile phone remains unmatched by any other business tool [Abra2007].

[33] The advantage of GDP per capita as a pseudo indicator of standard of living is that it is measured frequently, widely available and consistent what allows both for spotting trends and comparison between standards of living in different countries. It is measured consistently in that the technical definition of GDP is relatively consistent among countries. Controversially, the major disadvantage is that it is not, strictly speaking, a measure of standard of living since it is a single figure that provides no indication as to how prosperity is spread within the population. GDP is intended to be a measure of particular types of economic activity within a country. Indeed, nothing about the definition of GDP suggests that it is necessarily a measure of standard of living. The argument in favour of using GDP is not that it is a good indicator of the standard of living, but that, all other things being equal, the standard of living tends to increase when GDP per capita increases. As such, GDP can be a proxy for the standard of living, rather than a direct measure. GDP per capita can also be seen as a proxy of labour productivity.

[34] PPP are artificial exchange rates that are specifically calculated to reflect relative price levels. The PPP theory uses the long-term equilibrium exchange rate of two currencies to equalize their purchasing power [Enge1998].

[35] The law of one price can be stated as: "*In an efficient market all identical goods must have only one price.*" The PPP hypothesis is that free trade of goods will align exchange rates with their PPP values. An example of one measure of PPP is the 'Big Mac Index' popularised by The Economist, which looks at the prices of a Big Mac

more useful when comparing standards of living between nations because PPP takes into account the relative cost of living and the inflation rate. Nevertheless, although GDP per capita appears as the most suitable parameter given that it is a relatively straightforward measure to compare countries' economic performances and wealth the [OECD2005] reminds that it has to be handled carefully.

Alternatively, the OECD suggests the use of gross national income (GNI) as a variable of comparison. It comprises the total value produced within a country i.e. its GDP, together with its income received from other countries (notably interest and dividends), less similar payments made to other countries. Accordingly, GNI per capita is the relevant measure to use for analysing the development of living standards[36]. For most OECD countries the difference between GNI and GDP is relatively minor, with the exception of Luxembourg and Ireland where GNI is much lower than GDP. Reasons are that Luxembourg's GNI is determined by the considerable share of cross-border workers in total employment that report their earnings in their home countries[37]. [OECD2005]. Similarly, Ireland's GNI is hurt by extensive foreign ownership of large portions of its business sector, which are instead included in the GNI of the countries' of ownership. Indeed, Irish GDP figures include the output of many multinationals that is very significant given that 90 per cent of Irish exports are made by foreign-owned firms. In fact, while Ireland's position has risen up the GDP per head ranking since the mid-1990s to establish itself a place under the top five countries, due to the evident impact of foreign-owned multinationals in the

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burger in McDonald's restaurants in different countries. If a Big Mac costs US$4 in the US and £3 in Britain, the PPP exchange rate would be £3 for US$4. The Big Mac Index is presumably useful because it is based on a well-known good whose final price, easily tracked in many countries, includes input costs from a wide range of sectors in the local economy, such as agricultural commodities (beef, bread, lettuce, cheese), labour (blue and white collar), advertising, rent and real estate costs, transportation, etc. The Big Mac Index is inaccurate in certain cases because of the different market conditions that exist in differing locations: a Big Mac in downtown Chicago is likely to be priced higher than one in Wisconsin. Such pricing differences existing in one country demonstrate the imperfection of the Big Mac Index. In addition, in some emerging economies western fast food represents an expensive niche product price well above the price of traditional staples - i.e. the Big Mac is not a mainstream 'cheap' meal as it is in the west but a luxury import for the middle classes and foreigners. Although it is not perfect, the index still offers significant insight and an easy example to the understanding of PPP [Econ2009].

[36] Generally speaking, "*GNI is based on ownership (because income is accounted in owner's home country 's GNP, irrelevant of the location of business), and GDP is based on location (because income is accounted in GDP of a country where the business is located, irrelevant of owner's nationality)*." [Diff2011].

[37] The influence of the large share of foreigners in the country is also expressed by a cellular market penetration in excess of 100 per cent. Gareth Willmer, of consultancy Informa, reports that many foreign worker such as bankers and people that work for European institutions commute each day from neighbouring Belgium, Germany and France take up mobile subscription in Luxembourg although they do not live there [Will2000].

country, it drops to 17th in the GNI ranking according to the data of the OECD as shown in Figure 2-4.

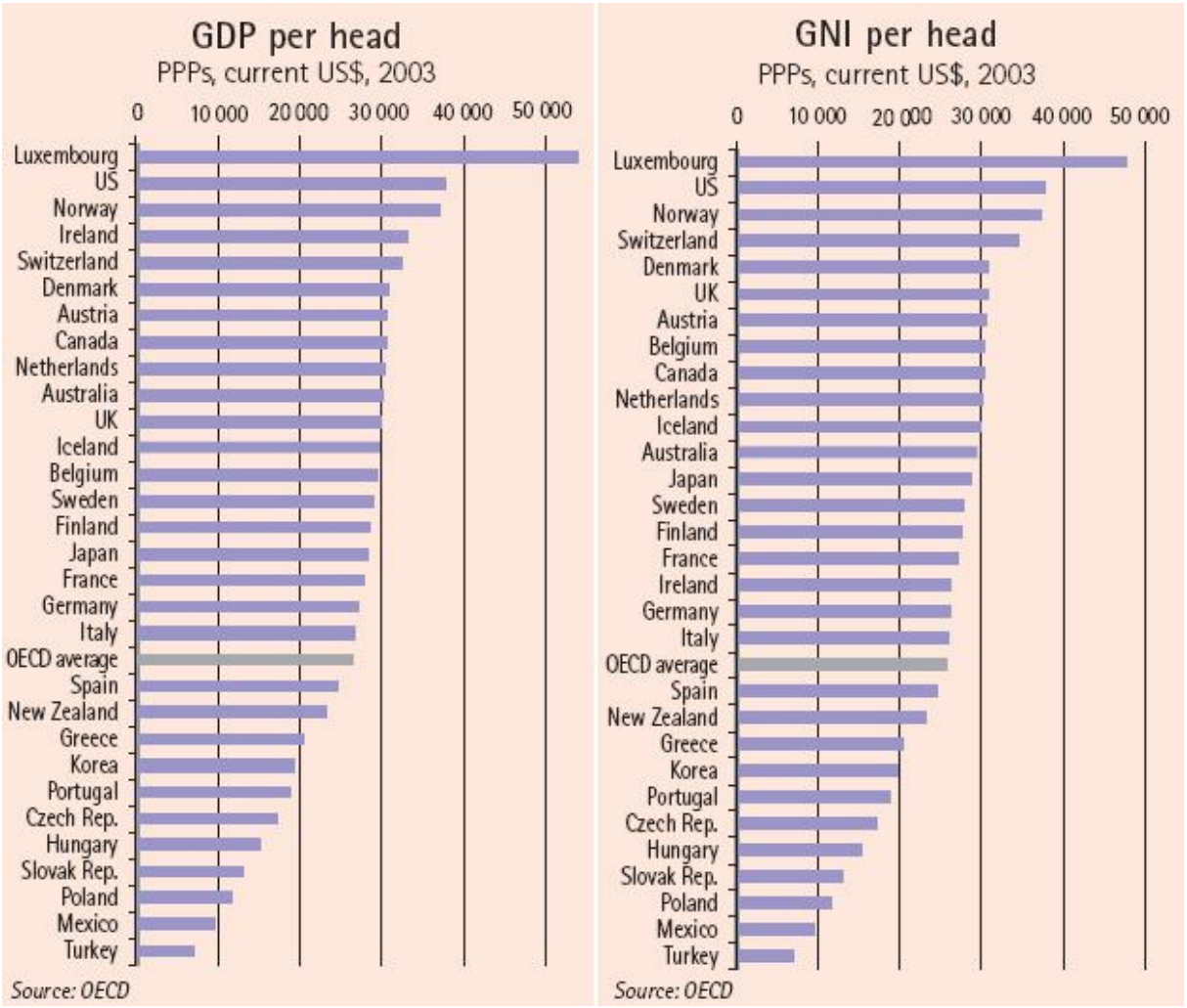

Figure 2-4: GDP per head vs. GNI per head [OECD2005].

In particular, compared with 21 OECD countries Ireland's GDP per capita swung from about 12 per cent below average in 1995 to 22 per cent above the average in 2003. Coincidentally, its GNI per capita moved from about 20 per cent below average in 1995 to a less pronounced 4 per cent above average. Hence, while Ireland produces a lot of income per inhabitant, its lower GNI number indicates that less of it stays in the country. This rare constellation gave rise to the question if Ireland is really one of the wealthiest nations in the world[38]; similarly it puts the Irish ranking with regard to cellular phone density in relation to its GDP into perspective. In particular, the Irish GNI is approximately 20 per cent lower than its GDP, which must be recognized when doing comparison given that its real wealth is more or less *en par* with

[38] An article in the Irish Independent claimed that "*Ireland is rated sixth richest country in global wealth league*" as found by rating agency Standard & Poor's [Inde2007].

obviously poorer countries at first glance. Altogether, the case of Luxembourg and Ireland illustrate that it would be too trivial or even false to make generalisation when speaking about income in the form of GDP.

Following the above discussion it can be concluded that GDP is a macro-economic indicator of a country's output/economy while the relevant measurement of living standards is real GNI per capita that illustrates more the micro-economic environment of individual consumers and their spending potential[39]. Indeed, GDP per capita is not a measure of personal income since it does not take into account that GDP is (mostly) not distributed equally within the population[40]. Consequently, some parts of the society have more financial resources than others limiting access to ICT which leads to the digital divide[41]. From a market point of view it can be postulated that countries, which exhibit an increase in wealth and correlating standard of living alongside income-diversity, can generally regarded as a good investment opportunity since a larger proportion of population can afford to buy new products and services. When considering the adoption of innovations such as the cellular telephone it is clear that the European region

[39] A good example for this consideration is provided by W. Michael Cox, senior vice president and chief economist, and Richard Alm, senior economics writer, at the Federal Reserve Bank of Dallas who claim that income statistics "*don' tell the whole story*" of living standards when dealing with the widening gap between the haves and have-nots in America. While income appears to be the wrong measure of financial well-being Cox and Alm regard household consumption as the far more direct measure of economic status. Consequently, the gap between the rich and poor is far less than most assume while the abstract, income-based measure does no longer apply in today's society. According to figures of the US Bureau of Labour Statistic the share of national income going to the richest 20 per cent of households rose from 43.6 per cent in 1975 to 49.6 per cent in 2006. Meanwhile, families in the lowest fifth saw their share fall from 4.3 per cent to 3.3 per cent. Figures showed that while the top fifth household earned US$149,963 a year, they spend US$69,863. In contrast, the bottom fifth earned just US$9,974 but spend nearly twice that – US$18,153. Reason is that those lower-income families have access to various sources of spending money that does not fall under taxable income such as sales of property, cars and securities, insurance policies redeemed, or drawing down of bank accounts. Many families are headed by retirees and those temporarily between jobs, and thus their low income total does not accurately reflect their long-term financial status [CoxA2008].

[40] The matter of income distribution is deeper discussed in Appendix I.

[41] Not only does the digital divide include the imbalances in physical access to technology but also the imbalances in resources and skills needed to use it. However, despite income the divide may also be classified based on gender, race groups and by locations. The digital divide as such describes access to rather basic landline telephones as well as more advanced technologies such as broadband or cellular telephony. Importantly, the digital divide is not only observable between countries but also within them. The most commonly described domestic divide is the one between urban and rural areas, the later traditionally suffering from later network rollout (i.e. waiting lists) or deductions in performance (i.e. deployment of xDSL lines) given the sparsely populated areas that limit profitability.

with its egalitarian legacy appears most favourable. On the other hand, large differences in wealth can also fuel positive psychological reactions of envy. Commenting on this phenomenon [Sama2003] concludes that in relatively poor economies, where there is a more pronounced difference between the haves and the have-nots, the influence of showing-off may be more important. The social needs of demonstrating status and maintaining connectivity have elevated the perceived value of mobile telephony to such an extent that a mobile phone is regarded as a must-have accessory by all income groups. Relative to high income-diversity economies, such as the US, low income-diversity societies have fewer attainable opportunities for individuals to demonstrate their predominant status. Mobile telephony has proved to be a relatively affordable, but vital, means of promoting individualism. [Sama2003] argues that in countries with a higher, more marked, inequality the demand for mobile telephones and hence the penetration rate is likely to be higher. However, in poorer countries the demand of cellular phones for show-off purposes might only be satisfied if the cellular phone is available at reasonable prices. As Kai Oistamo, Nokia's Chief Development Officer, remarks: "*So look and brand are highly important – it is much more of a status symbol in those societies.*" [Econ2010].

Controversially, although it appears naturally that the show-off effect might be more important in low inequality countries the launch of fake cellular telephones in the United States shows that even in highly inequality countries people are looking for options to express their status[42]. Franco M. Nicosia, a professor at the graduate school of Business Administration at the University of California at Berkley and a fellow of the American Psychological Association, said such actions define a person's "*aspirational reference group – the group they want to be part of in the future.*" [Bish1998]. One also has to select a status symbol that is recognized, valued and available, as argued by Mrs. Kvamme, owner of Faux Systems, a company that built replica car-phones in the late 1980s: "*If there are no car phones in your area, there's no appeal to the fake phone.*" Hence, Kvamme summarizes the phenomenon in the company's motto: "*It's not what you own, it's what people think you own*" [Bish1998]. Altogether, it can be postulated from the two examples above that people like to own symbols either to express both that they stand out from and reject the membership to the ordinary population or that they want to be part of a certain group; this is perfectly described by US-American singer Frank Zappa's famous notion: "*Communism doesn't work because people like to own stuff*" [Scho2012].

[42] The small company called Faux Systems near San Francisco created a replica car phone called 'Cellular Phoney' which it sells for US$16. Patricia Kvamme, the owner, says that the car phone proofed a big success with 45,000 units sold mostly in Los Angeles. Reasons are that driving is practically a religious experience in Los Angeles and that status-seekers can create an illusion of power and importance to catch up with their yuppie role models.

Indeed, while ownership of status symbols such as a car was long-time regarded as a form of reward for hard work its value eroded with the broader affordability due to mass production. Hence, new status symbols were needed and it could be assumed that the development of the first integrated circuit in the 1970s and subsequently the manufacturing of cheap but advanced products in the following decade established a new market (and fertile ground for status seekers) that offers a wide range of devices and gadgets that cater for more target and niche groups than ever before. On one hand the mass market was served with consumer electronics such as CD player, VHS recorder and gaming consoles while on the other hand the business sector enjoyed the first microcomputer or analogue mobile telephones. If people like to show-off in public it is understandable that a microcomputer is not useful given its size alone. Hence, it is not surprising that status seeker opt for the cellular phone – no matter if a replica or not.

2.1.9 Wealth and Cellular Telephony Diffusion

This section should illustrate the diffusion of cellular telephony in relation to a country's GDP per capita in the period 1990 till 2000 in five-year intervals starting with the year 1990:

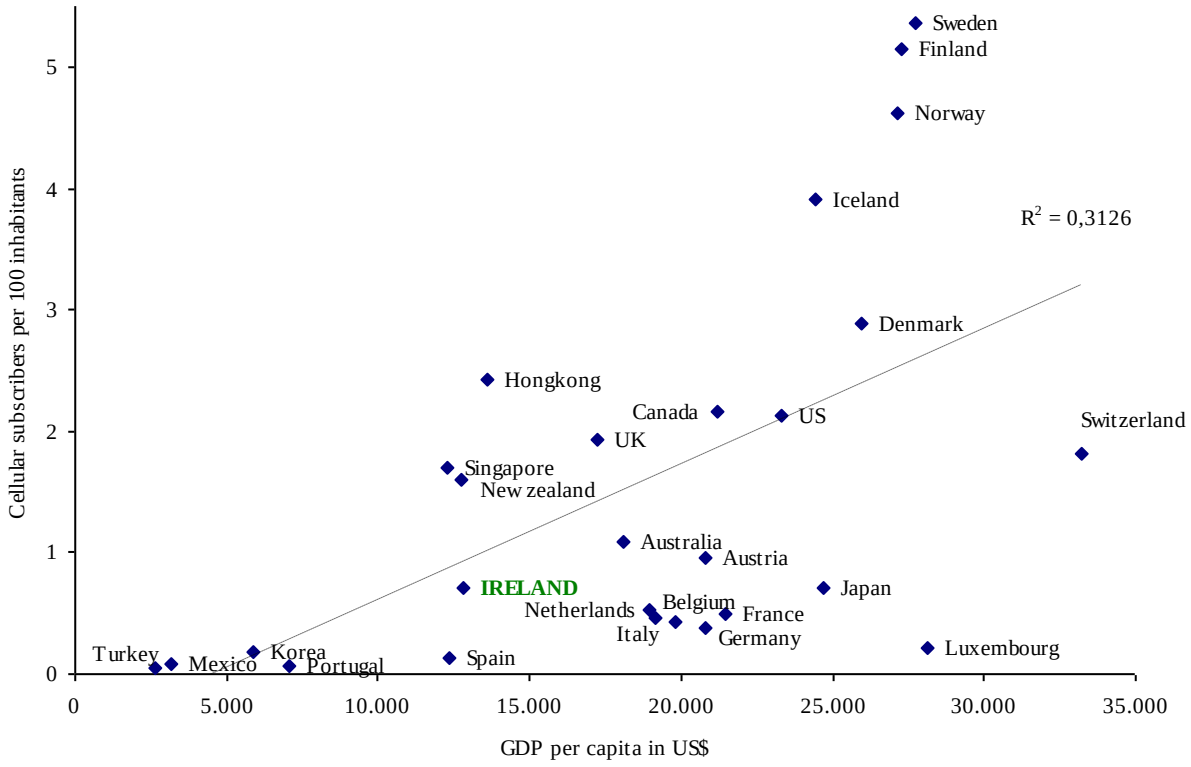

Figure 2-5: Cellular density vs. GDP per capita in US$, 1990[43] [ITU1999a].

[43] As the point of time for the examination the year 1990 was chosen since it was the first year when a significant number of networks were up and running for an average of about 5 years.

Figure 2-5 illustrates there is no strong relationship between wealth and mobile telephony density as expressed by the rather low coefficient of correlation $R^2 = 0.326$. Whereas the penetration rates among the Nordic countries somehow match their GDP and therewith form a group of their own such a homogenous behaviour can only be observed among the British-influenced nations with regard their cellular telephone density of 1 to 2 per cent which surely can be attributed to the deployment of standardized NMT and AMPS/TACS technology, respectively. With the exception of Austria and Switzerland which achieve the highest density of the mainland Europe countries (possibly driven by their rough topography similar to the one of the Nordic region) the remaining nations, particular the larger economies, do worse than their wealth would suggest as does Luxembourg and Japan. This anomaly clearly underpins the existence of other influential factors than wealth such as the use of proprietary systems that did not allow for economies of scale. Similarly, Ireland scores a rather astonishing rate of mobile telephony density leaving far richer economies thanks to the decision to adopt the TACS network standard.

Figure 2-6: Cellular density vs. GDP per capita in US$, 1995 [ITU1999a].

Figure 2-6 illustrate the situation in the year 1995. Apparently, the supposed link between wealth and cellular density has weakened during the five-year period ($R^2 = 0.1617$). Expectable, the Nordic region still leads the benchmark. Interestingly, the former British colonies show an

interesting pattern of diffusion since their performance ranks them above the trend line although large deviations between their wealth exist. Similarly, the strong growth in penetration in the poorest countries also fuels the change towards a smaller R^2 value. It can be assumed that these nations migrate to mobile telephony due to their underdeveloped fixed-line infrastructure that in return helped them to achieve levels of density matching those of the larger European economies that still suffer from their legacy of proprietary system deployment. The only exception represents Italy, which clearly benefited from its switch towards TACS prior the inauguration of GSM in the early 1990s. Altogether, it appears that this event helped certain countries to improve on their cellular density and that both national market factors and peculiarities may help or hinder the diffusion of cellular telephone services.

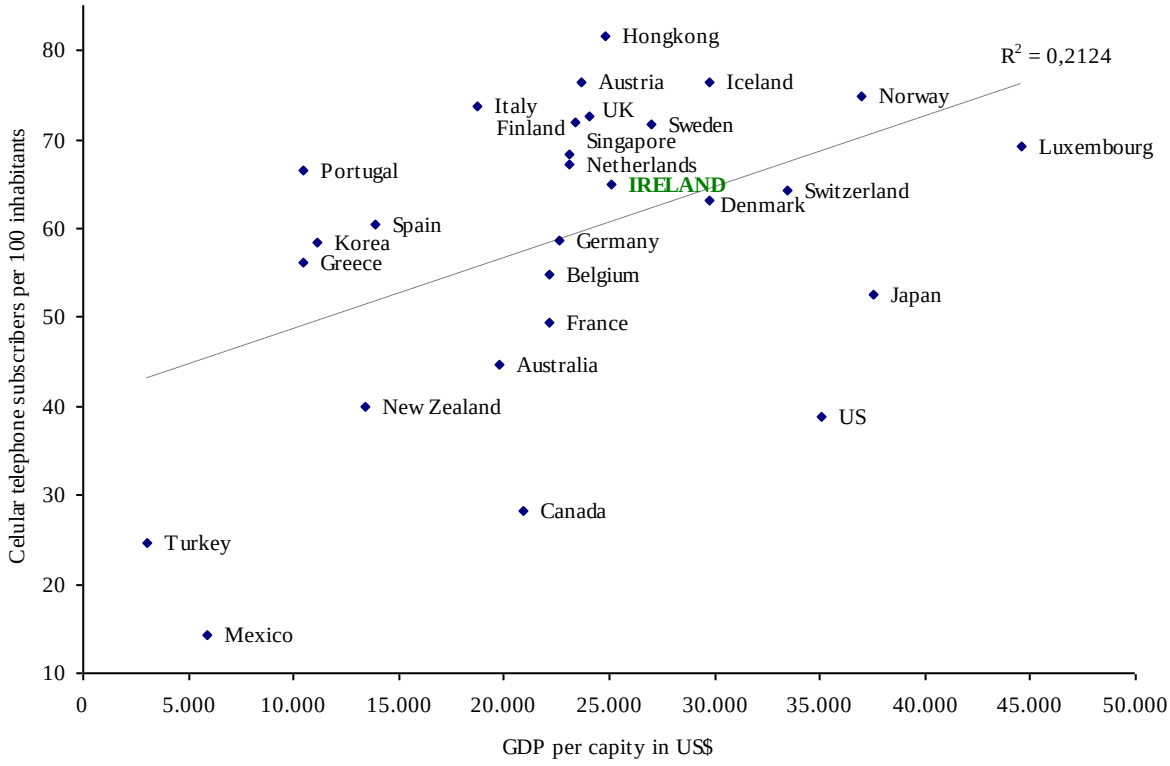

Figure 2-7: Cellular density vs. GDP per capita in US$, 2000 [ITU2005].

The scenario in the year 2000 is shown in Figure 2-7 above. Following the inauguration of prepaid card services in the mid-1990s it could be anticipated that the relationship between wealth and mobile telephony diffusion would continue to weaken even more. Indeed, the insignificance of income with regard to cellular phone subscription can most prominently observed among the Mediterranean countries that score on a similar level as the most affluent economies such as Luxembourg, Switzerland or Norway not to mention Japan or the North

American region[44]. It could be assumed that the latter's low cellular density is the result of the absence of prepaid service due to the underlying MPP billing arrangement which does not favour this payment characteristic[45]. Further, all major mainland Europe economies perform worse than their affluence would suggest with the only exception being the UK (and its culture cousins) which rank well above the trend curve. Similarly, Ireland's level of mobile telephony penetration is *on par* with far more richer nations such as Switzerland or Luxembourg.

The following Table 2-2 illustrates the values of coefficient of correlation in the period 1985-2002 not only for the selected countries but also on a global scale[46]:

Table 2-2: Coefficient of correlation between GDP vs. cellular density, 1985-2002 [ITU2005].

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0.09	0.28	0.24	0.28	0.32	0.31	0.27	0.18	0.13	0.13	0.16	0.26	0.31	0.26	0.24	0.21	0.23	0.25
2	15	21	24	26	27	27	27	27	27	27	27	27	27	27	27	27	27	27
3	0.18	0.32	0.30	0.36	0.43	0.49	0.51	0.51	0.54	0.57	0.57	0.56	0.68	0.62	0.6	0.7	0.65	0.61
4	18	28	36	40	47	66	78	98	112	126	143	164	173	177	179	179	175	162

In general, the coefficient of correlation value is rather low with a maximum of 0.31 in 1997 that does only indicate a weak dependence between wealth and cellular telephony adoption. Expectable, the coefficient of correlation increases until 1990, an indicator for the price

[44] Significantly, [Levi2009] notes that in countries outside North America the penetration rates are overstated, "*partly because of high pricing, many customers in these countries have more than one SIM card*". In contrast the North American region have lower density rates since "*SIM cards are less common and where individuals generally have only one mobile telephone number, are a more accurate measure of actual penetration because it is closer to a measure of the number of individuals who have mobile service than in countries that count SIM cards. The penetration rates in the U. S. and Canada are certainly not as much lower as the data indicate.*"

[45] It must be noted that the Canadian telecommunications market suffered from foreign ownership restrictions under which "*non-Canadians may not own, directly and indirectly, more than 46.7% of the voting securities of a telecommunications carrier and may not otherwise exercise 'control in fact' of such carrier through contract or otherwise*" which surely have limited the impact of new competitors to the rather oligopolistic-structured market [deVu2012]. It took until March 2012 that the government decided to lift some restrictions which it believe will lead to increased competition and will also encourage new entry in the market.

[46] Column '1' indicates the R^2 value for the number of selected OECD countries stated in column '2'. Similarly, column '3' shows the 'global' R^2 value of the numbers of countries stated in column '4' that had a network running at the time Appendix L provides a discussion on the global relationship between wealth and cellular density.

insensitivity of an innovation aimed solely at business and corporate users. However, the value of R^2 decreases thereafter until 1994, which might be due to the inauguration of the first consumer tariffs, followed by a peak in 1997. Then the level of R^2 decreases again what might well be explained by the broad launch of prepaid card services in 1997, just to increase slightly until the early 2000s. In contrast, the picture for the global setting is more consistent with an ever increasing R^2 value right from the outset of cellular telephony inauguration reaching a first maximum value of 0.68 in 1997, the same year when the selection of OECD countries recorded their maximum albeit only scoring half of the former mentioned the R^2, followed by another peak two years later ($R^2 = 0.7$) to decrease towards a level of 0.61. Simultaneously, the number of networks in the global setting increases until the late 1990s.

Altogether, given the scattered picture it is difficult to establish any stable relationship between wealth an mobile telephony density. However, it could be argued that in the smaller (OECD) sample the decreasing value of R^2 (0.21 in the year 2000) is a clear indicator for the impact of prepaid card services. At the same time, the increase the following years may be attributed to service providers reaction towards the declining service revenue by means of higher priced bundled packages. In contrast, the growth in the value of R^2 until the late 1990s might be a consequences of the rise in not so affluent countries joining the mobile phone bandwagon where even prepaid card services could not eliminate the exorbitant cost of mobile telephone ownership in the poorest regions. Hence, it appears that wealth still matters in the developing nations while prosperity alone does not ensure widespread diffusion in the richer economies.

2.1.10 Degree of Uncertainty

Rogers: "*Diffusion has a special character because of the newness of the idea in the message content. Thus some degree of uncertainty is involved in the diffusion process. An individual can reduce the degree of uncertainty by obtaining information. Information is a difference in matter-energy that affects uncertainty in a situation where a choice exists among a set of alternatives*." [Roge1995b].

The criteria of 'uncertainty' appears to be of high significance since Ireland ranks very low on the cultural dimension of 'uncertainty avoidance' which will be examined in Chapter 2.2.

2.2 The Role of Culture

"*For Celtic culture, Ireland is much like Iceland was for the Norse: It was sufficiently removed from mainstream Europe to protect it from invasions and to isolate it from many of the cultural changes which wracked the face of early Europe*"

Richard Hooker, 2011

As discussed previously, economic factors alone cannot explain observed disparities in cellular telephony diffusion. Indeed, its density has been internationally uneven and growth rates are arguably not directly related to economic factors. Hence, another factor has to be considered to be of vital influence – culture. This subsection features a small introduction into the phenomenon of culture and its values followed by an examination of its influence on cellular telephony adoption by means of a simple regression model and its implication in the Irish case. Finally, the abstract' findings puts one of the most prominent stereotype associated with the Irish culture into question.

Indeed, culture may represent another significant mosaic stone in the big picture of cellular telephone adoption and diffusion. [Park2002] pointed to the fact that consideration of the role and impact of culture is lacking in studies of new product adoption and diffusion. Nevertheless, [Mait1998] has proposed that culture is a vital factor in the diffusion of innovations such as the Internet. Furthermore, in postulating that culture plays a significant role in IT adoption, [Bagc2001] asserted, "*national culture has rarely been treated in Information Technology (IT) adoption studies*". This comes as no surprise since it is difficult to describe its exact role, given that culture is an "*unquantifiable construct*", according to [Mait1998]. The impact of culture is clearly not confined to social and political systems. An important, but often overlooked, fact is that there is clear evidence of strong links between culture and economic development. However, the nature and impact of the relationship is unclear[47] and, as [Inge2000] pointed out, it is difficult to establish even the direction of causality.

Culture plays a vital and complex role as a modifier of inter-personal communications. With regard to an innovation such as mobile telephony, it is important that individuals can effectively exchange data – experiences and knowledge – relating to the new service. [Tric1998] noted

[47] While some argue that economic development influenced cultural and political systems, others argue the opposite.

"*data only becomes information when it is interpreted by an individual, and this interpretation of necessity takes place against the backdrop of the individual's culture*". In the subsequent decision-making process about whether or not to adopt, "*information is a prerequisite*" [Simo1960] and "*the decision-making process is deeply affected by culture*" [Adle1986].

2.3 Definition of Culture

It is clearly helpful to attempt to understand what culture is and how it acts to influence or characterise national and individual values, judgements and decision-making. Understanding of the term culture is made more difficult by an abundance of proposed definitions, for example:

- Richard Hill, a cultural researcher argues, "c*ulture is the shared assumptions, values and beliefs of a group of people which result in characteristic behaviour*" [Hill2001].
- Edward T. Hall, an American anthropologist, defined culture as "*a system for creating, sending, storing and processing information*" [Hall1990].
- Geert Hofstede, a Dutch cultural researcher, devised what is arguably the most popular definition: "*the collective programming of the mind which distinguishes the members of the one group or category of people from another*"[48] [Hofs2001].

Among numerous illustrations for the concept of culture it was Hofstede who came up with the three-layer onion model of culture depicted in the in Figure 2-8.

[48]:"*Every person carries within himself or herself patterns of thinking, feeling and potential acting which have been learned throughout their lifetime experience. Much of this has been acquired in early childhood, because at that time a person is most susceptible to learning and assimilating. As soon as certain patterns of thinking; feeling and acting have established themselves within a person's mind, (s)he must unlearn these before being able to learn something different and unlearning is more difficult than learning for the first time. Using the analogy of the way in which computers are programmed; the book refers to patterns of thinking, feeling and acting mental programs as software of the mind. This does not of course imply that people are programmed in the same way that computers are. A person's behaviour is only partially predetermined by her or his mental programs: (S)he has a basic ability to deviate from them, and to react in ways which are new, creative, destructive or unexpected. Culture is always a collective phenomenon, because it is at least partly shared with people who live, or lived within, the same social environment, from which it was absorbed. It is the collective programming of the mind that distinguishes the members of one group or category of people from another*" [Hofs1991].

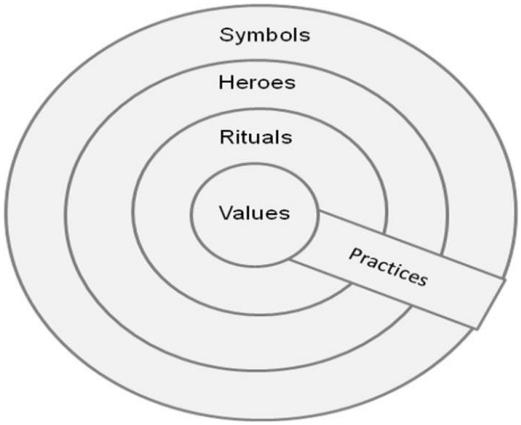

Figure 2-8: The Onion model of culture by Hofstede [Hofs2001].

The core stands for the underlying values, assumptions, norms, attitudes, believes and worldview which mostly remain the same. The core is invisible but influences the outer layers and is manifested through them. Indeed, these values are held at a deeper level and are invisible but determine individual's acting largely unconsciously, which makes it hard to analyse it. These inner values drive individual's behaviour, acting and judging based on the world-view derived from the implemented value-system i.e. do & don't, good & bad, clean & dirty, safe & dangerous, right & wrong)

The first layer around the core consists of common rituals such as eating, greeting, practise religion or communicating. These rituals and traditions are a result of long-term experiences and change only slowly.

The second layer around the core is represented by the heroes. Heroes act as admired persons or role models for many of the culture's values and beliefs. This person must not necessarily be a human being. A fictional person that has similar influence on the culture can also act as a possible ambassador. However, more common are politicians, musicians, athletes or actors that play a role as identifier in society. They are the lighthouses of behaviour that most of the individuals will use to align their personality to.

The third layer hosts the symbols, artefacts, products and behaviours of a culture. This layer includes symbols such as language, ceremonies, habits, uniforms, rules, signs, logos, brands but also artefacts (the physical characteristic of a person) that demonstrate the values of a culture and how they are practiced.

Culture is not a property of any single individual, but of a group. It is a collection of more or less shared characteristics possessed by people who have been conditioned by similar socialisation practices, educational procedures and life experiences. Similarities in environmental

background tend to produce similar mental programming. Culture is what differentiates people in a given collective from people in other similarly defined collectives e.g. families or nations.

It is easy to conclude that the family represents the initial and presumably most defining environment an individual may ever experience. Indeed, within a family the individual inhales the norms, values and beliefs (invisible dimensions) by means of observing the behaviour (visible dimension) of other members that will in large parts influence ones own behaviour and worldview. Hence, these two dimensions relate to each other as cause and effect respectively, with behaviour being the direct consequence of what people assume, value or believe in. Most importantly, it can be assumed that in a closed-knitted network like the family an individual learns to trust and benefit from the word-of-mouth communication that will even more strengthen the already obtained personal worldview while working as a virtual safety-net in moments of confusion and decision-making.

Culture frequently does not align with the artificial geographic borders of countries. Rather, it aligns more with physical geographical boundaries and formations, e.g., mountains, valleys, rivers, lakes, etc. as found by [Tria2002] who states that "*large mountains and wide seas reduce the possibility of cultural diffusion*"[49]. [Tria2002] further states that "*the cultures that emerge in different parts of the world often reflect the availability of flora, fauna, and other resources, as well as historical factors, such as migration, wars, revolutions, and inventions.*". [Hill1999] argued that cultural division is not based on logic but may take many different forms: national (social or community) cultures, corporate cultures, urban/rural cultures, gender and generational cultures, professional/vocational cultures and in-group/interest group cultures. He proposed that there are recognisable principles of culture:

- National cultures are rarely homogeneous since nations are largely artificial political and historic by-products of power struggles, changing alliances and pure happenstance. They share territory with other purely politically created cultures and are comprised of various regional cultures.
- Stereotypes are not always false.
- Genetics or race has nothing to do with culture.
- Cultures modify over time, but tend to revert to type.
- In determining behaviour, context is often as important as culture.
- Cultural issues are rarely simple and uni-dimensional. They are a matter of history, or more exactly myth, plus religion plus class.

[49] Indeed, Ireland is a prime example for this postulation.

- There are no good or bad cultures. A personal value judgement may not be relevant in the context of other people's value systems.

Consequently, [Gilb2003] even suggested that, "*all human societies face the same questions and problems – it is just the answers which are different*". Unfortunately, people tend to make generalisations about their impression of foreign cultures, a process for which the metaphor of stereotype was introduced[50] [Berr2011]. Hence, [Dagh1999] argues, "*the individual's inclination to adopt a new product is also influenced by his value system*".

2.3.1 Stereotypes and Proverbs

As previously illustrated, various definitions are employed to explain the nature of culture. Given that in everyday life, people do not resort to scientific approaches to make judgements on cultural differences people prefer to use stereotypes. Nevertheless, as Lehtonen states, stereotypes are also called "*best-guesses*" [Leht2000] because some generalisations are useful and indeed help to understand different cultures, while others are misleading or simply erroneous. Although people are clearly aware of other cultures and of (presumed) cultural differences, in the absence of specific knowledge or experience they frequently differentiate on the basis of broad stereotypical generalisations.

While traditional stereotypes only partially reflect the truth and are often misrepresentative, they do derive from the long-term observations and reflections of many generations, a product of folk wisdom, albeit tainted by the impact of bias and political propaganda. The many observed cultural paradoxes and behavioural patterns that appear to contradict accepted stereotypes illustrate the complexity of the concept of culture.

Gary M. Wederspahn (2003), an inter-cultural trainer, reported similar findings, and referred to proverbs and sayings as "*windows into other cultures*". According to [Wede2003] subtle differences of emphasis tend to become evident when similar proverbs are encountered in different cultures, and it is in these nuances that much may be gleaned about a people and its culture: "*Proverbs and popular sayings are capsules that contain highly condensed bits of a culture's values and beliefs. They are passed on from generation to generation as a legacy of folk wisdom – people tend to accept them, in an uncritical way, as 'truths' learned by their*

[50] [Berr2011] provides some further information: "*The word 'stereotype' was invented by Firmin Didot in the world of printing; it was originally a duplicate impression of an original typographical element, used for printing instead of the original. American journalist Walter Lippmann coined the metaphor, calling a stereotype a 'picture in our heads' saying, "Whether right or wrong (...) imagination is shaped by the pictures seen'*."

elders". This popular wisdom has a great influence on the assumptions, attitudes, motivation and behaviour of cultural adherents precisely because it is absorbed and internalised at a very early age and then taken for granted. Expressions of pessimistic fatalism are to be found among most cultures, perhaps the most notable being Murphy's Law – "*anything that can go wrong will go wrong*[51]" [Schn2006]. In Spain the phrase "*the best cloth is always the one that gets a spot*" is encountered, while the Japanese say that "*darkness lies one inch ahead*," and the British complain that "*the bread always lands but on its buttered side*" [Wede2003].

[Hill1999] related the consequences of culture to an invisible iceberg: "*We are conscious only of the tip; the habits, customs, protocol of every culture that is above the waterline. The things that really matter in inter-cultural relationships are out of sight: The different perceptions of the same things, the different preferences and even prejudices that result, the different ways of reasoning and, way down below the waterline, the different value systems*". In practice, Western Europe is familiar with at least three schools of reasoning: The Cartesian approach favoured by the French (and also evident in varying degrees among the Italians, Spanish, Dutch and the Swedes), the legalistic approach of the German-speaking and some of the Nordic communities, and the pragmatic approach of the British, the Irish and, to some extent, the Nordic peoples. Culture is inherently qualitative but may, to some extent, be measured in terms of people's perception of their own or other cultures. On this basis it is possible to chart individual cultures on a number of bases. Although many other scholars deal with the description and classification of culture in terms of dimensions, the work of Hofstede is perhaps the best known and provides a useful background insight and analytical framework for this research.

2.3.2 Cultural Dimensions

Hofstede[52] identified four different elemental factors in mental programming, '*cultural dimensions*', to objectively compare different national cultures:

[51] Murphy was an US Air Force engineer who's original citation goes as follows: "*If there's more than one possible outcome of a job or task, and one of those outcomes will result in disaster or an undesirable consequence, then somebody will do it that way*." [Schn2006].

[52] Hofstede was a psychologist, employed by IBM to determine what key factors needed to be taken into account in the management of the large, multi-cultural, workforce of the multinational. He empirically investigated the work-related cultural values of the employees in over 50 countries[52]. On the basis of this framework he formulated his notion of cultural dimensions. Hofstede discovered that the data clustered around four principal cultural dimensions; differing cultures could be readily discriminated on the basis of their relative score combinations on these dimensions. The dimensions used were masculinity, individualism, power-distance and uncertainty avoidance, a list of countries an their particular cultural vales can be found in Appendix H.

- Masculinity (MAS)

This captures the orientation and extent of sexual polarisation and dominance in national cultural attitudes and goals. It reflects the contrast between the male focus on achievement, material wealth and competition and the feminine preference for loyal personal relationships, respect for quality of life, nurturing and co-operation, before material goods[53]. In highly-masculine societies, people tend to have a strong desire and tendency to perform, achieve, make money, and show off; in a feminine culture, the important values are societal and people-oriented; showing-off is unacceptable and people are expected to be non-ostentatious[54].

- Individualism (IND)

IND reflects the degree to which people define themselves through their affiliation to a group or organisation. In cultures where IND is highly valued, the importance of personal initiative and achievement is emphasised. Individuals are motivated to achieve but this tends to encourage them to act in their own self-interest this producing the negative effect of making them self-centred. Highly individualistic cultures tend to downgrade or avoid collective work or group responsibility in the workplace. In contrast, members of cultures that favour conformism and collectivism over individualism consider themselves primarily within a social context, belonging to a group and with a responsibility to look after each other's interests, including family matters. IND also defines the extent to which empathy, traditional habits and common beliefs are valued.

- Power distance (PDI)

This defines a society's acceptance of inequality in power and authority. In cultures where PDI is high, people at the top level in an organisation make all the decisions and individuals at the lower hierarchical levels do not interact freely with other members. Members of society are predisposed to accept the fact that power is exercised at the higher levels within a hierarchy and decision-making is largely centralised. Societies with a low PDI engage individuals in participative decision-making processes and tend to accept more egalitarian relationships despite differences in their formal hierarchical positions.

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[53] The variable was termed 'masculinity' because, in nearly all of the 50 countries studied, men were more likely to score higher on attainment values than women.

[54] With regard to mobile telephony it may therefore be concluded that, in a highly masculine society, people are likely to use mobile telephones as means to show off and to differentiate (or even isolate) individuals. Moreover, the image of the mobile telephone is that of a yuppie gadget - an expensive fashion trend item. This may however have the effect of creating a negative impression of the new technology among the general public. In contrast, in predominantly feminine cultures (scoring low on masculinity), mobile telephones tend to be regarded as a useful means of strengthening social links. People value the convenience and utility of being able to make person-to-person calls at any time or place of their choosing as it improves the quality of life, a very feminine feature.

- Uncertainty avoidance (UAI)

This dimension reflects the extent to which a society feels threatened by unsure and ambiguous situations and consequently searches for secure and statutory structures. Cultures with low UAI have a high tolerance for facing an ambiguous or unknown future without experiencing undue stress. Individuals are risk-tolerant and tend not to work as hard as they might. In contrast, cultures that are high on UAI have low tolerance for ambiguity and feel extremely stressed by an uncertain outcome of a future course of events. Consequently, these societies try to compensate for potential negative events or outcomes by engaging in an extensive process of planning and forecasting. This dimension may have a significant impact on innovation adoption since societies, which are characterised by low UAI, tend to be more open to innovations and have much wider worldview. Importantly, Protestant and Chinese cultures rank relatively low compared to Catholic, Buddhist, and Arabic countries. Table 2-3 illustrates the global scale classification of triad countries by Hofstede.

Table 2-3: Hofstede's classification of triad countries [Baum2000].

	Japan	Ireland, UK, North America	Western Europe	
			Northern	Continental
Individualism	low	high	High	low
Power distance	high	low	Low	high
Masculinity	high	high	Low	high
Risk avoidance	high	low	Low	high

The data in Table 2-3 indicate that despite many differences some regions show surprising similarities. Most prominently, Ireland, the UK, Australia and the US perform equivalently on their cultural dimensions[55], which might be due to their European heritage. Consequently, Hill concluded that, in the light of the many obvious characteristic differences between the European nations "*Europe is unity in diversity*" [Hill1999].

2.3.3 Culture's Influence on the Adoption and Diffusion of Innovations

The correlation between innovation adoption and cultural values has been the topic of many research studies. Earlier research has demonstrated that cultural dimensions "*have a significant effect on innovation adoption and innovativeness*" [Lauk2011]. Hence, it was decided to identify the most crucial dimension in the adoption and diffusion process of an innovation. [Stee1999]

[55] A discussion on dimensions can be found in Appendix F while a global illustration on countries' UAI and PDI values is provided in Appendix G.

states that "*cultural UAI has a negative effect on consumer innovativeness*" and hence is often related to resistance to new ideas and hinders innovation adoption by consumer. [Dobr2009] argues "*UAI is the cultural dimension which is greatly connected to innovation and innovativeness diffusion [since it is] associated with fear towards risk, uncertain situation.*" Hence, cultures high on UAI feature a low tolerance for ambiguity and uncertainty and thus prospective adopters of these cultures "*are not certain about the benefits of new products and consequently delay their purchase decision.*" [Dobr2009]. Consequently, [Tolb2011] concluded, "*UAI was found to slow down innovation acceptance and diffusion due to the inherent risk aversion of the society*". [Siva2001] found that "*UAI to be a hindrance to the adoption of new products*" while [Tell2003] reported that "*low UAI results in faster overall adoption.*". Finally, [Fran2001] determined that "*the country's innovativeness correlates with the country's tendency for UAI*". Given these findings UAI's importance can surely be confirmed.

Due to the focus of the thesis is necessary to question if the former described link is also valid in case of cellular telephony. Hence, a simple linear regression analysis[56] was performed with Hofstede's cultural values against mobile telephony density as illustrated in Figure 2-9 below.

[56] Countries' mobile density was ranked again its cultural value on a yearly basis with the resulting coefficient of determination being plotted against the particular year.

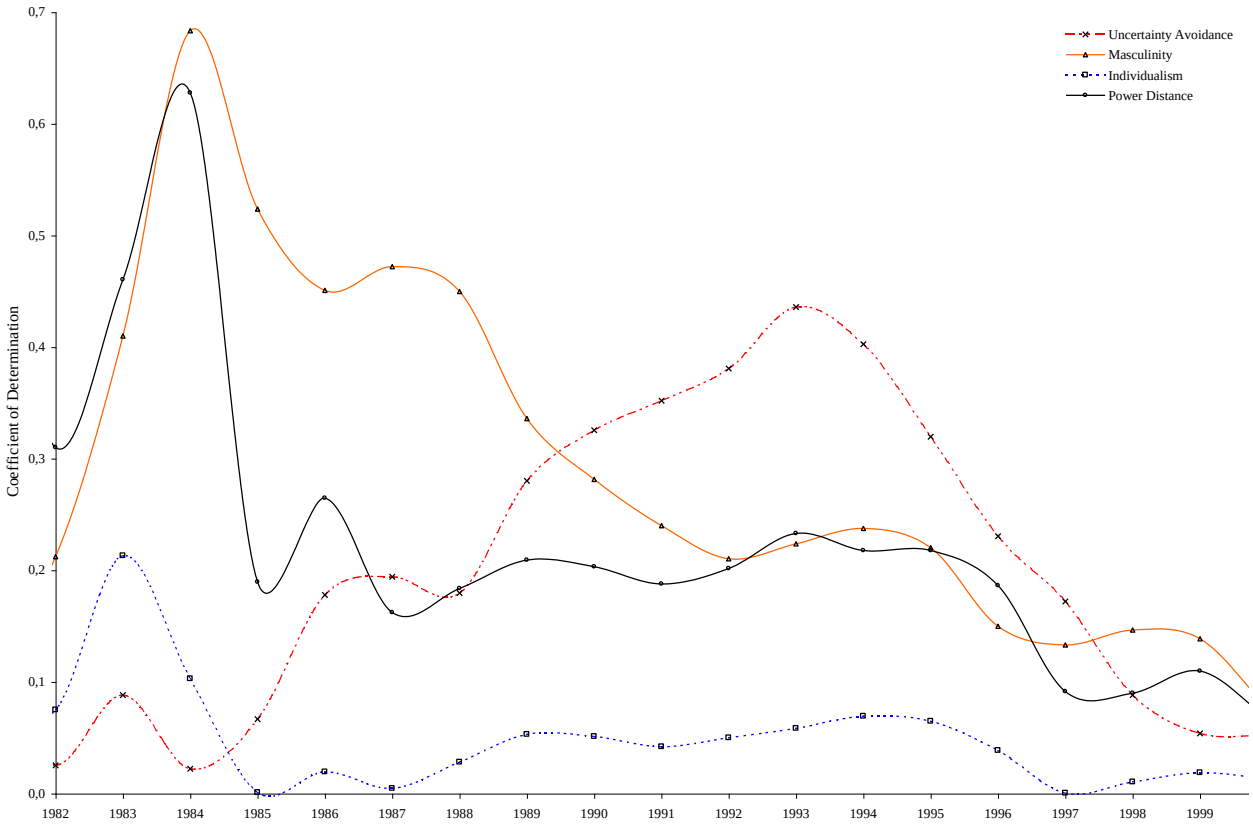

Figure 2-9: Correlation between cellular telephony density and Hofstede's values, 1982-2000.

As depict above MAS, PDI and IND show the largest correlation with cellular density in the early phase of mobile telephony while UAI's influence seems to increase in the mid-1980 whereas the other dimensions' R^2 symmetrically decline while stabilizing in the first half of the 1990s until they bottom out in the second half of the 1990s.

A closer examination reveals that the high score of PDI at the beginning of the 1980s is attributed to Japan's pioneering role in launching the first commercial cellular network in 1979, two years ahead of the Nordic NMT systems, and the launch in Hong Kong that has a similarly value on PDI. Coincidentally, the high R^2 for MAS is a consequence of the feminine cultures of the Nordic countries. Over time, both dimensions' importance decline with the launch of the majority of networks in the late 1980s. At the same time, the correlation between cellular density and UAI grew stronger until the mid-1990s given that both public familiarity grew, not only but due to the European-wide deployment of GSM systems and prepaid card services which diminished risk perception that convinced the even most risk averse individuals to join the mobile bandwagon. Consequently, given that UAI exhibits the strongest correlation it was decided to concentrate on this value for further examination against an Irish backdrop. The significance of UAI is also confirmed by [Sund2005] who claims that "*UAI has the greatest effect*" on diffusion in the field of wireless communications as [Sath1999] found that UAI is a

major factor explaining the adoption of wireless services. For a closer inspection the situation in the year 1990 was depict in Figure 2-10[57].

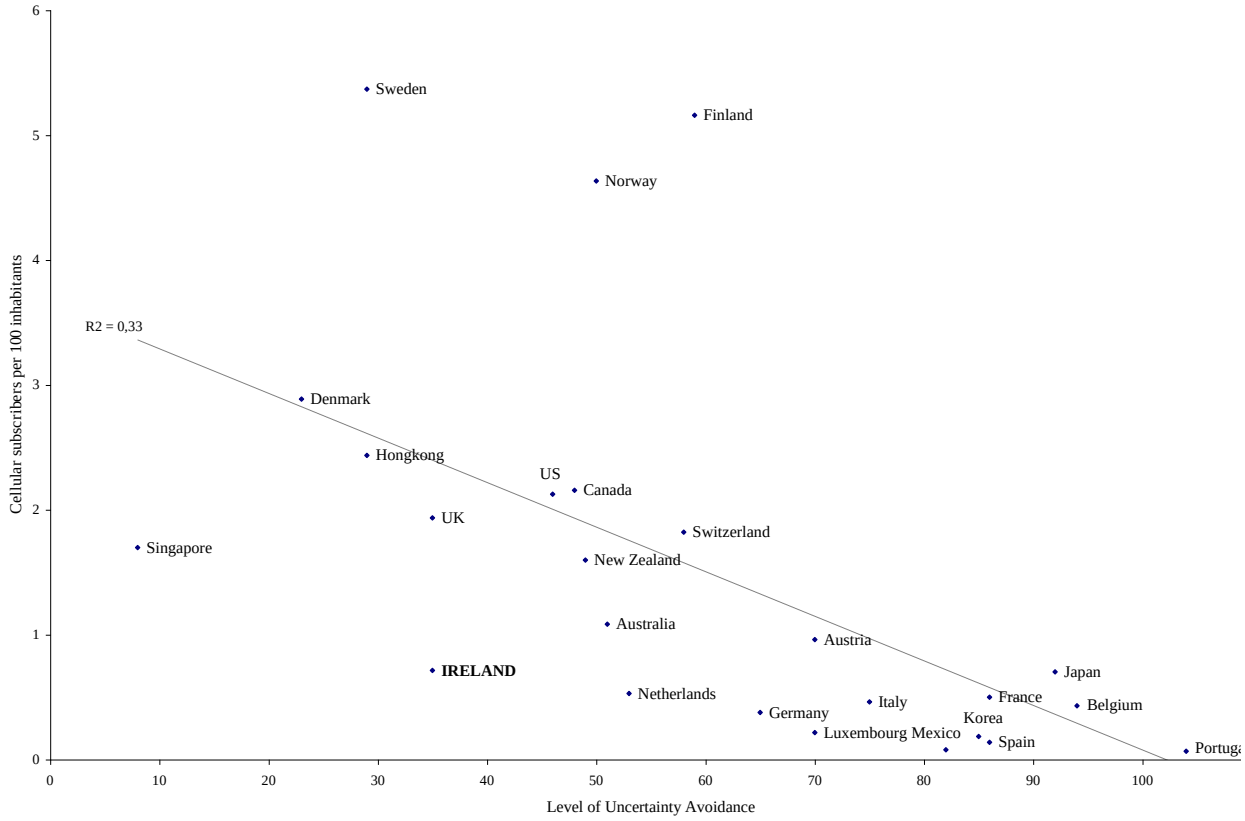

Figure 2-10: Level of UAI vs. cellular density, 1990 [Lagr2002], [ITU1999a], [Tech2012].

Obviously, from a cultural perspective it appears that nations that rank at the top end with regard to UAI achieve the lowest cellular density regardless of their prosperity. Controversially, Ireland may be seen to clearly under-perform in the benchmark given that it records a similar level of UAI as the UK (and to a larger extend the British-influenced countries) and Sweden. It appears likely that Ireland's poor relative performance is largely attributable to low disposable income level. Indeed, it was not until the Irish economy began to flourish in the early 1990s, coincidently with the rollout of GSM networks, that the cultural effect may have been able to take full effect. Increased wealth, the launch of prepaid packages, handset subsidisation and growing popular familiarity with mobile telephony, effectively eliminated cost as well as social

[57] 1990 represented the point in time when the last country had successfully implemented their initial analogue cellular network (Portugal in 1989).

acceptance barriers to adoption[58]. Nevertheless, Ireland achieves a higher mobile penetration than all of mainland Europe's nations with the small exception of the two Alpine nations.

The crucial role that UAI plays in the adoption process of 'uncertain' new technologies asks for a deeper investigation of both its origin and the underlying influences that form it. Furthermore, it is still not clear what are the contributing aspect(s) that cause countries to have high or low levels of UAI and which of them prove applicable in the Irish case.

2.3.4 Concept of Uncertainty Avoidance

Some cultures value stability and certainty other cultures value change and ambiguity. Uncertainty tolerance is a cultural predisposition to value risk and ambiguity over certainty and stability. At the individual level, this is called tolerance for ambiguity. People with intolerance of ambiguity have high levels of uncertainty, seek clear black-and-white answers and prefer societies where the rules are clear and individual decision making is limited [Samo2012]. Before proceeding it is worthwhile to recall some of the value's most prominent characteristics:

Table 2-4: Characteristics of low and high UAI cultures.

Characteristics of low UAI cultures	Characteristics of high UAI cultures
Typically the country is newer or more recently settled.	Generally older countries/cultures with a long history.
The population tends to be ethnically diverse.	The population is more ethnically homogeneous.
Risk and pragmatism[59] is valued in business (i.e. US).	Risk is avoided in business (i.e. Germany).
Frequent innovations.	Low tolerance for innovation, prefer to stick to traditional routines.
Citizens are proud of nation.	Citizens are often critical of their own nation.
	Higher max. speed limits and a higher rate of motor vehicle accidents.
Foreigners or minorities are encouraged to assimilate.	Xenophobia is common and foreigners/minorities tend to be ostracized.
Examples: Ireland, US, Singapore (the least risk-averse culture), Jamaica, Sweden, China.	Examples: Greece (the most risk-averse), Portugal, Japan, Israel, Spain, Latin America.
Protestant and Chinese cultures tend to score low UAI.	Catholic, Buddhist, and Arabic nations tend to score high UAI

[58] Clearly, financial constraints limit the immediate fulfilment of desires. While there may be a cultural pre-disposition to adoption (low UAI) this may be negated by a lack of available financial resources. With prepaid cards, cost barriers were effectively eliminated and the perceived financial risk of buying a card was minimized. Hence, nations with high UAI were able to achieve density rates similar to those of more risk-tolerant regions.

[59] [Hill1999] argues that Europe is familiar with at least three schools of reasoning contributing to the mental programming – one being the pragmatic approach of the British and the Irish and, to some extent, the Nordic.

Given the characteristics of a high UAI culture, Ireland does surprise with qualifying as a low UAI society according to Hofstede's values. Controversially, Ireland has one of the most ethnically homogenous[60] [Levi1998] and catholic population in Europe, as well as being an old country/culture. Consequently, the Irish constellation clearly demonstrates a paradoxes.

To get a clearer picture of the nature of UAI Hofstede established the concept of UAI: "*A basic fact of life is that time goes only one way. We are caught in a present that is just an infinitesimal borderline between past and future. We have to live with a future that moves away as far as we try to approach it, but onto which we project our present hopes and fears. In other words we are living with an uncertainty of which we are conscious. Extreme uncertainty creates intolerable anxiety, and human society has developed ways to cope with the inherent uncertainty of living on the brink of an uncertain future. These ways belong to the domains of technology, law, and religion*" [Hofs2001]. While technology and law helps people to defend themselves against the uncertainties of nature and the uncertainties in the behaviour of others religion helps to accept the uncertainties people we cannot defend themselves. In particular, the knowledge of life after death is the ultimate certainty of believers that allows them to face uncertainty in life [Hofs2001]. Given the prominent role that religion still prevails in both society and in Irish history particularly further research is concentrated on religion as it is one of the fundamental ways for human society to cope with uncertainty.

2.3.5 Religion's Influence on Uncertainty Avoidance

Significantly, Hofstede found, that generally speaking Protestant countries and those with Chinese influences score low in UAI while Catholic, Buddhist and Arabic speaking countries tend to score high in UAI [Hofs2001]. Significantly, Hofstede adds that religion and UAI are meaningful related and that religion is not the root cause of UAI differences between countries as most prominently illustrated on examples such as Ireland, instead it "*should rather been seen as a result of common cause; an established religion reinforces the values that led to its adoption, however, confirming either strong or weak uncertainty avoidance.*" [Hofs2001].

Hofstede further explains, "*the dominant religious affiliation in a country may have been a result of previously existing mental programmes as much as a cause of such programmes. All of the great religions of the world at some time in their history underwent profound schisms;*

[60] David Levinson states that: "*Ireland ha a population of 3,550,000 [in the 1990s] and is ethnically homogenous, with 95% of the population being Irish […]. The population is also homogenous in religion, with 93% being Roman Catholic and the remained being mainly Protestant (3% Anglican) and Jewish.*" [Levi1998].

between Roman Catholics, Eastern Orthodox and various Protestant groups in Christianity. Differences in mental programming between groups of believers have probably played a major role in these schisms. Religious conversion does not mean a total change in cultural values" [Hofs2001]. Albrecht further suggests that the roots of these different mental programmes lies evidently in history; while the Latin European countries were growing from the remains of the Roman Empire[61] the Germanic countries did not. Consequently, Albrecht concludes "*in the same way as early childhood experiences have a major impact on personality these early societal experiences must have had a lasting impact on polity, affecting not only all institutions that have followed but also the corresponding mental programmes.*" [Hofs2001]. Moreover, Safiek Mokhlis claims "*Religion is an important cultural factor to study because it is one of the most universal and influential social institutions that has significant influence on people's attitudes, values and behaviours at both the individual and societal levels.*" [Mokh2009]. Hence, Figure 2-11 illustrates the extent of the Roman Empire and its invasions. Most obvious the Nordic region as well as Ireland and Scotland did not form part of the Roman Empire.

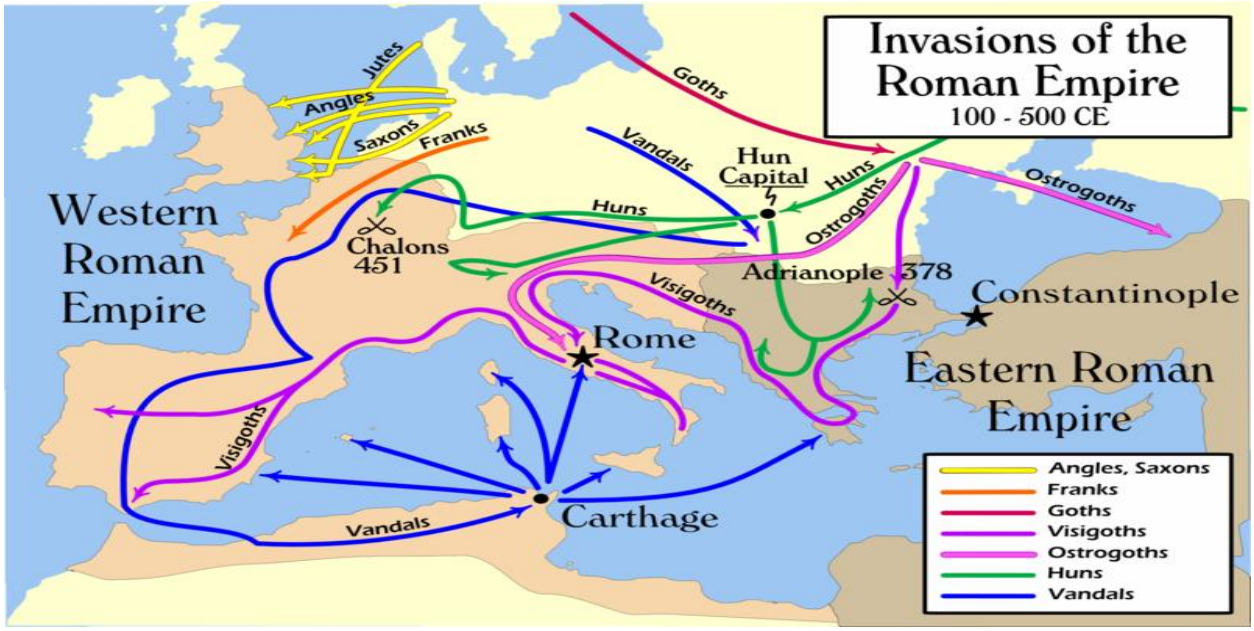

Figure 2-11: 'Barbarian' invasions – major incursions from 100–500 AD [MapM2006].

The crucial role of the historic link between the Roman Empire and a nation's culture is confirmed by Hofstede's research. He assumes that the stronger and longer the influences of the Roman Empire was on a culture (i.e. Roman law and Romance language) the higher its level of

[61] Roman Empire (27 BC – 476/1453) achieved its greatest extent around 100 AD, controlling appr. 6.5 million km2 of land surface. Due to its large coverage and endurance, Rome's institutions and culture exercised a significant influence on the development of language, religion, architecture, philosophy, law, and forms of government in the territory it governed, particularly Europe and by means of European expansionism throughout the modern world.

UAI as particularly evident in the Mediterranean region [Hofs2001]. In contrast, the Nordic and Anglo region score the lowest level of UAI given both their relatively short period and small amount of shared history with and geographical remoteness from the Romaine Empire which reduced the latter impact. Alongside, the Protestant Reformation separated these cultures from the determine influence of the Roman Catholic Church [Hofs2001].

To illustrate the particular link between UAI and Catholicism the average values on the four dimensions were compared between Catholic and other Christian countries. For the purposes of this thesis countries in which over 50 per cent of the population adhere to the (Roman) Catholic religion are considered to be Catholic countries while those with over 50 per cent practising alternative forms of Christianity are categorised as Christian countries. Table 2-5 shows the average score cultural dimensions obtained on regional religious affiliation.

Table 2-5: Average Hofstede's dimension [Lagr2002], [Tayl2003].

Countries	Power distance	Individualism	Masculinity	Uncertainty avoidance
Catholic	49	61	55	79
Christian	38	70	38	55

As may be anticipated, Catholic countries reflect a more traditional, conservative and authoritarian ethos since, with the marginal exception of individualism, they record significantly higher scores on each dimension than other Christian regions. The fact that other Christian countries have a profile that is closer to the Nordic model, with its lower scores on power distance, masculinity and uncertainty avoidance, tends to favour the diffusion of innovations more than that of Catholic countries. It is particularly significant that the greatest divergence is associated with UAI where the Catholic countries recorded a value close to 50 per cent larger than their other Christian counterparts. UAI has been shown to be the primary dimensional determinant of adoption and diffusion performance, hence its relevance for cellular telephony. Stephan Taylor asserted, "*religion is a belief system that cannot be challenged or changed with any form of logic, education, or training.*" [Tayl2003].

Given the enduring influence of religion, which in the case of Catholicism is associated with high levels of UAI, it is interesting to see how Ireland, as one of the most Catholic nations, scores among its Catholic cohorts (Austria, Belgium, France, Ireland, Italy, Luxembourg, Mexico, Portugal, Spain) on UAI. To highlight the cultural similarities the US and the UK was included in the following Figure 2-12:

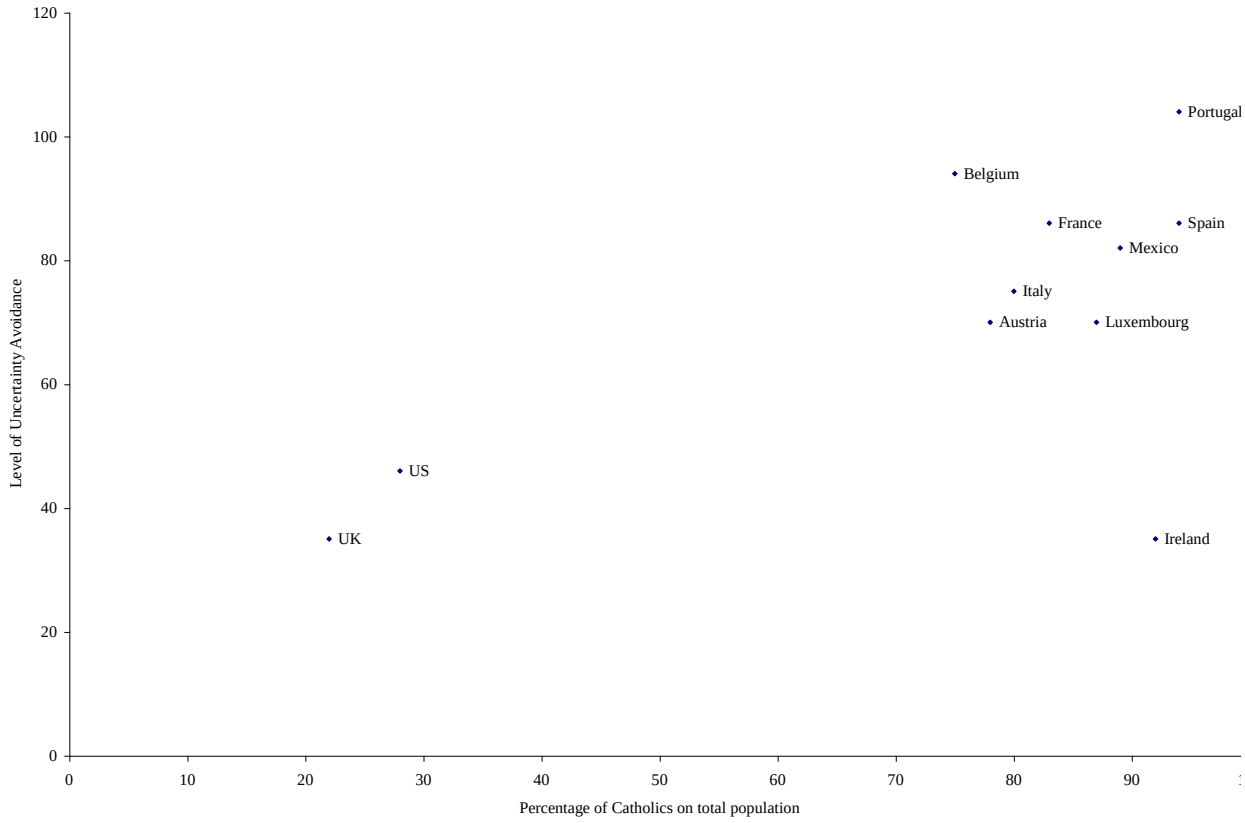

Figure 2-12: Share of Catholics vs. level of UAI within a country [Tayl2003], [Lagr2002].

Clearly, Ireland contradicts the trend that a high proportion of Catholics in a society translates into a similar level of UAI. Indeed, Ireland records a score of UAI that is virtually identical to the ones of its country cousins reflecting the impact of long political and economic involvement and a consequent transfer of cultural trading values and traits[62].

This chapter has examined the adoption and diffusion of mobile telephony and socio-economic and cultural criteria. In particular, Rogers' theory of adoption and diffusion of innovation was used to find the attributes that contribute to the Irish's extraordinary level of mobile phone adoption and usage. Starting with the element of the communication channel it was shown that communicating information about an innovation by means of inter-personal

[62] An alternative explanation of this contradiction could by hypothesized as being a consequence of the exemption of the Emerald island from the influences of the Dark Age which haunted much of Europe and its achievements. Indeed, [Cahi1996] argues "*not only did Irish monks scribes maintain the very record of Western civilization -- copying manuscripts of Greek and Latin writers, both pagan and Christian, while libraries and learning on the continent were forever lost -- they brought their uniquely Irish world-view to the task.*". However, examining this route would represent another interesting subject for exceeding research the scope of this thesis.

communication channels in the form of word-of-mouth is most efficient among members of a society whereas the traditional Irish housing and family structure is most receptive for this kind of propaganda. Following the Irish legacy of emigration it could be assumed that these emigrants abroad communicate with their families and friends in their home country and therewith, establish a communication channel from cosmopolite source. This in turn results in traits of a cosmopolite nature, which forms and elemental part of an early adopter characteristic. Given that cosmopoliteness is closely related to world-openness which is further supported by the Irish's open economy and its strategy of attracting foreign countries to settle on the Emerald island it was found that this enhanced the creation of an early adopter society which is open to new ideas and technologies.

Furthermore, in contrast to Rogers assumption that age does not play a determine part in the adoption and diffusion process it was determined that this is more a question of the financial capabilities that comes with age rather than a static fact. This was illustrated by the rather weak correlation between mobile telephony density and wealth. Given that the inauguration of prepaid services lowered the cost of ownership and thereby, the entry barrier associated with innovations' first appearance to younger people, the group that created the phenomenon of a 'mobile culture' and contributed to the wider acceptance of mobile telephony within society.

Additionally, it was possible to establish a link between the role of culture and mobile telephony adoption and diffusion. Firstly, it was proven by means of a linear regression model that the cultural dimension of uncertainty avoidance (UAI) is the most significant of all of Hofstede's dimensions. Secondly, it was demonstrated that Ireland scores a rather low level of UAI similar to that of countries such as the UK or the US. This can be traced back to be a consequence of their emigrant legacy. Thirdly, it was shown that high levels of UAI are closely related to mostly predominantly Catholic nations which represents a contradiction in the Irish context given that Ireland is the most Catholic country within Europe. Controversially, this puts one of the most prominent stereotypes associated with the Irish culture into question.

3 The State of the PSTN and the Migration towards Cellular Networks

"We're the mobile generation, we don't need landlines."

Róisín Ingle, The Irish Times, Apr. 30, 1999

After investigating the socio-economic and cultural influences on the adoption and diffusion process of the mobile telephone this chapter will highlight the relationship between the state of the legacy network and possible substitution effects introduced by cellular telephony. In contrast to the findings of the previous chapter with regard to the link between mobile telephony and wealth Chapter 3 demonstrates a strong correlation between the later and PSTN subscription. Moreover, it has been shown that the deployment of the Irish fixed-line telephone network was hampered by historic events, such as wars, but also by a wrongly and biased judgement of the public's interest in telephony services which stood in stark contrast to the policies in most other regions around the globe. Consequently, the proliferation of the wireline telephone network was plagued by inefficiency, unreliability and long waiting lists. Not surprisingly, the Irish people migrated to its wireless counterpart to overcome the gap in tele-connectivity which resulted in Ireland being among the first countries in which mobile phone subscriptions overtook fixed-telephone subscriptions, which in large parts was a consequence of the un-bureaucratic scheme of prepaid services.

3.1 The Digital Divide and the Jipp Curve

In the absence of a timely viable alternative some countries' inhabitants may, merely on the basis of a desire for convenience or security rather than any vital need for a means of communication, subscribe to a wireless carrier. These customers value the opportunity to '*get connected*' via a cellular phone higher than the distant prospect of the comfort and quality of a fixed-line telephone, even when both wireless networks were weak and analogue phones bulky. In contrast, the migration to mobile telephony may be expected to be smaller in regions where individuals can easily purchase a fixed-line connection. Consequently, it appears that two significant factors emerge as partial determinants of the diffusion of cellular telephony: the state of the PSTN and

the costs of access. In regions where the provision of main lines[63] has failed to meet demand the cellular services has enabled many *un-wired* individuals to get connected.

At the matter of fact, the costs of establishing a PSTN infrastructure are high. In sparsely populated remote areas established monopolistic providers historically often considered marginal costs to be prohibitively high and, unless compelled to do so by government and in the absence of competition, failed to expand their networks significantly beyond the viable centres of population thus, creating an infrastructural deficit. Further, many incumbents, often on the basis of established policy, political pressure or convenience, opted to purchase their equipment principally from one domestic supplier – the so-called *national champion* – who, as a form of monopolistic provider, had little incentive to develop more advanced equipment or to reduce prices. With the introduction of competition in the telecommunications sector private operators were in a position to install their own networks and this put the established providers under pressure to improve their infrastructure and level of service. Once monopoly market structures were dismantled, new market entries and resultant competition stimulated new investment and causing prices to fall. Ironically, in this climate of growing competition, operators opted to concentrate on the more lucrative customer segments such as businesses that are principally located in regional centres of population – the larger cities; since countries with a high level of urbanisation can enjoy economies of scale through concentration of infrastructure deployments, they have the ability to implement advanced network features at lower cost[64]. In response, regulatory authorities introduced the principle of universal service provision to ensure that rural and peripheral areas were not disadvantaged in this commercial pursuit of profitability [Godd1995]. The impact of this conditional imposition is however controversial. [Godd1995] asserts that this form of intervention will not help matters much since the policy applies to analogue or digital telephony but not to the provision of more advanced services such as the

[63] *Main lines per 100 inhabitants* is the most commonly used indicator for level of tele-connectivity. However, as with any statistical variable it does not fully capture the situation and may even be misleading since it does not differentiate between lines serving households and lines which are used for business/government, etc. [ITU2005].

[64] Conversely, access costs are normally higher in city areas due to the more complex environment, legal restrictions, property values and the necessity for negotiated co-operation with other parties. Nevertheless, the advantages of urban concentration and the availability of buildings suitable for network implementation provide a better revenue stream and enhanced return of investment. On the other hand relatively high-density population areas are normally associated with high levels of PSTN connectivity, which might reduce cellular migration.

Digital Subscriber Line (DSL). This will inevitably act to widen the existing technology gap and reinforce established geographical disparities at the expense of the rural areas[65].

On a global scale the OECD describes this phenomenon as the *digital divide*[66], which refers to "*the gap that exists between geographic areas or individuals at different socio-economic levels in respect to their opportunities to access information and communication technologies*" [OECD2006]. Accordingly, the concept of the digital divide encompasses more than simply the provision of access to a basic telecommunications infrastructure, although such infrastructural connectivity is essential. The principal indicator used to reflect the level of universal telephony service provision is the number of access lines per 100 inhabitants (penetration rate or density). On the basis of this measure the extent of the (national) digital divide is evidently strongly correlated with the level of national income as illustrated in Figure 3-1.

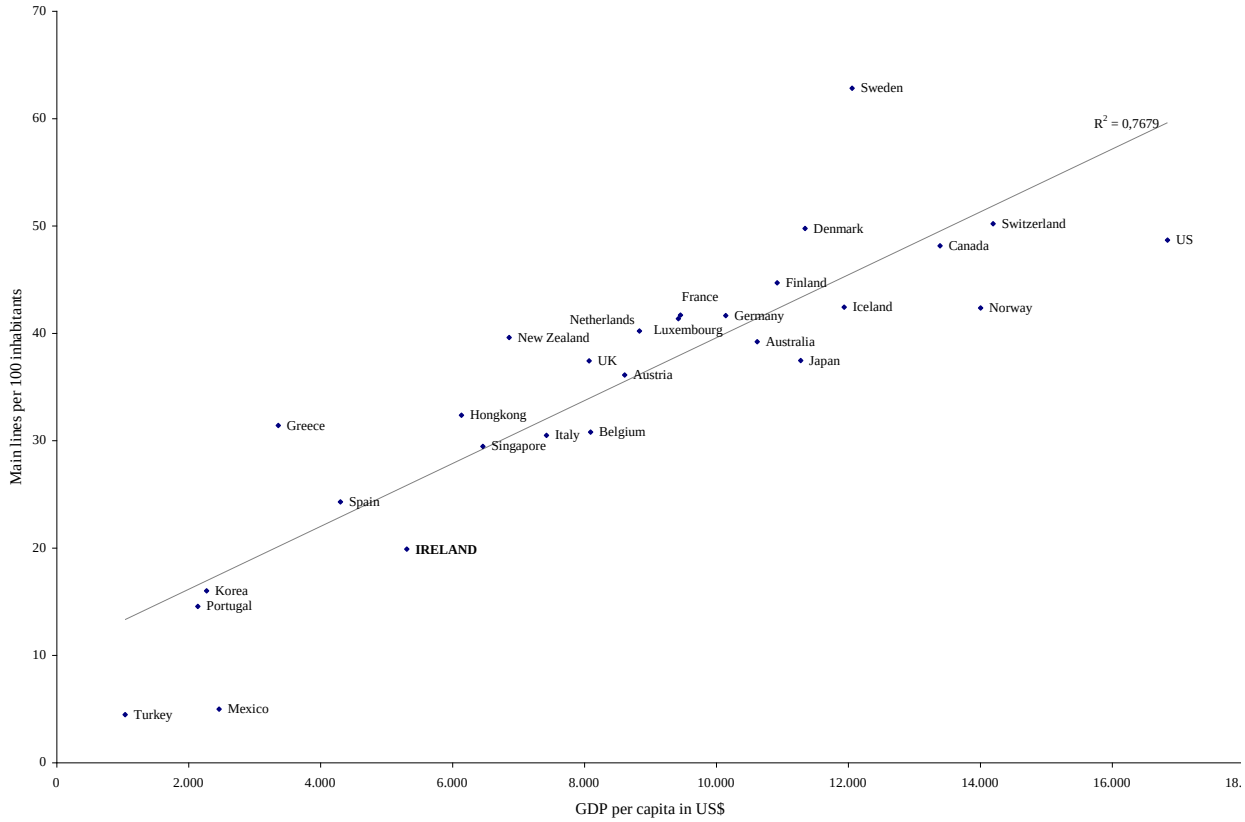

Figure 3-1: Main line density vs. GDP, 1985 [ITU2002].

[65] According to the OECD it may be expected that discussion of the digital divide will tend to gradually shift towards the level of access provided by advanced infrastructures.

[66] Significantly, the OECD reminds that the term must be considered to be distinct from the concept of universal service used in telecommunication policy in that it places emphasis on access to those information and communication technologies needed to access the internet.

The resulting graph is dubbed the '*Jipp Curve*', probably the most familiar diagram in the economics of telecommunications[67] [Jeun2000]. The ITU further notes, "*fixed-line tele-density tends to be correlated with a host of other factors that also rise as a nation's wealth rise (e.g. average disposable income, level of education, level of investment, degree of electrification)*" [ITU2002]. Not surprisingly the Nordic region alongside Switzerland and the North American countries lead the benchmark whereas poor economies such as Turkey and Mexico rank at the bottom end. Interestingly, the not affluent Mediterranean countries follow more or less the trend curve. Obviously, Ireland is performing worse than its financial potential would suggest which questions the former made correlation between wealth and telecommunication infrastructure deployment. Hence, it appears necessary to investigate the reasons behind this abnormality.

3.2 The Irish Public Switched Telephone Network

The first telephone exchange was opened in Dame Street's Commercial buildings by the British United Telephone Company[68] with five subscribers[69] in 1880 [Hall193a]. By 1893 service were only available in Dublin, Belfast, Cork, Limerick, Dundalk, Drogheda and Derry in 1893. Similar to their British counterparts, the Irish Postmaster-General was also pessimistic on the benefits of the telephone: "*Gas and water were necessities for every inhabitant of the country. Telephones were not and never would be. It was no use trying to persuade ourselves that the use of the telephone could be enjoyed by the large masses of the people in their daily life…*"[70] [ibid.].

[67] Named after Professor A. Jipp, who was one of the first researchers to publish about the relationship in 1963.

[68] It was the amalgamation of the Edison and Bell telephone companies licensed by the British government. The telephone was received very sceptical by the British Post Office, as outlined by Sir William Preece, its chief engineer: "*I fancy the descriptions we get of its use in America are a little exaggerated, though there are conditions in America which necessitate the use of such instruments more than here. Here we have a superabundance of messengers, errand boys and things of that kind…The absence of servants has compelled Americans to adopt communication systems for domestic purposes. Few have worked at the telephone much more that I have. I have one in my office, but more for show. If I want to send a message – I use a sounder or employ a boy to take it.*" [ibid.].

[69] According to reports the switchboard was operated by a boy who proved to be not very reliable which soon led to his replacement by female operators – a familiar appearance – causing Arthur C. Clarke (science fiction author and inventor) to describe the phenomenon as follows: "*that curious mathematical law with which all efficiency experts are familiar: One boy equals one boy: two boys equals a half boy; three boys equals no boy at all.*" [Hall1993a].

[70] Surprisingly, this view was also share by critical media such as The Times: "*When all is said and done the telephone is not and affair of the million. It is a convenience for the well-to-do and a trade appliance for persons who can very well afford to pay for it. For people who use it constantly it is an immense economy, even at the highest rates ever charged by the telephone company. For those who use it merely to save themselves trouble or add to the diversions of life it is luxury. An overwhelming majority of the population do not use it and are not likely to use it at all, except perhaps to the extent of an occasional message from a public station.*" [ibid.].

[Hall1993a] notes that this rather negative verdict had to be seen in the context of the postal and telegraph services which were among the world's finest at the time[71]. Then in 1893 a telephone link was established between Belfast, Glasgow and Carlise via a submarine cable while trunk lines were laid next to railways while the telephone gained broad public recognition.

However, the financial viability was of most governmental concern since the Chancellor of the Exchequer in 1904 still believed that the "*telephonic communication [was] not desired by the rural mind.*" Controversially, this appraisement stands in stark caveat to the experience gained in the US where it was reported "*the telephone was particularly interesting for farmers*[72]." [Huur2003]. Moreover, a popular request of farmers was "*to get good roads and telephone*" at the time. Hence, farmers had subscribed to 2 million of the total 7.5 million telephones by 1910. A virtually similar disastrous impact on the proliferation of telephony services was the begin of WW II which "*virtually halted further developments*" [ibid.]. Even worse, following the Easter Rising and the Civil War in 1922 the telephone system was described as "*wholesale destruction of telephone lines*[73]" and "*that at most it was only a skeleton*" [ibid.]. The disastrous effect these events had on Irish tele-density are evidently depicted in the following Table 3-1:

Table 3-1: Tele-density in capitals and other major towns, Jan. 1, 1926 [Huur2003].

Tele-density	Cities	Tele-density	Cities
31	San Francisco	10	Berlin
28	Stockholm	8	Munich
27	Washington	7	Auckland, Havana
24	Los Angeles, Toronto	6	Brussels, London, Osaka, Rotterdam, Tokyo
23	New York	5	Amsterdam, Antwerp, Budapest, Vienna
21	Chicago	4	Buenos Aires, Glasgow, Prague, Warsaw
17	Montreal	3	Beijing, **Dublin**, Milan, Moscow, Rome, St. Petersburg
16	Copenhagen	2	Shanghai
15	Oslo	1	Naples
13	Zurich		

Source: Data from E. Feyerabend, 50 Jahre Ferrnsprecher in Deutschland, 1877-1927, Reichspostministerium, Berlin 1927

[71] There were 22,000 miles of telegraph line with 83,000 miles in operation, and 5,000 telegraph offices in Great Britain and Ireland while telegram traffic rose from 33 million in 1884/1885 to 50 million in 1886/1887 [ibid.].

[72] Multiparty lines served up to 15 farms while most systems were operated on a non-profit cooperative basis [ibid].

[73] It was reported that the cutting of the transatlantic cable at the Valentia station during the Civil War caused the route for the first transatlantic telephone cable (TAT-1) in 1955 to by-pass Ireland [ibid.].

Not surprisingly, the benchmark is lead by the North American and Nordic cities; both regions being prominent as early adopters and were not heavily involved in WW II or other conflicts which massively hurt telecommunication development.

Although the P&T and the government outlined several plans for the extension of the telephone network[74] these could not be realised to due to impact of the Emergency and hence virtually all application for telephones for social and many business purposes were refused resulting in long waiting lists. While Erskine Childers, Minister for P&T, notes in 1951 growing demand was also due to that: "*Young people in the country particularly are beginning for good or ill to dislike isolation and communications of every kind are now regarded as essential to modern civilisation.*" [ibid.], Mr. O'Droma, Deputy Secretary of the P&T, criticised that "*no effort had been made to 'sell' telephones; in fact the Department's practice of insisting on payment, by all new subscribers, of rental covering a year at least in advance was designed to contain the enormous latent demand within manageable limits.*" [ibid.]. However, Dr. Leon O'Broin, former Secretary of the P&T, claims that the inability of the Ministers for P&T to obtain sufficient capital fund was the core reasons for the slow network rollout[75]. Finally in 1979, the Government recognised the underdeveloped state of the system and approved a development plan for an integrated digital network[76]. It is worth noting that such a radical plan would have been deferred if the infrastructure had been in such a desolate condition [ibid.].

Altogether, the slow moving incumbent with regard to PSTN deployment might have manifested a bad image about the PSTN that may have contributed to people signing up to cellular telephony. Tom Allen, Network Services at V-IR – Eircell at the time – confirms the worse state of the PSTN: "*Up to 1984, the telephone network was run by the Civil Service, The Department of Posts & Telegraphs. There was under investment in the network particularly in the 1960s and 1970s. The quality of service fell behind other countries (e.g., every time it rained the number of faults rose due to non pressurisation of large multi pair cables) […] the closest parallel would probably be the DDR, at the time of the fall of the Berlin wall. Most importantly, the level of phone penetration was well below that of the U.K.*" [Alle2012e]. This is confirmed by [Burn2003] who states, "*In 1980, Ireland's telecommunications system was perhaps the worst*

[74] In one model the maximum saturation was argued to be one in ten people to have a telephone installation. Coincidentally, the P&T was "*mindful on the fact that the rural electrification scheme might change the outlook of the farming community towards what may be regarded as 'urban luxury'*" [ibid.]

[75] Dr. O'Broin states that Ministers *"[were] modest men who came to the Post Office without much in the way of ideas [being] essentiall juniors.*" Even not those with some seniority "*were able to fight their corner in the cabinet room or with the Minister for Finance who controlled the supply of money.*" [ibid.].

[76] Contracts for digital exchanges were awarded to L.M. Ericsson (AXE10) and CIT-Alcatel (E 10 B system) [ibid.].

in western Europe. Operated as a government department, it was vastly overstaffed [with a staff of more than 18,000, which made the largest employer in Ireland], its equipment was antiquated, its service was erratic, and its charges for both domestic and international calls were among the highest in Europe.".

Obviously poorer, largely rural economies were more alarmed by the effects of the digital divide than their richer counterparts. These countries typically suffer from inadequate, unsatisfactory and unreliable PSTN coverage, and experience higher monthly line rental and call charges[77]. Furthermore, the fact that many national PSTN are technically outdated, both in terms of internal competence and installed equipment, significantly hampers the timely implementation of fast and reliable access technology. These negative factors are reflected by the level of pending requests for a telephone connection by potential customers. The number of unmet applications for connection to the PSTN, which have to be held back over owing lack of technical facilities, is described by the size of the waiting list[78] as shown in Figure 3-2. [Alle2012e] attests that "*[…] there were long waiting lists for installation of a new connection, (sometimes up to 4/5 years). If someone needed a phone connection quickly, e.g., for a site office at a building site, he was going to be disappointed […] and there was significant suppressed demand.*".

[77] Andrea Holland, of Telemon Communications, an Italy-based marketing and e-commerce company, describes the unsatisfactory situation in Italy: "*The flurry of wireless chatter came about, in part, because Italians hate to feel taken advantage of. In Italy, there is something called 'fregatura'. They have a fear of being screwed. The phone company in Italy has a history of expensive and unpredictable rates with strange rules that antagonized and often confused the consumers. Wired phones have a complicated rate structure that is based on a series of audible clicks called 'scato'. You could buy a device to count the clicks, but it was difficult to determine usage. People racked up enormous phone bills without knowing it. It got lumped into this concept of fregatura, because you don't know what you pay. Many people faced 300,00-lire bills (US$160) and had no way to pay. These stories were in the news all the time and the rate of interest for unpaid bills was so high that there was no possibility of anyone ever having the resources to pay it all back. When cellular phones became available, they brought an easy-to-understand per-second rate structure. Italians felt that they were in control of what they were spending*" [Walk2000].

[78] It may be assumed that the data understate the true waiting list because many potential customers see little point in registering their request given the excessive delays for the provision of service.

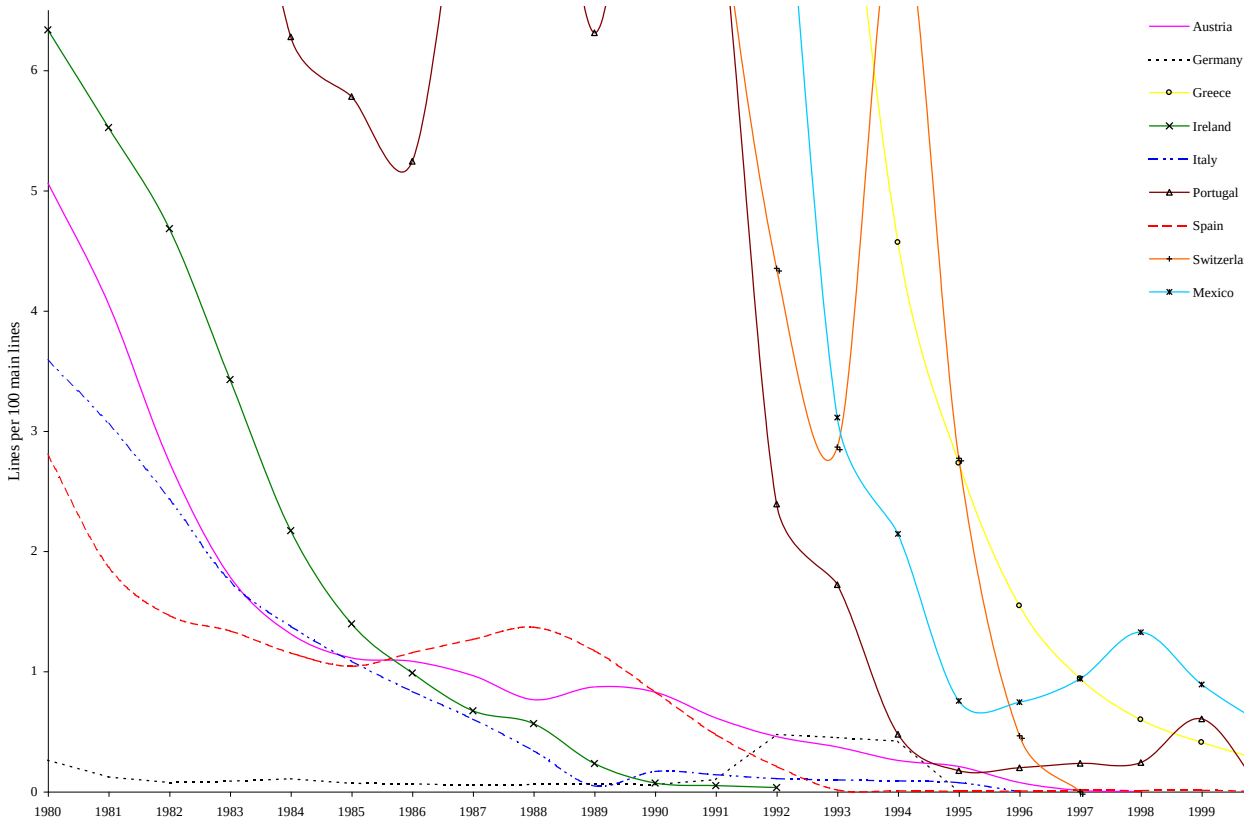

Figure 3-2: Waiting lists for a main line, 1980-2000 [ITU1999c], [2005c].

Until the beginning of the 1990s waiting lists were endemic throughout most of Europe and the situation was particularly acute in the smaller southern European countries. The reunification of Germany in 1989 resulted in a rapid growth in demand for connectivity which, given the antiquated state of the inherited telecommunications infrastructure in the former East Germany, inevitably resulted in a period of relatively long waiting lists, a situation which was gradually resolved as new infrastructure was provided. However, even after market liberalisation introduced competition, clear regional differences are still apparent. Competition concentrated on the more lucrative customer segments associated with urban areas. As noted earlier, regulators introduced the principle of universal service provision in an attempt to moderate the growing trend towards reinforcement of a rural-urban divide. [Godd2000] asserts that this intervention can only have a marginal positive impact since the policy applies only to analogue and digital telephony and not to the provision of universal access to newer services. In his view, a more significant and inevitable outcome will be a widening of the existing technology gap and a reinforcement of established geographical disparities at the expense of the rural areas[79].

[79] This is evidenced by the fact that the telecommunications density in national capitals such as Lisbon, Madrid and Dublin is between two and 2½ times that encountered in the remainder of each respective country [Dodd1995].

With regard to Ireland the elimination of waiting lists was caused by two factors, as reporter by [Alle2012]: "*In 1984 the telephone system was taken from the Department of Posts and Telegraphs and transferred to a state owned company 'Telecom Eireann', which was given the freedom to operate as a normal business. The service improved rapidly in the next 5/6 years and was privatised as 'eircom' in 1998/1999. Phone ownership levels rose during those years but not as much as might have been expected.*" While the separation of the PSTN business from P&T clearly helped the situation the migration to cellular telephony absorbed most future demand for a fixed-telephone connection as discussed in the next abstract.

3.3 Migration to Cellular Telephone Networks

Established regional PSTN providers were widely regarded as being undercapitalised, inefficient and arrogant monopolies protected from competition by the high economic cost of entry to fixed-line service provision. The emergence of mobile phone operators offered the prospect of a viable communications alternative. Their entry was timely, given the level of public dissatisfaction and the persistent difficulties related to the provision of fixed-line connections for residential customers. It is reasonable to assume that fixed-line waiting lists consequently fell largely due to a widespread migration to mobile service providers by both existing and potential fixed-line subscribers. This scenario finds support by [Alle2012e] who reports that the decrease in waiting lists "*was due to the launch of the mobile telephony network 'Eircell' in 1985. Thus, people needing immediate provision of a phone turned to Eircell, i.e., they ceased to use a fixed phone. This was particularly true of builders, site contractors, etc. These are usually small companies employing a small number of people and don't always have a fixed office, i.e., their van is their office. They are also very heavy users of the mobile network [which] probably reflects the fact, that the fixed network never achieved the levels of penetration of other countries and some of the functions, that in those countries was carried out by the fixed network, e.g., small PABX with Receptionist to allow remote staff to contact their office, were taken over in Ireland by the mobile network.*". The [ITU2002] argues that underlying this shift there is a more significant shift: from a paradigm of scarcity to one of plenty. Whereas, in many parts of the world, demand for PSTN connectivity has, historically, exceeded supply and given rise to waiting lists, there is no equivalent bottleneck for mobile services. Once base stations are established, consumers can purchase and operate a cellular phone. The customer is empowered to make the connectivity investment decision and this power has effectively been removed from the incumbent operator. Coincidentally, prepaid packages made the cost of a wireless connection more predictable, controllable and often more affordable than a fixed one. Hence, these factors, combined with

immediate availability of access, created the perception in many countries that cellular telephony was a *democratic* means of communications. Consequently, the OECD suggests, "*an inefficient operator, with a low quality of service and long waiting list, may prompt faster growth in mobile telecommunication*" [OECD1996]. This assumption is perfectly mirrored by the Irish experience.

Additionally, [Baka1997] assert that the impact of the initial cost of telecommunication service provision is more significant than expected. Relative to fixed-line telephone costs, and given the advantages of mobility and convenience, mobile services are inexpensive. However, whereas fixed-line operators incur large capital and current costs in the expansion and maintenance of their physical networks, mobile operators do not. This is shown in Figure 3-3.

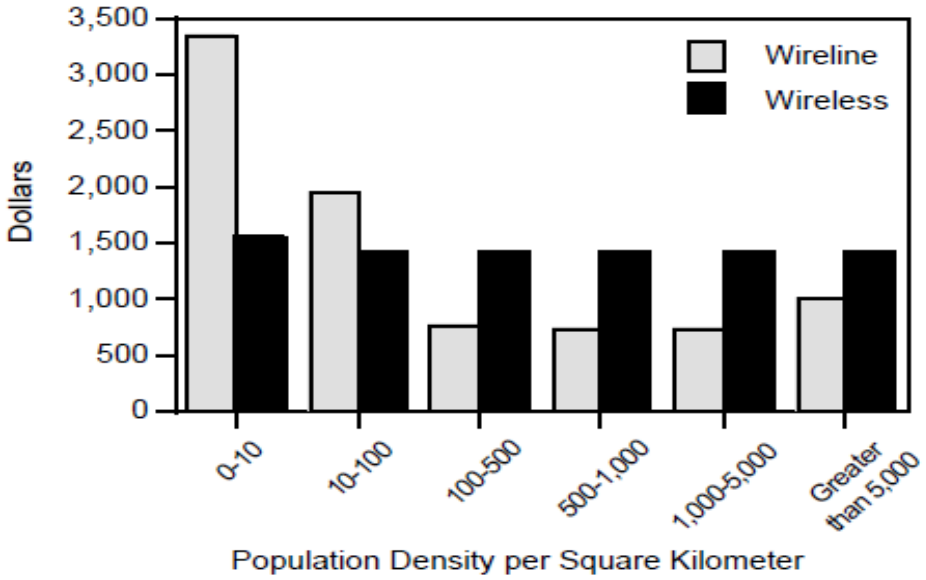

Figure 3-3: Investment per line as a function of population density, 1995 [Morr1995].

The cost per line for wireless is less than wireline for densities smaller than 100 persons per square kilometre. From this perspective it is clear that the deployment of a PSTN in Ireland was rather unattractive. Similarly, mobile carriers find it hard to achieve a sufficient coverage given the topography of the island as argued by John Stand, a telecom consultant: "*A higher density of network investment is needed because the country is quite unusual in terms of population density, and topographically it's quite difficult to cover.*"[80] [Camp2010].

With the launch of prepaid cards in the mid-1990s many regions that had formerly been disadvantaged experienced a boom in *telephony connectedness* [ITU1999b]. [Grub1999] also identified a negative correlation between mobile density and the size of the PSTN, thus confirming the existence of a substitution effect. It is consequently unsurprising to find that in

[80] Eoin Macmanus, director at 3 Ireland, confirms: "*When you are trying to manage a network for a population that is as geographically spread as Ireland, the cost of managing the network per user is much higher.*" [Camp2010].

these formerly disadvantaged regions the cellular network growth rates are much greater than those for PSTNs and to consequently conclude that prepaid cards stimulated demand by artificially reducing the cost of entry. The requirements for initial/monthly payments and an insistence on appropriate credit worthiness further encourage individuals to migrate to wireless and increasingly restrict demand for the PSTN. Hence, several countries have experienced a slow down, or even a decline, in main lines as depicted in Figure 3-4:

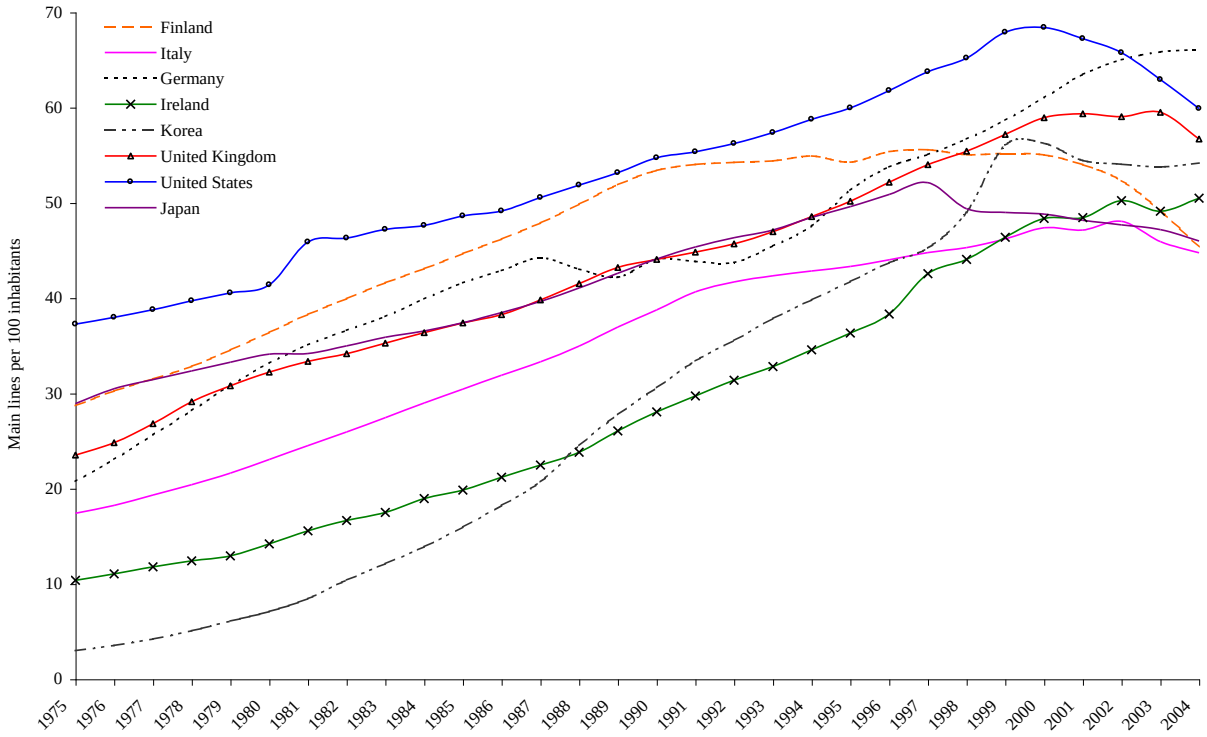

Figure 3-4: PSTN diffusion in selected countries, 1975-2010 [ITU2003], [ITU2012].

The extent to which mobile telephony can or will displace and substitute for fixed network telephony is regularly discussed in mature markets such as the UK or Germany. Although the relatively technologically sophisticated Nordics readily accept the prospect of extensive or even complete network replacement, it has been found that even traditionally slow (late) adopter countries such as Portugal and Italy tend to follow the lead of their northern counterparts. Consequently, *Samaan (2003)* concludes "*mobiles are different from other technologies in that they do not succumb to the traditional pattern of digital divide*" [Sama2003]. In Ireland cellular subscriptions overtook its fixed-line counterpart in the year 2000. The following Figure 3-5 depicts the situation for the selected countries:

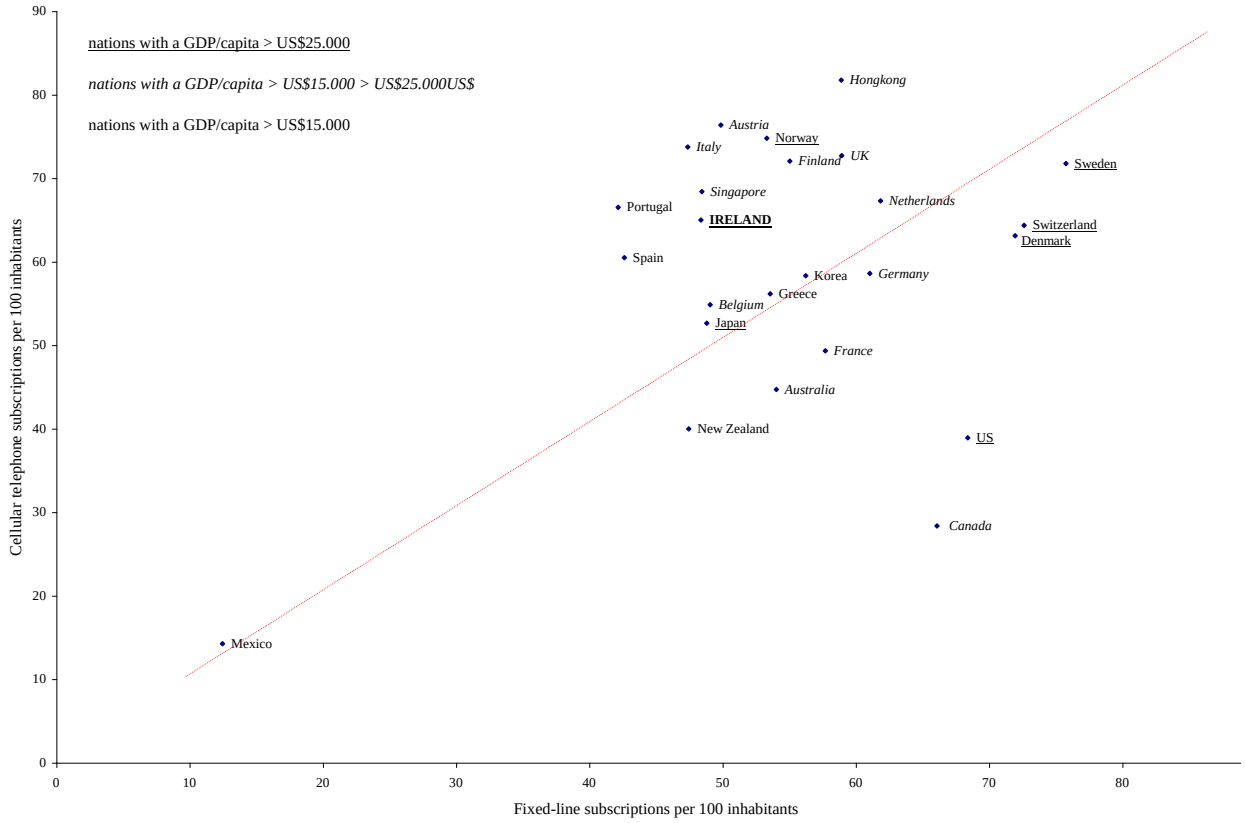

Figure 3-5: Cellular vs. fixed-line telephony density, 2000 [ITU2001].

Countries with a leading position with regard to PSTN density, the North American countries, Switzerland but also Denmark and Sweden and much of the Central European countries, tend to perform poorly in terms of cellular density compared to not so affluent economies since the uptake of prepaid service. Surprisingly, smaller economies, particular those in the Mediterranean region, have managed to achieve levels of cellular density, which exceed those of the major economies that can surely be attributed as migration towards wireless telephony due to the weak PSTN. During the late 1990s, the smaller and sometimes poorer European countries outperformed most of their larger and richer neighbours, producing a tenfold period increase and reaching penetration levels of up to 75 per cent (Italy). In contrast, over the same period their main line numbers only doubled while mobile phone subscriptions overtook the wireline telephone penetration. Hence, it comes by no surprise that the [ITU2003] attests that "*the year 2002 marked an historic turning point in the history of telephony, for it was the year when mobile subscribers overtook fixed-line subscribers worldwide*".

Significantly, mobile telephone penetration is particularly high in countries where the fixed-line market is regulated or dominated by an incumbent. Overall, the Nordic countries are foremost in both wireline and wireless categories, while the diffusion experience of the other

nations is not as homogenous. Countries that may have been regarded as traditionally slow adopters such as Greece and Portugal, have managed to overtake major economies recently. Hence, it may be assumed that the introduction of cellular telephony has been a chance for many countries to catch up and surmount the digital divide.

Expectably, wireless carriers witnessed individual's readiness for cellular migration and launched imitative tariffs, which offer the benefits of mobility while mimicking the traditional, familiar and convenient perception and operation of a fixed-line telephone including differential pricing of local and long-distance calls[81]. Additionally, other strategies aim to change user perception of their mobile phone; users should be encouraged to regard their wireless phone as their primary communication device[82]. This is perfectly illustrated by a comment of a cellular subscribers in Dublin who proudly confirms that "*we're the mobile generation, we don't need landlines.*" [Lick1999]. On a similar note consumers migrate to mobile telephony because it enhances the quality and freedom of their individual lifestyles. [Agne2004] encapsulate the paradigm change by questioning "*Why would you phone a building when you want to speak to a person?*" Indeed, the mobile phone appears to meet the needs of teenagers following the result of a study by Ling and Yttri among Norwegian teens. While one teenager reports that "*the mobile telephone is a big part of my life*" another one states that "*Nobody sits at home and waits for the [fixed] telephone to ring*" [Ling2002]. Moreover, while initially many regarded a mobile telephone as a supplement to, rather than a substitute for, a fixed-line telephone, primarily by business users, the launch of prepaid cards ultimately enabled individual consumers to easily obtain affordable personal connectivity.

This chapter has illustrated the crucial relationship between both the quality of as well as the access to the PSTN on the adoption and diffusion process of mobile telephony. In contrast to wireless telephony its wireline counterpart was found to show a strong dependency on the level

[81] This may be achieved by the introduction of location-dependent tariffs such as *home zone* services, where different tariffs are imposed when users are close to their homes compared to when they are remotely mobile. According to O2 Germany, the latest entrant to the German mobile market, it was this service option in particular which helped the operator to gain significant growth: "*Fuelled by the success of the unique Genion 'HomeZone' service, O2 Germany has established itself as the most dynamic and innovative operator in the German market - the largest in Europe. In 2004/05, both revenues and customer numbers accelerated throughout the year, outstripping both our expectations and our competitors, and leading to further growth in market share*." [Page2005].

[82] This perception may persuade them to make calls via cellular phone in preference to using an available fixed-line telephone even when it charges are more expensive.

of wealth within a country which establishes a ‘digital divide’. Indeed, disposable income contributes to the likeliness of getting connectivity to the fixed-telephone network. Most significantly, while the former correlation might provide a logical explanation for Ireland’s low level of PSTN density it was demonstrated that far poorer economies achieved similar or even higher levels of fixed-telephone penetration rate. It was determined that domestic events and policies had a major devastating impact on the proliferation of the Irish fixed-line telephone network. One on hand the British domination followed by the civil war and WW II hindered any greater attempts and initiatives to deploy a decent infrastructure. On the other hand it was shown that the Irish government’s assumption of the significance and role of the PSTN was wrongly made, particular in comparison with developments and policies in other countries. Consequently, Ireland suffered from an outdated and weak telephone network coupled with a slow moving incumbent which culminated in long waiting lists. Hence, the Irish level of fixed line tele-density remains one of the lowest until today with a declining tendency in recent years due to the introduction of prepaid card services, initially already on the analogue network, which represented a novel approach at the time.

4 Systems and Standards

"The [Eircell] service could be extended to link up with Northern Ireland and Britain and even made fully international."

Alan Corbett, The Irish Times, Aug. 14, 1985

Similar to the technical condition and availability of the wireline network the set-up and specification of the wireless system is essential for the likelihood of commercial success as illustrated in this chapter. Whereas a wide variety of cellular telephony systems and standards were developed throughout the analogue era only a few achieved significant levels of recognition. It is shown that an open standard such as the Nordic NMT system or a global standard such as AMPS/TACS is the key in obtaining economies of scale that in turn reduces the cost of ownership to customers. Hence, the legacy of the British-developed TACS system, which is based on the US-American AMPS standard, is illustrated. It is found that the Irish government's decision in favour of the AMPS-derived TACS enabled the Irish mobile telephony customers to benefit from reasonable priced handsets as well as from the possibility to source equipment from a global market. Most significantly, this chapter demonstrates that Eircell's cell-site usage tactics towards its privately owned British counterpart enabled the customers to enjoy some flavour of international roaming, which as a novelty at the time[83].

4.1 Cellular Telephone Systems and Standards

Over the last three decades several systems were developed based on various standards and technologies. To date systems may be categorized in terms of three generations: 1st generation (1G) systems, 2nd generation (2G) systems and 3rd generation (3G) systems[84] as shown in Table 4-1:

[83] Appendix C features a more detailed abstract about the purpose, reasoning and importance of standard-setting.

[84] Pre-cellular systems were termed 'zero generation (0 G)' systems.

Table 4-1: Cellular standards and launch date [Mobi1995], [UMTS2003].

Region	1G	2G	3G
Japan	NTT-M, AMPS-based (1979)	PDC (1993)	cdma2000
	J-TACS (1988)	PHS (1993)	W-CDMA
Europe*	NMT (1981)/Scandinavia		
	TACS, AMPS-based/UK (1985)	GSM (1991)	
	Radiocom2000/France (1985)	DCS-1800 (1993)	W-CDMA
	C-Netz/Germany(1985)	DECT (1993)	
	RTMS/Italy (1985)		
US	AMPS (1983)	D-AMPS/IS-54 (1994)	
		TDMA/IS-136+ (1995)	cdma2000
		CDMA/IS-95 (1995)	W-CDMA
		GSM (1995)	
Technology	FDMA	TDMA/CDMA	CDMA

* The table includes only the larger cellular systems.

+ IS-136 is an evolution of TDMA standard for both cellular and PCS systems at 1900 MHz and supports 9.6 Kbps data transmission; D-AMPS is now called TDMA/IS-136.

4.2 First Generation (1G) Analogue Systems

As radiotelephone networks reached saturation due to continuing demand, cellular technology was developed to improve systems' capacity. Although a multitude of analogue standards emerged between the late 1970s and early 1980s, all of these 1G systems relied on Frequency Division Multiple Access (FDMA) methods for their air-interface to provide multiple radio channels for multiple users, as first evidenced in the US-developed AMPS system. All subsequent systems continue to use the cellular concept whereby frequencies may be re-used in relatively remote small cells within a cellular network. This concept was first described by researchers at AT&T's Bell Laboratories (currently Lucent Technology) in 1947[85] [Farl2012].

4.3 Proliferation of 1G Systems, Economies of Scale and Cost of Ownership

Given that most manual or automatic pre-cellular systems were close to saturation since customer demand outstripped the systems' capacity, most of the other European nations followed suit and developed systems for their respective regions. Most importantly, it was soon realized

[85] Previously, mobile radio-telephone services such as the US's Mobile Telephone Service (MTS) in 1946 resembled walkie-talkie systems where operators handled the calls and only one person at a time could talk.

that standardization is the key element in the reduction of costs due to economies of scale [Nasi2009]. Controversially, although co-operation on analogue standards for mobile communications in Europe had been attempted by France, the UK and Germany, the major countries finally opted to develop proprietary systems, based on their domestic technologies and to promote their respectively national champions in the mid-1980s [Paet1983]. Consequently, most of the systems failed to attract larger markets abroad given that they were not developed in an open architecture[86] nor did they enable to manufacturers to achieve the vital goal of economies of scale, with the exception of the Nordic NMT[87] and the TACS system.

Countries which lacked the financial or technical capacity to develop their own standard chose to adopt one of the major foreign standard systems, typically either NMT or AMPS/TACS, in the expectation that they would ultimately benefit from economies of scale and a consequent reduction in equipment prices and tariffs. This strategy is further described by [Funk2000] who indicate that these external-adopter countries of AMPS/TACS predicted, "*that the adoption of a single standard by the US, with its large population and high per capita income would cause the number of AMPS subscribers to grow rapidly and low cost handsets to appear*".

Countries such as France, Germany and Japan chose to operate protectionist policies and rejected foreign involvement. Indeed, [Beis2003] found that "*nations are often reluctant to support a standard that is seen as the property of a foreign company.*" Consequently, these countries fell behind and failed to benefit from economies of scale that translate into international falls in handset prices and service charges or to obtain developmental benefit from participation in alliances such as those formed by Nordic countries[88]. Hence, the emergence of a

[86] Hans Myhre, former director of the NMT Group, argues, "*Our philosophy was always to have an open interface and full standardisation. Patents usually only create problems.*" [Tele2012].

[87] The NMT standard was developed as a result of a successful co-operation between Denmark, Sweden, Norway, Finland and later Iceland. The Danish PTT was contemplating the development of an automatic mobile telephony system and entered into negotiations with Sweden, Norway and Finland about the idea of establishing a pan-Scandinavian standard incorporating a roaming ability. Roaming was an important issue; it would significantly enhance system flexibility and convenience from a user perspective and drive prices down by opening up a market which would be of sufficient size to allow manufacturers to achieve economies of scale in research, development and manufacturing. The concept of a common Nordic mobile telephone system dates back to 1969 when it was first proposed to a meeting of NordTel[87], an organisation for promoting co-operation between the PTTs of Norway, Denmark, Finland and Sweden, in Kabelvåg (Norway) [Bach, 2000].

[88] Interestingly, Germany and France were in negotiation about the development of a unified European analogue standard. Given the prowess of Siemens (Germany) and Matra (France) in the PSTN segment both companies were

pan-European or even a global standard was impeded. Instead, three global standards emerged – AMPS, TACS and NMT as illustrated in Table 4-2.

Table 4-2: The characteristics and diffusion of selected analogue mobile system [Lind1995].

System	AMPS	TACS	NMT-450	NMT-900
Home market	US	UK	Scandinavia	Scandinavia
Main developers	AT&T Motorola	Adopted version of AMPS	The Nordic PTTs	Nokia, Ericsson
Introduction year	1983	1984	1981	1986
Countries (1992)	42	26	34	10
Subscribers (1992)	13,221	3,759	1,285	1,337
Infrastructure suppliers	8	4	>10*	5
Main regions covered	America, Caribbean, Far East	Western Europe, Far East	Western & Eastern Europe, former USSR	Western Europe

*Since NMT was an open standard it is difficult to determine the correct figure given that firms anywhere in the world could enter the market as long as they had competencies. However, [Palm1998] speak about "*some 10 other competitors*" besides Nokia. The major firms were Ericsson, Storno, Philips and Siemens.

Table 4-2 illustrates the massive support and backing behind the systems that translated into its large-scale adoption within a region and even continents. Consequently, the involvement of overseas suppliers resulted in a large variety of products and stirred competition, which created the foundation of a virtually global market from which technology could be purchased.

Unfortunately, the diverse development of 1G systems resulted in a fragmented European market with a consequent loss of inter-operability with no fewer than eight incompatible standards. An international roaming facility could only be provided in a few geographical areas where the same standards were adopted. In the pre-digital era only two international roaming areas existed, both based on the NMT standard: Denmark, Finland, Iceland, Norway, Sweden and Switzerland and between Belgium, Luxembourg and the Netherlands (BeNeLux)[89].

wrongly assumed to be leaders in wireless technology also. Ironically, both governments were unable to overcome the rivalries between the various firms to achieve consensus. While Alcatel, Siemens, Matra, Philips and Thomson were each developing their proprietary systems their governments, including the UK before it decided to adopt AMPS/TACS, tried to forge a compromise. Unfortunately, both countries' governments finally gave up in late 1984 and allowed Siemens and Matra to rollout their non-compatible systems [Mars1984]. [Funk2000] suggest that the companies "*would probably have been much more successful than they have been in the analogue era (and possibly also in the digital ear) if Germany and France had been early adopters of either the NMT or TACS system*".

[89] Most significantly, a special border-roaming scheme was established between Eircom and Vodafone (UK) in 1991, which provides a flavour of international roaming; its configuration is further discussed in Chapter 4.5.

However, it must be stated that the NMT systems of the BeNeLux countries were slightly different to the genuine NMT specifications due to national peculiarities therewith eliminating any possibilities of international roaming between the former mentioned two regions. Similarly, the French operator SFR was required to modify its chosen NMT technology dubbed NMT-F. Most significantly, from a technical point of view only the TACS system promised the potential, besides the NMT system, of creating a large enough global interim market to generate economies of scale given that its equipment could be used without modification, which help in some way to consolidate the fragmented European experience[90]. Hence, customers and network operators were able to source equipment from various manufacturers – domestic (Europe) and abroad (overseas) – who themselves could serve network operators around the globe.

Following the strong increase in subscriber bases in the Nordic NMT-450 networks it was foreseeable that the capacity of these initial networks would not cope with future demand. Hence, the NMT-900 system, which featured some technical improvements such as hand-held phones alongside many more channels, was developed in the mid-1980s and simultaneously introduced in all four NMT founding countries in December 1986 [Gris2009]. Meanwhile, other countries experience similar capacity problems with their initial systems and adopted NMT-900 or TACS, which already operated at 900 MHz, as interim technology since the launch of GSM was expected at the beginning of the 1990s at the earliest. Appendix D depicts the proliferation of deployed systems in the European market at the end of 1991[91].

As a matter of fact, the proprietary systems of the large European economies failed both to generate comparable attention among equipment suppliers and to create markets large enough to achieve economies of scale which resulted in corresponding terminal prices as shown in Table 4-3:

[90] This said it is fair to mention that roaming still remained an obstacle given that the billing processes and underlying software and mechanisms were not that mature.

[91] The last analogue network (NMT-900) was launched on Faroe Island in June 1992.

Table 4-3: Lowest available equipment prices in Europe, Sep. 1, 1990 [Paet1993].

Country	Terminal (US$)	Country	Terminal (US$)
Spain	2,780	Finland	1,770
Portugal	2,700	Netherlands	1,720
Germany	2,530	Italy	1,590
France	2,190	Denmark	1,470
Luxembourg	2,150	Iceland	1,330
Belgium	2,140	Sweden	1,1400
Austria	2,120	Ireland	1,110
Switzerland	2,010	UK	20*

* The UK is an exception due to its two-tier service provision structure. Consequently, equipment is subsidised by service providers and prices are therefore not comparable with other countries.

Not surprisingly, the Nordic region and their Anglo-Irish counterparts record the lowest terminal prices thanks to the realized economies of scale due to the deployment of an open standard (NMT) or standardized global technology (AMPS). The reasonable priced terminal prices must have contributed to the erosion of the public image of cellular telephony being a tool only for business or yuppies in Ireland. Indeed, this impact persists as a legacy of positive or negative experiences of these early systems and colours attitudes towards mobile telephony within society.

At the turn of the century TACS and NMT still represented an essential part of mobile telephony. Perhaps surprisingly, TACS achieved relative success during GSM's early era due to the introduction of attractive tariffs[92]. In retro perspective, operators enjoyed growth both in

[92] The analogue system was used to provide a cheap alternative for low-usage customers whereas GSM services were exclusively targeted at the more demanding and high-volume business segment; Telecom Italia Mobile's launch of "*highly attractive service tariffs*" [Zoll1996a] such as the Family-Plan combined with low handset prices and the introduction of prepaid services in Portugal and Ireland opened up the consumer market and eliminated long-cherished prejudices about mobile services as being expensive and snobby. In Ireland, Eircell's TACS network achieved arguably the highest penetration figures among its European counterparts as a result of its launch of a prepaid service. Besides, a basic, featureless, analogue service is also attractive to some customers who just want a simple mobile telephone service, as suggested by Andy Bennett, marketing manager of Motorola Telco: "*The analogue packages offer a straightforward service without all the value-added services of digital and this is what some consumers still want*" [Benn1998]. This assertion is supported by Heikki Tarrainen, marketing manager at Nokia Mobile Phones: "*We believe there is still a market for analogue technologies. The C-Netz network has excellent coverage across the country, and some people prefer good coverage to extra uses such as fax and data*

subscribers and in return of investment from their analogue networks as high-usage business customers migrated to new digital services leaving spare capacity for the analogue networks[93].

Due to their proprietary technologies these systems continued to experience a decline in popularity. Since the national standard favoured domestic equipment manufacturers handset and usage prices remained high, thus constraining demand. This is confirmed by [Mobi1994a] which states that TACS has resisted the commercial implementation of GSM better than the other systems, in part because of its relatively low equipment prices. With the exception of the UK, France and Sweden, who allowed private operators to provide services in competition with the incumbent PTT, in all other countries PTTs maintained a monopoly and thus, kept service charges high and competition among phone suppliers low. Sadahiko Kano, Institute of Japanese-European Technology Studies, summarizes the situation: "*Technological innovations studied here and there around the world as disjoint ripples required a break-through to become a synchronised wave-of-creative-destruction' [...] with standardisation playing a crucial role and R&D efforts focussed and co-ordinated*" [Kano2000].

Over time, the capacity of the 1G systems in some regions became insufficient to satisfy expanding consumer demand. Additionally, the security and speech quality provided by analogue systems was still below PSTN levels. Coincidently, the developments in both battery and IC technology made digital communications devices more economical than their analogue counterparts and enabled the design of smaller and lighter hand-held telephones. A point had been reached where it had become evident that 1G systems were becoming obsolete.

4.4 The Development of the Total Access Communication System (TACS)

Among the larger European economies the UK was the only region where the decision on the adoption of a particular standard was not notably based on the power of the incumbent

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capabilities that you get with GSM networks. It is also important to keep our current customers happy" [Mobi1997]. Coincidentally, it is worth noting that the climate of economic liberalization and opening-up of new markets in Asia, Latin America and Eastern Europe helped boost analogue system subscribers numbers throughout the 1990s.

[93] Hence, it is unsurprising that wireless carriers chose to launch several new tariffs on their analogue networks given that "*there is a lot of spare capacity on these networks*" as John Jensen, analyst at Salomon Smith Barney, concludes [Mobi1997]. The consultancy OVUM adds that most analogue networks have better geographical coverage than their digital equivalents. The NMT-450 technology in particular continues to play an important role in maintaining coverage in sparsely populated parts of the Nordic region [ibid.]. Due to NMT-450's great success research started on possible ways to digitalize NMT. One proposal was GSM-450 while the CDMA Development Group (CDG) suggested a CDMA-450 system. The third option was Digital-NMT (D-NMT) [GSMB2000].

monopolistic operator or on a government bias in favour of a national champion[94]. Instead, the UK Conservative Government's prime policy was focussed on deregulation, liberalisation of the labour market and privatisation of state-owned companies[95] than on supporting the domestic manufacturing sector[96]. Hence, emphasis was put on the establishment of a regulatory and commercial framework that foresaw that two competing cellular networks should be installed, as a duopoly,[97] therewith following the example of its US counterpart[98]. While BT was set to be one of the operators[99], the other licensee would be given to a private company. The licence was offered by holding a competition, which gained five applications. Finally, in December 1982, the UK government announced that the second licence was won by Racal Telecom[100] in a joint bid

[94] This replicates the situation in the pre-cellular era when the British decided to operate their 'System 4' on the mobile automatic telephone system (MATS-B) technology of TeKaDe (fonetic for TKD – Süddeutsche Telefonapparate-, Kabel- und Drahtwerke AG) from Germany (later owned by Philips and now part of Alcatel-Lucent) [Cryp2012], which was deployed in six countries, notably in the Netherlands and Germany [Cell2012].

[95] Since the privatisation of British Telecom (BT) in 1984, the telecommunications market has experienced unprecedented growth: GBP7.5bn in 1984 and over GBP31bn per annum in 2000 [Kush2007].

[96] This philosophy was coined 'Thatcherism' after Margaret Thatcher who implemented her uncompromising policies (i.e. political and economic initiatives) that earned her the nickname 'Iron Lady'.

[97] The introduction of competition in the mobile sector was one consequence of the enactment of the British Telecommunication Act of 1981, which prepared the way for the liberalisation of the supply of customers' premises equipment and for the granting of more autonomy in their use of leased lines. This philosophy is perfectly summarized in a statement of the Department of Trade and Industry (DTI), as "*liberalisation and competition have been the keys to dramatic reduction in prices and the much greater choice now available to consumers as other countries have followed the UK's lead and opened up their markets*" [DTaI2001]. The first move was to establish a competitor to BT. Hence, a licence was granted to Cable & Wireless to run a public telecommunications network through its subsidiary, Mercury Communications. Historically, Cable & Wireless was founded as a British telegraph company in 1860. With increasing competition from companies using radio communications such as Marconi's Wireless Telegraph Company, it was decided in 1928 to merge the communications methods of the British Empire into one operating company, initially known as the Imperial and International Communications Ltd, and changed to Cable and Wireless Limited in 1934. Following the Labour Party's victory in the 1945 general elections, the government announced its intention to nationalise Cable and Wireless, which was carried out in 1947. Controversially, the Thatcher government decided to privatise the company again in 1979 [Grace2012] [Butl2004].

[98] France and Finland also introduced cellular telephony as a duopoly but without major impact; while the second market entrant Société Française de Radiotéléphonie (SFR) in France was also a subsidiary of a state-owned company it suffered from high interconnection rates the Swedish incumbent Televerket had control of the regulatory aspects and allocated only a small amount of frequency to its private counterpart Comviq (it initially deployed its proprietary featureless manual system, Comviq-450) when it launched its NMT-450 network in 1981 [Grub2005].

[99] BT formed a joint venture with Securicor, Telecom Securicor Cellular Radio Ltd., named '*Cellnet*' [Ofco2011].

[100] Racal was created in 1950 as Racal Ltd, the name being derived from the partners RAymond Brown and George CALder Cunningham. Racal Electronics plc was once the third-largest British electronics firm offering products

with Millicom[101]. Significantly, both licensees were not allowed to sell services directly to the customers but via service providers to further increase competition while the later sell airtime, which enabled them to target potential user groups, by tailor-made tariffs,

Following the awarding of the licences the Joint Radio Telephone Interface Group (JRTIG) was established by the DTI between the licensees to evaluate and develop the appropriate technical standards to ensure inter-operability [Coll2009]. Together with the DTI both operators collaborated to determine the best system for the UK market. Again, the British government followed the US's example in letting the market players decide which standard to deploy. Despite the JRTIG's philosophy of creating a level playing field BT tried to expand its domination to the cellular market by dictating certain technical aspects to hinder the competitor to bring forward its most beneficial solutions[102] [Coll2009].

Meanwhile, the selection of the standard to be used proved similarly controversial. Initially, BT was in favour of the German C-450 system but Racal aimed for a AMPS-based system since the operator realised that "*the cost of entry from a potential subscriber's point of view would be critical to the success of the business*" mainly represented by the price of the mobile phones which could be lowered by means of the large volume of the US market and the availability of technology from several suppliers[103]. Following the abandonment of the German solution BT looked at the French MATS-E (Philips and Alcatel) and the Nordic NMT system[104] but Racal

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including voice and data recorders, point of sale terminals, laboratory instruments, and military electronics such as radio and radar. It was the parent company of Vodafone (VOice and DAta over teleFONE), before the mobile telephony provider was sold in 1991. Racal was purchased by Thomson-CSF (now Thales Group) in 2000, thereby giving the French firm access to the lucrative UK defence and armaments market [Thal2012].

[101] Millicom Incorporated was formed in 1979 to pursue cellular telephone opportunities in America, and in 1982, it was awarded by the US Federal Communications Commission one of three cellular development licenses. In 1982, Millicom founded, with Racal Electronics Plc, a joint venture which evolved into Vodafone Group Plc.. [Meur1994] argue that Millicom's experience in the cellular telephone trial led Racal to partner with the former which was until then engaged in the pager business. Since that year Millicom began applying for cellular licenses internationally, mainly in South America and Africa (currently it holds more than 10 licences). In 1990 Millicom entered a joint venture with Swedish cellular operator Kinnevik to form the Millicom Group [Mill2010].

[102] For example, BT wanted Racal to connect to its network at the (expensive) local exchange level, rather than on a national network level. Furthermore, BT claimed that Racal would only be possible to connect to the BT network using BT's developed 'System X' exchanges rather than Ericsson's AXE [Coll2009].

[103] It is worth noting that Racal, a manufacturer themselves, "*had aspirations to build and sell mobiles, and were looking for a large enough market. Their opinion was that the market for a modified version of AMPS with 25 kHz channel spacing (ie TACS) was much larger than that for NMT, or other European-based systems.*" [Luth2010].

[104] Stephen Hearnden, Technical Director Cellnet at the time, remarks that a feasibility study was carried out by BT in February 1982 suggesting the use of NMT-450 transferred to 900 MHz [Hear2010b]. He notes that "*the AMPS*

still insisted on AMPS given that NMT-450 had both security as well as capacity problems in handling the volumes that AMPS would [Meur1994]. Ted Beddoes, Technical Director V-UK at the time, states that "*AMPS was adopted as the basis for TACS because after technical consideration it was judged to be more advanced at the time*[105]*. NMT was based on mobile radio, AMPS was a fresh look at the problem, e.g. the co-channel and adjacent channel issues and higher signalling rates – rightly or wrongly.*" [Bedd2010]. Most significantly, Malcolm Luthien, Chief Technical Officer Cellnet at the time, states that "*there were also a number of commercial factors, such as the number of suppliers that manufactured the infrastructure and the mobiles – the AMPS market was much larger so the expectation was the same would be the case for TACS, enabling greater competitive supply and driving down costs.*" [Luth2010].

Finally, all parties involved opted for the AMPS route, as stated by Luthien, "*the final decision to adopt TACS was taken at very senior level in BT, Racal and the UK government, and was based on overall benefit to UK plc.*" [Luth2010]. Following further modification of the AMPS system resulted in a more sophisticated system to suit the European frequency allocations and to be more appropriate to British needs[106] [Brit2005]. TACS systems – as its cousin AMPS – were sold under licence to overseas markets[107] [Meur1994]. Then, V-UK chose Ericsson as its infrastructure supplier while Cellnet selected Motorola[108], which resulted in proprietary systems, a fact which will play a significant role in relation with the Irish TACS network.

Controversially, while the British government saw TACS as an innovative approach for establishing a level-playing-field competition in the cellular consumer market – which could rely

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system had a better spectral efficiency what mean that higher capacity and higher quality networks were possible. A second factor was hand-off. Since NMT was designed for large cells this was also reflected in the periodicity of the signal strength measurements for hand-off which would work out highly disruptive in a small cell network.".

[105] TACS's further advantages were that it allowed for higher numbers of subscribers and enabled transmitters to use lower power (and subsequently enabled hand-held phones) alongside a more effective re-use of frequencies.

[106] Among the modifications were changes to the radio frequency, radio channel bandwidth and data signalling rates. In particular, the system was deployed in 25 kHz radio channels compared to 30 kHz channels in AMPS. It utilizes 50 MHz spectrum at 900 MHz rather than at 800 MHz [Sche1991].

[107] Given that Racal realised that they need a large-capacity switch, especially for London and the larger cities, Ericsson with its AXE digital switch was the only viable option since AT&T and Motorola only had small switches (the use of small switches would result in the installation of many more switches therewith increasing inter-switching signalling and load on the network); with the Racal contract Ericsson had become a supplier of all three standards, NMT, AMPS and TACS and the largest supplier of cellular infrastructure in the business [Meur994].

[108] [Hear2012a] remarks that "*Racal had a policy of buying European and went first. Cellnet couldn't buy Ericsson because they wouldn't at that time sell to competitors in the same country so we were left with Motorola, Strange isn't it how far reaching decisions are made?*".

on economically priced equipment thanks to the UK's vote in favour of the slightly-modified established AMPS system – it also had its drawback. Whereas observer might get the impression of the UK's route as being logically planned and straightforward from a market point of view it somehow blurred the negative effects it had coincidentally on its manufacturing industry which involvement were neglected, resulting in the absence of a national champion[109].

Then in January 1985, Cellnet and Racal launched their cellular telephony service in duopoly [Coll2005]. Ironically, although the two network operators were ostensibly in competition, their charges were more or less identical. Additional, service offers were still aimed at business users "*which made the cellular telephone synonymous for the yuppie excesses of Margaret Thatcher's Britain in the mid-1980s, and especially in London, where the networks were first installed*." [Wray2010]. Indeed, "*within both BT and Securicor, the view was [mobile communications] were not mass market. That was also the view in V-UK*," according to Mike Short, Director of Cellnet at the time [Coll2005]. This reserved view was partly influenced by the limited and expensive availability of frequency spectrum that led to permanent congestion in the London

[109] It could be argued that the situation of the cellular sector illustrates another example of the decline in the British manufacturing sector, particular in the 1970s and 1980s, which saw the implementation of the free-market-attitude resulting in strong support for the service sector (i.e. financial services, insurance, news media, real estate, etc.). Stephen Temple (Director Technical Affairs, Telecommunications Division, DTI (1988–1994); Chairman of the ETSI Technical Assembly from 1988–92): "*The haste with which the UK government had selected the TACS analogue standard, based as it was on an established US technology (AMPS) and the speed with which licensing awards were made gave UK manufacturing industry absolutely no chance to develop any hardware. The two UK networks were therefore being built, at that stage, almost entirely on imported equipment. UK industry were out of the game of supplying first generation cellular networks, even before the game had started. Some argued that the start of the new 900 MHz analogue cellular radio services could have been delayed a year or 18 months to give our manufacturing industry a chance to develop the necessary equipment. But the UK Conservative Government applied a consistent of priorities to all their decisions. Top priority was the consumer interest, second was the financial services sector (there appeared money to be made from mobile radio), third was the other service industries (in this case the mobile network operators and service providers) and absolutely bottom of the heap was the UK manufacturing industry. […] STC [formerly Standard Telephones and Cables, is Britain's second-largest electronics group, a major manufacturer of computers, telecommunications equipment, and transmission cables, both wire and fibre optic] fell by the wayside, Keneneth Corfield had just left STC after the company has incurred some financial losses. The City of London, whose short-termism has probably inflicted more damage on the UK manufacturing base than occurred during the entire Second World War, put into STC a new management team tasked with swinging the axe on any new expenditure and lot more besides. As usual it was long term R&D that got tossed over the side of the ship. The STC engineers were disappointed. I regretted this in view of the very fine research record of their Labs at Harlow in Essex.*" [Temp2011].

area causing the launch of the London Premium for each call made in this area[110]. Despite the competitive approach it took V-UK until 1986 to overtake Cellnet with regards to market share. In response Cellnet started to subsidies handsets, a move that fundamentally changed the way cellular phones were sold, not only in Britain but also in most markets around the world. Therewith, the farsighted decision to implement a duopoly structure for the provision of mobile telephony proved successful in bringing down prices, which enabled a mass market to emerge[111].

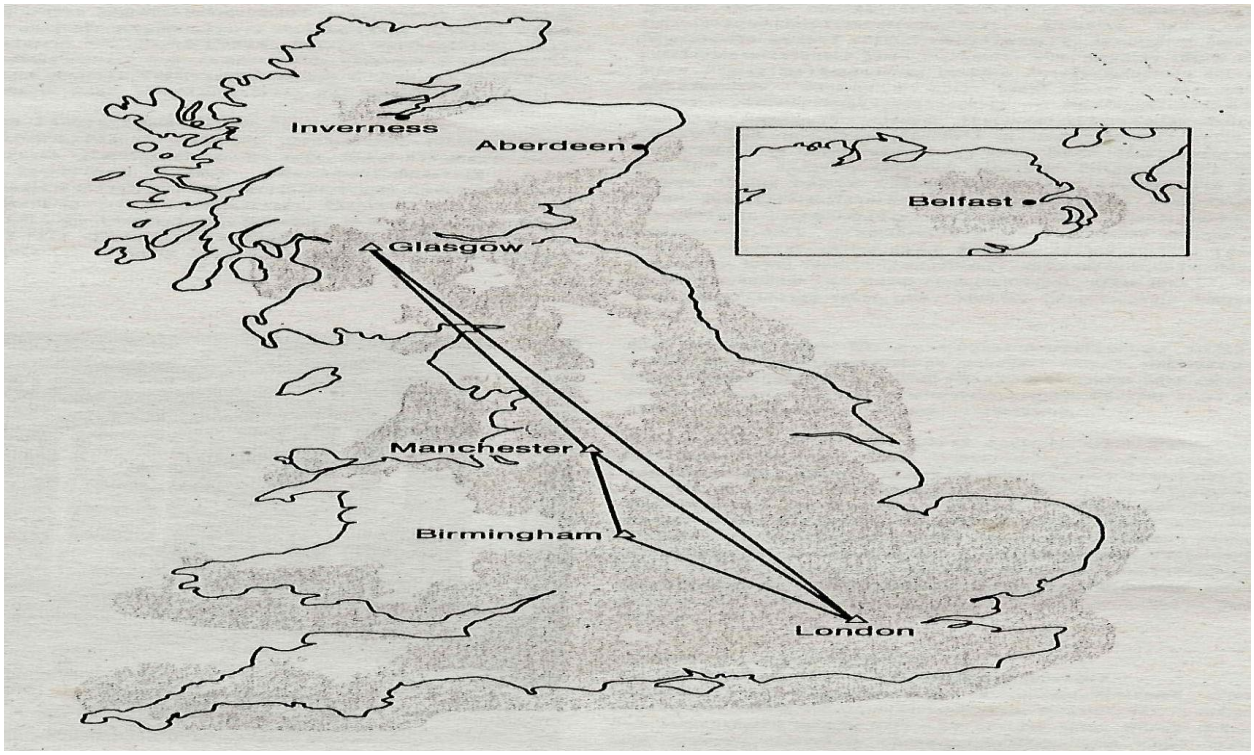

Figure 4-1: V-UK's TACS network with its four mobile switching centres, Jun. 1987 [Eric1987].

Surprisingly, the TACS system did not provide any roaming features although the principles have been successfully demonstrated for many years by their Nordic counterparts. [Luth2010] reports "*at a technical level we decided early on to write specifications to allow for national roaming (i.e. between the two UK operators). It was not an easy task to device this interface – TACS predates the concept of HLR [home location register] and VLR [visitor location register], and hence there was no guarantee that we would have online verification of a roaming mobile's credentials. In practice we were also working with some constraints from the infrastructure vendors [that would be costly and take some time to deliver]. However, the main reason for not*

[110] Following strong growth in call volumes, particularly in the London area (more than 50 per cent of the total telephone traffic), the operators persuaded the government to release additional frequency spectrum borrowed from a military allocation. Hence, the new system was called Extended-TACS (E-TACS) [Brit2005].

[111] This event was followed by further innovations such as the introduction of Low-User tariffs which were accompanied by the ever-growing variety of both hand-held mobile phones and suppliers.

implementing national roaming was that it ran the risk of being anti-competitive. (Good) radio coverage was a major competitive driver between the two licensees, but if national roaming had been implemented there was a real danger that the less populated parts of the country would be carved up between the operators with national roaming (carrying higher roaming charges for customer) being used to expend effective coverage. That served to kill the drive to implement the roaming interfaces generally." [Luth2010]. Regarding roaming with the Republic of Ireland (RoI) he states, "*the extra revenues this would have brought in would not have justified the costs of implementation.*" [Luth2010]. This view is also shared by Hearnden who attests that "*we also considered roaming with both the RoI and Italy who also had TACS but we didn't see much of a market (how little did we know) and the billing seemed an insurmountable problem. Roaming seems so easy now but in those days only the Nordic had it and we had so many problems keeping our networks running that we had little time for new initiatives.*" [Hear2010].

Interestingly, although there was no national or international roaming in place at the time there was a form of 'pseudo-roaming' established between Cellnet and the PTTs of Jersey, Guernsey and the Isle of Man since "*Cellnet hosted [the related] base sites on the UK network and the billing were separated out and paid to the island's operator*[112]." [Hear2012b].

Expectable, 'The Troubles' also influenced the network architecture of both operators; regarding Cellnet's network [Hear2012c] argues that there was no switch located within Northern Ireland (NI)/Belfast since "*[it was] difficult to find a secure site, remember it was in the times of the troubles with the IRA.*". Subsequently, the Belfast MTX was connected to "*Manchester then Glasgow or it may have been the other way round. We did a lot of reparenting of base stations to switches as traffic levels and new sites increased.*" [Hear2012c]. The Glasgow switch itself was connected to Eircell's switch in Dublin [Alle2012a].

TACS was also relatively successful in mainland Europe given that it was adopted by Austria, Italy and Spain as an interim solution to cover the permanent increase in subscribers until the introduction of GSM. Moreover, TACS has been adopted elsewhere, notably in Far East (Hong Kong, Taiwan, Singapore, Malaysia, and China), Middle East (Kuwait, the United Arab Emirates, and Bahrain) and Middle East in a number of variations including Narrowband TACS (N-TACS) by Motorola and Japanese TACS (J-TACS) to expand network capacity.

[112] [Hear2012b] further reports: *"[…] there was only radio equipment on each island (each had 3 base site locations to give broadly 90+% coverage) connected back to the mainland switches via analogue initially then E1 circuits on the submarine cables.*". The Island networks were launched around 1986/87 [Hear2012b].

4.5 The Eircell System

Given the small Irish population of just 3.5 million in the 1980s it was clear from the outset that this would not justify the development of a domestic Irish cellular telephone system since it would fail to achieve economies of scale. Hence, the now defunct Irish government department of Posts & Telegraphs (P&T)[113], as part of the civil service, examined the conditions and feasibility of a cellular network in Ireland [Alle2012a]. Controversially, it is worth noting that neither the RoI) nor the United Kingdom (UK) have consulate its neighbouring country for the selection of its cellular network standard at cellular telephony interception, which appears rather narrow-minded from today's point of view when considering the potential of economies of scale or possible roaming options (both features had been demonstrated by the Nordic NMT system for three years). At the same time, this incident again demonstrates very well the early stage of the mobile telephony industry altogether.

Initially, P&T was in favour of the NMT system provided by Ericsson given that the relation with the Swedish company was very close since it was involved in the upgrade of the Irish telecommunications infrastructure at the time [Alle2012a]. Consequently, a letter of intent was signed with Ericsson. Hence, a trial of the NMT technology was conducted by Ericsson, which indicated problems with existing PMR users such as the police, as, reported by [Alle2012b][114]. Consequently, P&T was more or less required to opt for the British-developed TACS system standard and traded-in their initial order of a NMT network against a TACS system in summer

[113] On January 4, 1984, P&T was defunct with the establishment of two semi-state organisations, An Post and Telecom Éireann (TE). TE, which full formal title was Bord Telecom Éireann, the Irish Telecommunications Board, established by the Postal and Telecommunications Services Act, was a state-owned telecommunications company until it was privatised and renamed as Eircom in 1999.

[114] "*There was a "Nordic" 450 MHz trial conducted by Ericsson in Dublin in Mid 1983. This consisted of a single test Base Station at a high point outside the city. Drive testing was carried out over an approximately 40 Km radius of the city centre. Signal propagation was found to be excellent. However, Ericsson also monitored the 450 MHz Spectrum from this high point, to establish patterns of usage in the 450 MHz Band. The conclusion drawn from this survey and subsequent discussions with the Department of Communications, who controlled the Spectrum at the time, was that a mobile network based on 450 MHz wasn't viable. Principally, this was because the Department had licensed PMR Operators (including the Police) in the Band, with the added complication, that the existing mobiles used the opposite end of the 450 MHz Spectrum to that utilised by mobiles in the Nordic system, i.e, the 'go return' pattern was reversed and additionally, the separation between the mobile and base station transmit frequencies differed between the existing PMR systems and the Nordic system. The only solution would have been to clear the Band of other users and this wasn't an option, when the Police were one of the existing users*" [Alle2012b].

1984; commercial service was launched on December 1, 1995 under the '*Eircell*' name[115] [Alle2012a]. The Irish's selection of the British TACS system may not come as a surprise due to the unique peculiarities and circumstances – both in historical and geographical terms.

Indeed, Gerry Fahy, Strategy Director at V-IR, points to another reason for adopting TACS, which is related to the roaming possibility given that the RoI and NI share a land border: "*…the majority of Irish overseas trade was and is with the UK and the majority of overseas trips are to the UK. On that basis it was a sensible chose the identical standard so that there was the potential to extract economies of scale from the neighbouring market, to be in a position to have a roaming solution across the land border which at the time had huge political and national significance and also the potential to provide a roaming service of some variety for business traveller.*"[Fahy2010]. The possibility of providing cross-border or even overseas communications was well recognized as reported by [Corb1984]: "*The [Eircell] service could be extended to link up with Northern Ireland and Britain and even made fully international.*"

Controversially, despite the chance to create a greater market that would translate into favourable equipment prices and comfort while travelling abroad roaming was not established initially; partly due to Eircell's commercial section intervention, which feared that such an agreement "…*would damage the business of their dealers*" [Alle2012d]. Additionally, V-UK had no significant interest in NI, since it focussed on England and the London area [Alle2012a].

Expectable, given the close proximity of the RoI and the UK, which stirred tremendous trade and travel activities[116] between the countries it was just a matter of time until first developments of co-operation and cross-border initiatives were developed on a broader scale[117]. With this

[115] [Alle2012d] reports that initially a MTX located at Adelaide Road was serving the whole country; due to customer growth a second MTX was installed in Clondalkin which catered for base stations in the Dublin area only. "*It was thought, that a third MTX would be required in 1995/96, as TACs traffic was still growing at this time, (GSM take up was slower than envisaged). However, we survived without it! A second mini crisis occurred in 1996/97, when we introduced Pre-Paid ("Ready to Go"), initially on TACS only, as traffic began to rise again. However, the introduction of Pre-Paid on GSM stopped this growth.*" [Alle2012d].

[116] [O'Kee1998b] states that calls to Britain account for some 60 per cent of out-going traffic from Ireland.

[117] For example, the Confederation of British Industry (CBI) NI joined with the Irish Business and Employers' Confederation (IBEC) to form the IBEC/CBI Joint Business Council in 1991. Its task is defined as follows: "*The IBEC-CBI Joint Business Council is the voice of business on the island of Ireland working in collaboration with its member companies and strategic partners to sustain and develop trade and economic co-operation on the island of Ireland*." The Council was established in 1991 in very different political, economic and social circumstances to those which prevail today. Over time JBC has evolved as circumstances have changed [IEBC2012].

background it comes as no surprise that similar initiatives were also observable in the cellular industry by means of the establishment of a 'Border-Roaming' agreement in 1991[118] without the involvement of either governments[119] although driven more by necessity due to the land border[120] between the RoI and NI as outlined by Beddoes (V-UK): "*the infrastructure providers for both Vodafone [UK] and Ireland was Ericsson [Cellnet had chosen Motorola]. So we thought it would be easy, and we understood how to program the switch, theirs and ours. The intention was to be ahead of Cellnet. The problem was that our border cells in NI Ireland provided some overlapping coverage with southern Ireland and vice versa, hence in the border regions Vodafone customers would lock on to the southern Irish systems and not be able to make calls and vice versa. We (Vodafone) programmed both the Vodafone northern Irish and southern Irish switches to detect the country and network code and reroute the calls to their home network by using the number translation tables in the Ericsson switches, really quite simple and at no cost. The southern Irish would only allow us to do this for the minimum number of overlapping cells. In practice the user did realise how it all worked. Call charges in the Vodafone network did not change, I did not know what the Irish charge for roaming calls. We were not very good at negotiating and they perceived that if they could persuade us to do this trick for all the cells in the north they would have coverage of the complete Irish continent. And this was agreed. Cellnet had no such enterprise! The idea was mine the implementation was done by Vodafone engineers. No governments were involved.*" [Bedd2011]. Fahy agrees that therewith "*...people could make and receive calls on the corridor either side of the border with Vodafone [UK] who had an identical channel allocation to Eircell in RoI. In areas outside of the nominated cells, e.g. Belfast, Customers could receive calls. At the time this was seen as the best option to prevent Customers from both Networks from entering a zone around the border where they would not be able to receive or make calls.*" [Fahy2012]. [Alle2012d] adds "*customers couldn't select a*

[118] While roaming agreements were commonly known and in place since the early 1980s most media broadly highlighted and discussed this feature in relation with the Nordic NMT system. Consequently, literature on the subject of roaming between the RoI and NI is vague. While some sources state that there is no such agreement in place others report the opposite but did not give any further details about its unique specifications and nature.

[119] [Alle2012c] remarks that "*there was no 'political' input into in the decision. At the time, the involvement (or indeed knowledge) of politicians and Civil Servants in the development of the mobile business was minimal.*"

[120] The initial impetus for the roaming agreement was given by V-UK since it could expand its coverage as outlined by [Alle2012b]: given that V-UK had a very small number of sites in NI with the majority of them being located on high elevation levels black spots were the results which limited demand. In contrast Eircell's network was based on a more normal distribution of site, including low level elevation base stations, resulting in more continuous coverage. Consequently, when the Border-Roaming agreement was put in place V-UK's coverage was substantially improved which made the network more attractive resulting in higher usage levels and an increase in customers.

particular network to make a call. In TACS calls were always set up on the strongest Control Center signal, even if a viable signal was available from another Base Station. Thus, if an Eircell customer was still on the Southern side of the border and was receiving a stronger signal from the Vodafone Network, than from the Eircell Network, (although the latter was strong enough to support a viable connection), he would be connected to the Vodafone Network, i.e., the stronger signal 'blocked' the weaker signal. Hence the only way to maintain continuous coverage was to allow a form of roaming. Essentially, a Vodafone or Eircell mobile customer picked up the strongest signal available, irrespective of which side of the border he was on and irrespective of which was his 'home' network."

While the implementation of the Border-Roaming alone represented an astonishing achievement when considering that roaming arrangements were still an absolute novelty at the time, with the exception of the Nordic NMT system thanks to its open standard architecture. Moreover, the benefit for Eircell user did not stop at the border as [Alle2012b] reports: "*Eircell customers could receive calls in those parts of Scotland and Northern England in the coverage area of <u>all</u> the Base Stations, parented off the switch (located in Scotland [Glasgow]), which also served the Vodafone Border Base Stations included in the 'Border-Roaming' agreement.*"

The following Figure 4-2 illustrates the coverage maps of all three TACS operators:

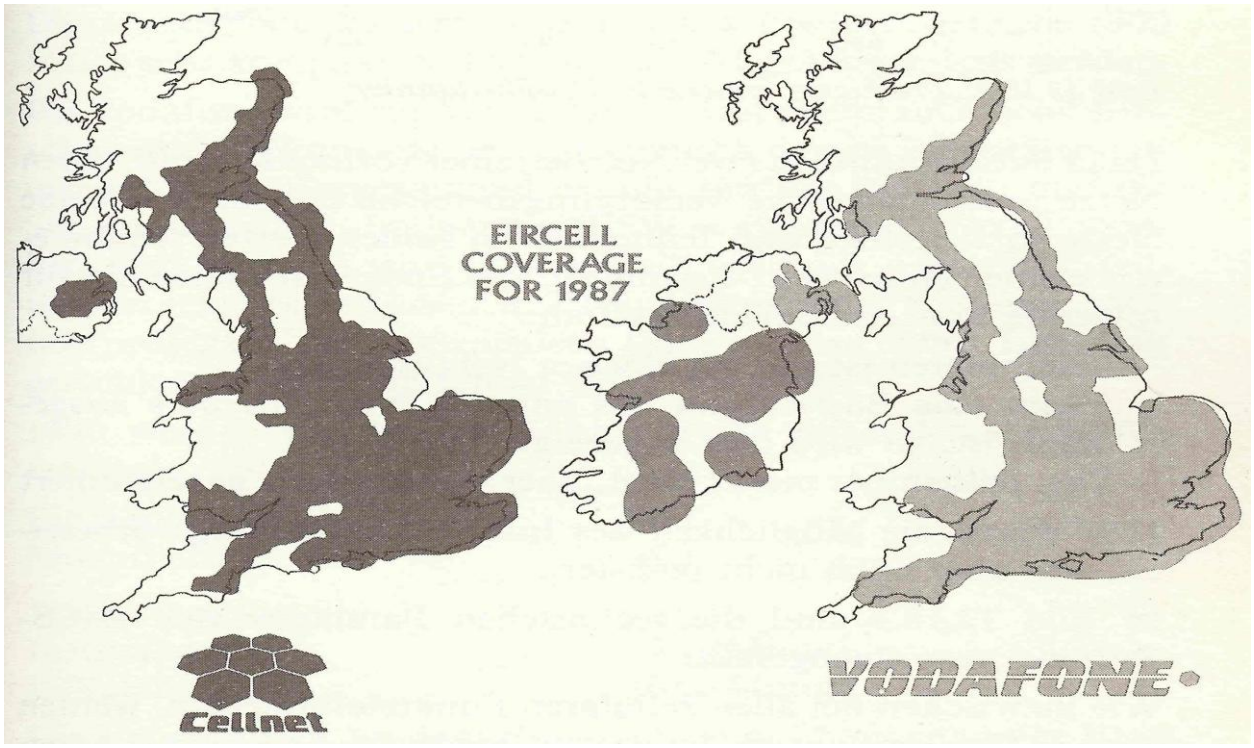

Figure 4-2: TACS network and coverage areas of Eircell, Cellnet and V-UK, 1987 [Sche1991].

Expectable, given the technical feasibility of the Border-Roaming solution V-UK "*wanted it to extent as far as Dublin and Belfast but Eircell wouldn't allow the Dublin area to be included in the coverage offered to Vodafone customers. Accordingly, Vodafone didn't include Belfast in the 'coverage package' offered to Eircell customers.*" [Alle2012d]. However, from a technical viewpoint V-UK customers travelling in the RoI should have received calls in areas not included in the Border-Roaming agreement but connected to the same MTX as a Border-Roaming site, as explained by [Alle2012]: "*I can't recall if Dublin Base Stations were on the same MTX as those included in the Border-Roaming Agreement but assuming, that they were, it would have been possible for Vodafone customers to receive but not to originate calls in Dublin.*[121]". Altogether, Irish users could enjoy some flavour of international roaming, a feature still unavailable in Central Europe, with the exception of the BeNeLux countries and Switzerland. It could not be stressed enough that this achievement was only possible due to the Irish's foresight selection of TACS and the particular configuration of the 'Border Roaming' agreement[122].

The implications of this decision did also offer the possibility of purchasing equipment from abroad. Irish customers and suppliers worked-out an alternative to source affordable handsets: grey-imports. According to [Fahy2010] "*there was an extensive grey market principally as an overflow from the UK but also from other TACS markets in the Far East.*" Therewith, Irish customers did not only benefit from bulk buys[123] from UK suppliers but also from spill over from this market [ibid.]. Given that Ireland had the largest portion of young people within its population there was a strong demand for low priced mobile phones. Consultancy EMC estimates that half of new subscribers take advantages of the ready market for second-hand phones that are recycled from the UK; expectable, manufacturers responded with attractively priced models[124].

[121] However, prior registration (and subsequent programming) with the cellular operator the mobile telephones could be used in either country even though requiring a second account with the then domestic operator, which was a convenient solution for a lot of people who travelled regularly between the two islands on business.

[122] It took until 1998 that talks about an island-wide tariff between Eircell and V-UK were established that foresaw that either customers could make and receive calls when roaming at national rates [Mobi1998].

[123] [Rese2011] states that *"[…] there was a huge Market both grey and black, from the UK some guys bought up loads of phones in the UK for little or nothing in the early 1990s as the UK had at that time two providers competition was strong and phones had a big discount at retail, in Ireland at the time there was no such a discount.*"

[124] NEC, the second biggest selling brand has introduced their P100 hand-portable at the price of a second-hand or grey-import mobile telephone thus reducing the impact of imports on the Irish market. Similarly, SONY's launch of its low-priced '*Mars Bar*' phone model put further pressure on both suppliers and grey-imports [EMC1993].

Significantly, the sourcing of equipment from abroad by means of grey-imports was not a phenomenon connected to the analogue era of mobile telephony but persists until today. Moreover, users accept that equipment comes along without local language support or that usage even may be illegal. The acceptance of such drawbacks is understandable given that the cost of handsets is the biggest obstacle to affordability, according to the GSM Association[125] [eShe2008]. Surprisingly, the grey-market is not exclusively driven by price sensitivity but also by desirability, which is particularly the case for the Apple's *iPhone* (Appendix J) underpinning the symbolic value. Altogether, it can surely be confirmed that the Irish's selection of the TACS system had a positive impact on its later adoption performance thanks to reasonable priced handsets, which paved the way for attractive tariff options such as prepaid packages.

Given the findings of this chapter it was shown that the selection of the mobile telephone system standard is of vital importance for the success of every cellular network operator since it in large parts determines its widespread diffusion. It was shown that proprietary systems developed in the large economies of Germany, France or Italy failed to achieve economies of scale given that their development was driven under the direction of state owned incumbents that favour the technology of the 'national champion' for political reasons. In contrast, a more open and global system emerged as the most attractive way for both wireless carriers and their customers to the obtained economies of scale given their potential to offer reasonable-priced equipment. The Nordic NMT system is the prime example in this regard because it was developed in co-operation among the Nordic countries as an open standard that invited overseas manufacturers and suppliers to compete on a global market resulting in a win-win situation for all parties involved. This work demonstrated that the development of the TACS system provided alike potential since it was not only based on the rather global AMPS standard but also stimulated world-wide demand from operators and manufactures. In return, TACS users capitalized on affordable handset prices which lowered their cost of ownership.

With regard to Ireland it was shown that the Irish mobile telephony users benefited from this constellation and even managed to source equipment from abroad, most significantly from the UK market where handsets were heavily subsidised, but also from overseas region. This

[125] Although manufacturers such as Motorola have developed a US$50 handset for markets such as Nigerian, nearly 80 per cent of handsets are still distributed over the grey-market in 2007 [ibid.]. The situation is similar in Kenya with more than 40 per cent of phone in the market coming from off-trade imports and Chinese manufacturers like Huawei and ZTE or from Dubai [Kiny2009]. Sellers of 2nd hand or refurbished phones have mostly avoided paying import or trade tax. Hence, the Indian Director General of Trade has clarified that refurbished phones brought into India as parallel imports are considered illegal since 2004 [Leen2004].

eliminated the long-time cherished prejudice of cellular telephone mobility being restricted to the most affluent members of society. In parallel, it was demonstrated that Eircell deployed a clever tactic towards its privately-owned British counterpart Vodafone-UK who advocated the Irish operator for better network coverage in the border region in return for the establishment of a roaming agreement that enabled the Irish customers to enjoy some flavour of international roaming in parts of Great Britain.

Altogether, the Irish have also in the mobile market demonstrated their capability and foresighted view in utilizing foreign technology and services to favour their domestic needs and demands, as exemplarily illustrated in the case of broadcast reception from UK television.

5 Billing Arrangements, Tariff Options, and the Cost of Ownership

"The Streets are alive with the sound of mobile phones and now they are likely to belong to laid-back teenagers as high-powered men in suits."

Róisín Ingle, The Irish Times, Nov. 24, 1997

The previous chapter has examined the technical features of the Irish mobile telephone system and the implications it had on the likeliness of adoption by the Irish customers. Next, this chapter will concentrate on the service side and in particular on the tariff options offered. Firstly, it was demonstrated that it is of vital importance to integrate the cellular telephone service as smoothly as possible in the existing wireline network and replicate PSTN's calling habits by billing arrangements such as CPP and RPP. Secondly, international benchmarks on OECD basket cost revealed that there is high correlation between mobile telephone density and its costs, particular prior the era of tariff differentiation. Thirdly, it was shown that tariff options act in significantly lowering the financial adoption barrier to previously un-addressed market segments such as the youth or low spending users. Most significantly, the global launch of prepaid card services in the late 1990s transformed the traditional perception of a mobile telephone as being exclusively reserved for the more affluent parts of society into a rather democratic means of communication among all segments within society. Finally, it was demonstrated that Eircell's strategy to launch its respective tariff on its analogue network remains unique among its European cohorts and helped it to overtook its British neighbour with regard to mobile telephony density in the year 1999.

5.1 Billing Arrangements

The two billing arrangements established in cellular telephony markets are Calling Party Pays[126] (CPP) and Mobile Party Pays (MPP). The choice for either scheme depended on the possibility to implement cellular communications' billing scheme most gently in the existing PSTN architecture which itself depends on the fixed-line network's status and legacy.

[126] The party that is initiating the call pays the entire cost of the call that is for call setup as well as call termination.

5.1.1 Mobile Party Pays (MPP)

The MPP scheme – where the receiver directly contributes to the cost of each call[127] – is the favoured pricing structure in a number of countries such as the US, Canada, China/Hongkong and Singapore. Under this scheme, the calling party pays its origination network operator only the first leg of the call up to the interconnection point of the receiver's (termination) network. The cost of the termination – the part of the call that extends from receiver's network interconnection point towards the receiver's mobile telephone is billed to the receiver of the call – significantly, it is up to the receiver's carrier if and at what charge it will impose on its subscriber. MPP schemes are primarily encountered in countries with unmeasured calls (where the fixed-line charges often include free local calls) on the PSTN which reduces the costs to call a cellular phone; hence, flat-rate/free local calling plans on the fixed network created a 'free culture' which subsequently formed a perception of telecommunication being democratic and widely available at low prices. Hence, PSTN customers such as in North America would be reluctant to call a mobile phone if priced at a premium what put it at a disadvantage[128]. Consequently, wireless operators were required to implemented MPP as a means to integrate cellular telephony into the established 'free culture' while imposing most of the costs of calling a mobile phone on their cellular subscribers. The ITU rightly attests that "*the practice of charging mobile users for incoming calls discouraged cellular take-up.*"[129] [ITU1999b].

5.1.2 Calling Party Pays (CPP)

The most common cellular telephone pricing structure throughout the world today is referred to as Calling Party Pays (CPP); hence, the person initiating the call pays the entire cost of the call – that is the calling party pays its origination network operator the segment up to the interconnection point of the receiver's (termination) network and also the segment from the interconnection point up to the terminating network's receiving party for call termination.

[127] Interestingly, in most European and CPP countries the MPP scheme is applied to calls to mobiles roaming abroad. In detail, the calling party pays only for the national segment of the call whereas the receiving party itself pays for the mobile service in the international segment including termination abroad.

[128] Significantly, according to internal memos AT&T proposed a wireless telephone system in 1915 but feared that it would undermine its wireline telephone business [Wu2008].

[129] The OECD states that MPP "*creates an incentive for subscribers to switch off their mobile phones when not placing calls to avoid being charged for incoming calls, and also discourages them from giving out their phone numbers.*" [OECD2000]. In response, [Cran2003] report that "*U.S. mobile operators have overcome these disincentives by introducing bucket plans, which permit the subscriber to purchase a certain level of minutes for a flat monthly charge The FCC in 2003 credited increases in the size of bucket plans at declining rates with being 'a major driver of average mobile usage in the United States'*." [Cran2003].

According to the [OECD2000] the principal reason for extending PSTNs CPP system to mobile service was "*that it was relatively easy to graft onto the existing fixed network pricing*" [OECD2000]. Similar to the fixed telephone at home which is constantly switched on and can receive unlimited incoming calls at no charge (except the monthly subscription fee) a cellular phone owner under the CPP regime enjoys the comparable comfort of being permanently reachable at no extra costs. Hence, economists such as [Levi2009] argue that CPP was put in place to encourage the adoption of mobile phones[130]. CPP enabled the launch of tariffs aimed at low-income customers without the need of a credit check; its most prominent example being the offer of prepaid services, which allowed for free incoming calls – a key driver of its rapid and outstanding success[131].

Historically, MPP was the scheme deployed in most markets throughout the world right from cellular phone's inauguration in the analogue era. Hence, countries that feature MPP billing arrangements outperformed those with CPP in place until the year 1997. However, overtime many countries (particular in the less developed world) switched from MPP to CPP (as illustrated Appendix E[132]) not only but also due to the growing attractiveness of prepaid card services to low-spending and young consumers in an attempt to win new subscribers[133].

5.1.3 CPP's Bottleneck Monopoly and Mobile Termination Rate (MTR)

Controversially, although the CPP scheme appears simple it has led to problems regarding regulation and the role of competition with regards to the market of call termination. Ironically, although the cellular telephony market is one of the most competitive sector it still features heavily regulated MTR, which represents a paradox, according to [Litt2008].

In particular, given that the terminating wireless operator has a *de-facto* monopoly for call termination it enjoys a bottleneck on call termination to its customer what results in market power. Consequently, the terminating network operator can set the termination fee above market

[130] This philosophy has to be seen against the backdrop of a smaller tele-density outside North America where cellular telephony was seen as a fast means to increase the number of telecommunications access paths. Only after the launch of prepaid card schemes many countries under the CPP regime overtook MPP countries [Levi2009].

[131] However, a number of mobile operators started to offer the first minute of a call free to the receiving party to overcome the perceived resistance of prospective mobile consumers to MPP [OECD2000].

[132] The Appendix E depicts the established billing structures of the given countries and the date in time when MPP-born country performed a switch towards a CPP environment.

[133] This is most prominently evident in France where until the year 2000 cellular subscribers enjoyed a mix of CPP and MPP arrangement in form of 'Bill & Keep' where the cellular subscriber had to pay his network provider for incoming calls [Pena2002]. After the switch MOU levels rose from 45 minutes to 71 minutes [GWM2004].

level that exceed competitive or cost-based levels, a situation that was regarded as inhibitor to the future growth of cellular telephony, rising concerns by several parties, including national regulators and wireline[134]. Indeed, there is little competitive incentive for cellular operators to reduce termination charges for calls to their networks. Consequently, MTR rates came in the focus of regulators that eventually led to similar actions and reduction (or just due to the threat of regulation) given that the rates were regarded as 22 to 100 per cent in excess of cost [Litt2008]. Although MRTs gradually decreased over the last decade in Europe, they still vary across countries[135], as illustrated in the following Figure 5-1.

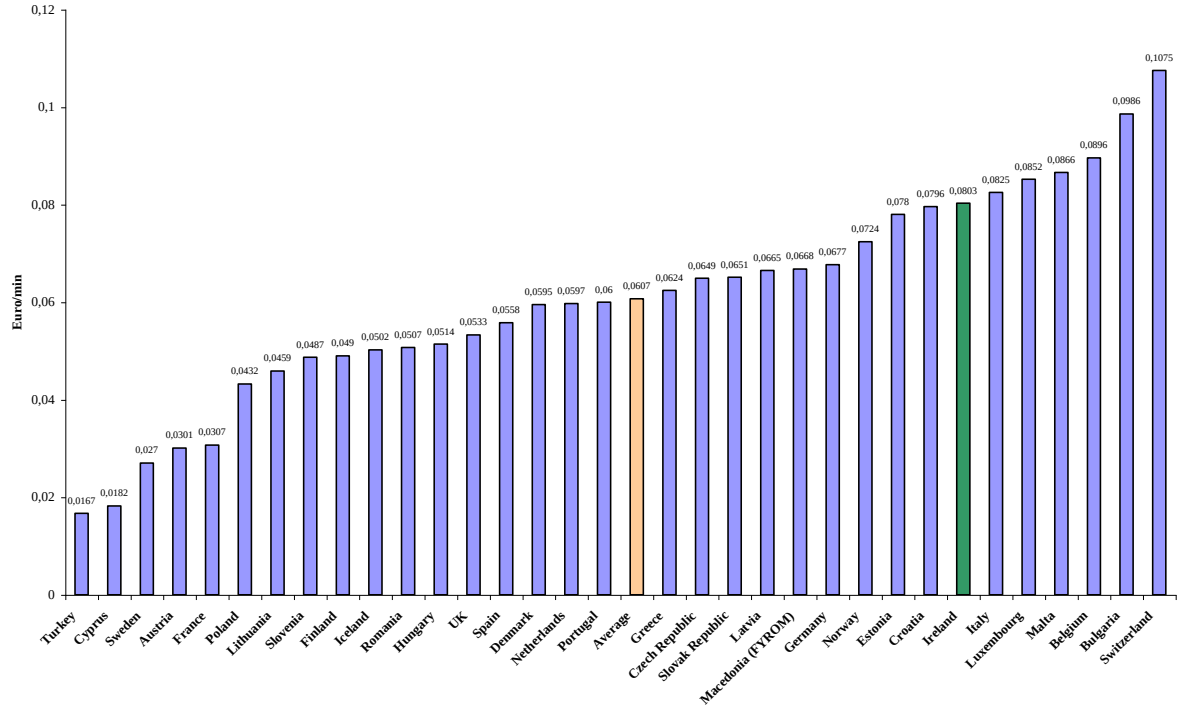

Figure 5-1: Mobile termination rates, Jul. 2010 [IRG2010].

Hence, EU telecoms commissioner Reding[136] calls for bringing MTRs more in line with the actual costs[137] [Redi2009]. The European Commission (EC) stressed the fact that national

[134] In 1999, Oftel introduced conditions in the licences of BT Cellnet and Vodafone to control the level of the MTR they make to fixed operators. Given that MTRs make up about two thirds of a fixed carrier's retail price for calling a mobile phone and about 40 per cent of the cost of calling from one mobile network to another [Ofte2010].

[135] The Telecommunications Management Group (TMG) said that the average global MTR in 2009 was US$0.08 cents/min. The Latin America-Caribbean and European regions have the highest MTRs at over US$ 0.10 cents/min. while Asia-Pacific and Middle East and North America regions record MTRs of 5 cents/minute [TMG, 2010].

[136] Reding: "*While there may have been a greater tolerance of high mobile termination rates when mobile networks were first being rolled out across Europe, they can no longer be justified today at this advanced stage of mobile market development*" [Redi2009].

regulators are obliged to consult with the EC and other Member State's regulators according to EU law since MTRs affect mobile operators in other Member States and thus the single market.

According to Figure 5-1 the Irish cellular operators' MTRs were the seventh highest among its European counterparts, which may act as an indicator for an oligopoly market. Following consultation with ComReg all cellular operators agreed in October 2010 to reduce their MTRs over the next two years to approximate them to the European average[138] [ComR2010].

Given that regulator involvement in a highly innovative market such as cellular telephony was seen as a non-competitive and disturbing factor CPP markets are still looking for a more market-driven solution that put all parties on a level playing field[139]. From a CPP operators' perspective the possibilities of cellular users under the MPP scheme to both switch-off their phones and to not give out their numbers must appear as a major fear for their business[140]. CPP appeared as a safe harbour on the first view that promised a fertile base for rapid subscriber growth by means

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[137] Historically, MTRs have been typically ten times higher than equivalent fixed termination rates. Hence, the EC has set out a recommendation for EU telecommunication regulators on the cost-based method to be used. Under this scheme MTRs should converge to approximately €0.015 to €0.03 per minute by the end of 2012 [Kenn2009].

[138] In 2009, cellular operators already confirmed reductions inline with other European member states, as stated by ComReg's Chairman, John Doherty: "*these reductions by the mobile operators should deliver significant cost savings to Irish consumers over the next three years and ensure Ireland remains competitive among its European peers"*. In particular, according to the European Commission's 14th Implementation Report, a mobile phone call costs an average Irish consumer €0.11 per minute, making them better off than the EU average (€.23) [ComR2009].

[139] Alternative billing arrangements such as the Mobile Termination Carrier Selection (MTCS) were developed which should open-up the *de facto* termination monopoly. Under the MTCS scheme the calling subscriber selects which of the national cellular carriers should terminate its call to the receiving party. [Krus2008]. Another arrangement was recommended by German consultancy [WIK2008] recommends the abolition of MTRs on the ground that the Internet works without them. When using web-based services such as Skype, the calling party pays by means of its broadband connection, as does the receiving part, representing a peer-to-peer connection[139]. Although this scheme may appear rather different from today's practice WIK suggests that the move towards Next Generation Networks (NGN) may need such a philosophy change. WIK concludes that "*what customers want is neither CPP or RPP, but rather some variant of a flat rate plan*" [WIK2008]. Interestingly, the suggested flat rate pricing structure is most likely to be implemented in MPP countries such as the US and Canada illustrate.

[140] In response, MPP operators have introduced several measures to contradict such user perception by providing voice-mail and caller-ID as well as lower-priced first minutes of an incoming call. Furthermore, in the light of the tremendous success of prepaid card services the requirement of MPP prepaid customers to budget their airtime for incoming calls manifested operators' aversion against the MPP policy. It can be assumed that the former mentioned factors are over-exaggerated by CPP network operators (partly by their biased view given the gap between the cellular density figures of the US and CPP countries) creating a negative myths surrounding the MPP billing pattern which in returned helped them to manifest their monopoly on call termination. Subsequently, it provided them with an incentive to attract new subscribers by means of subsidies handsets and lower subscription charges.

of prepaid card services alongside subsidized handsets given that it had certainly accelerated growth in mobile telephony density in those countries where it is in operation as argued by Chris Gent, CEO of Vodafone, "*It is more fair. When the calling party pays, you're more open to receiving calls as well as making them, so you're more likely to keep your mobile phone turned on all the time. If you go down the streets of, say, London or Paris, people are walking and talking on their phones in a way that you just don't see in the States*"[141] [Zege1999]. Indeed, experience showed that introduction of prepaid card services was the key to attract new subscribers which was difficult to implement in a MPP regime[142], which underpins the determine role of tariff options in the adoption and diffusion process of mobile telephony.

5.2 From 'One-Size-Fits-All' to Tariff Differentiation

Historically, wireline and wireless telephone subscribers were served by a monopoly operator that offered services in a 'one-size-fits-all' manner. This approach appeared sufficient in retrospect given its business-driven nature in the pre-liberalisation era. Indeed, the PSTN system was regarded as a public utility free from any market-driven philosophy. Furthermore, equipment was installed on the customer's premises by the incumbent operator and telephones were assigned or licensed rather than traded freely to subscribers while the operator remained the owner of the devices. Hence, the telephone was regarded as something that belongs to the public network (operator) and not to the user. Further, one could only call a place rather than a person. Despite these obstacles the fixed telephone soon made its way into our daily life and became a virtual 'family member' therewith stressing its use by a community rather than by individuals.

In contrast, cellular telephony was regarded as a small business-to-business segment of the incumbent wireline carrier, which may have even feared competition from its in-house mobile unit. Hence, it can be argued that monopoly carriers concentrated on their fixed-telephone business just due the sheer size of their subscriber base that meant that development and

[141]In countries where MPP is the deployed billing arrangement some market player started a discussion on changing towards CPP. In the US, the Cellular Telecommunication Industry Association (CTIA) neither supports nor opposes CPP, but argues that the marketplace should be allowed to offer both options back in 1999. Meanwhile, a Federal Communication Commission's review on the CCP pricing structure acknowledged that "*CPP has the potential to help both the mobile market and local infrastructure competition to grow*" [OECD2000]. This view is more than understandable, given that mobile telephony has shifted away from a solely business user-driven market towards a consumer market which promises future growth both in subscribers and traffic.

[141] Hence, the costs are evenly split and are covered by the monthly subscription fee for the Internet access provider.

[142] On the other hand, given that US operators have, until recently, avoided aggressive marketing to low-volume users and teenagers, they have not encountered the same profitability problems as their European counterparts.

expansion of cellular telephony was neglected. This scenario changed with the arrival of competition that required all participants to differentiate themselves from their competitors.

The issue of tariff and price differentiation is a historical consequence of the evolution in mobile telephony. In its initial phase in the 1980s the provision of wireless telephony was the exclusive right of the state-owned mainline incumbent in most countries[143] [OECD1996]. Since cellular telephones were first adopted by individuals of the innovator category (i.e. cost-insensitive business customers), there was no pressure to launch attractive and innovative tariffs plans. Members of this adopter category did not ask for justification of the premium for cellular telephony since it was presented as a complementary to fixed-line telephony rather than a substitute for it. Hence, call prices were not set to attract general consumers[144]. Expectable, tariff schemes imitated the simple structure of landline telephony, which was priced on the basis of a single standard tariff (only differing between peak and off-peak calls). Although this strategy may surely be seen as unattractive in today's market place such a primitive tariff plan surely helped to convinced potential subscribers who feared to sign-up to an innovation which costs were not transparent[145]. Indeed, it can be argued that complex charging systems generate uncertainty and scepticism among customers.

With the global launch of analogue cellular systems in the 800-900 MHz bands using suitcase-sized hardware, the wireless innovation was adopted by a wider range of commercial and business customers such as self-employed sales men as well as wealthier consumers. However, competition was still very limited, typically a maximum of two operators, providing no incentive to lower prices.

Thankfully, as a result of far-reaching liberalisation policies and a shift towards digital systems in the early 1990s, governments issued additional cellular licences in the 1800 MHz band for new entrants which contributed to the emerge of one of the most competitive communication markets particular addressed at the consumer which were served by a large variety of phones and tariffs. Significantly, whereas the simple functionality of voice communications in the analogue era offered few opportunities for differentiation, the deployment of digital technology allowed for more advanced applications and tariff variation, serving the early-majority category. Interestingly, while digital cellular was promoted by means of its roaming capabilities or messaging facilities the more basic analogue system was utilized to

[143] The main exceptions were Sweden, France, UK and the US [OECD1996]. Additionally, the incumbent PSTN carrier in the US at the time was not a state-owned business but a private company (AT&T).

[144] Coincidentally, operators used prices to ration the limited spectrum resources, particular in metropolitan areas.

[145] It is quiet astonishing to see that mobile operators recognized the value of price 'transparency' at such an early time of cellular telephone diffusion – a criteria which is served by means of prepaid, flat-rate and one-rate plans.

expand the consumer market in addressing customers that favoured a mobile phone for security reasons or remote parenting. Hence, operators had to stress the potential advantages and benefits of cellular communications to overcome the widespread belief that it is an expensive luxury that is still restricted to the business segment. As a lasting consequence, consumer markets became competitive where subscribers were enabled to benefit from a wide range of tariff as operators seek to serve user needs and demands to differentiate themselves from competitors[146].

Finally, with the establishment of digital services in the 1800/1900 MHz range the mass market was reached with fierce competition for the late adopters and laggards to join the 'mobile bandwagon'. Consequently, it was more important than ever that network operators offer a mixture of low prices and tariff differentiation in a strategy to attract customers.

Differentiation was especially important for market entrants since they in general cannot easily make significant inroads into the primary subscriber base of the dominant incumbent. One key factor was the establishment of a 'selling point' within their tariff portfolio given that the mature operators could rely on their substantial, loyal customer base[147]. Interestingly, Eircell proved that the launch of innovative tariff schemes, such as its novel prepaid card tariff, was not the sole territory of new entrants, altered its image of being a slow-moving monopoly operator [Cárt1998]. Its prepaid service was developed to lure away as many customers as possible prior the market entrance of ESAT Digifone. Another way to attract customer attention is by under-cutting the price of rival offers which is seen as the most extreme form that results in a so-called 'price war' which, if prolonged, is of high risk to all participants. Thus, operators generally prefer to achieve advantages through unique tariff plans and marketing efforts to attract attention by potential customers. Eircell ran a free flight promotion for any new customer that signed-up to its prepaid service, which was followed by a lottery with a new car as a price each day [Cárt1998].

Accordingly, price packaging emerges as a key factor in the marketing mix, particularly in the price-sensitive consumer market. Most significantly, wireless carriers still needed to achieve a balance in their revenue streams and maintain adequate profitability given that a large share of low-usage subscribers can prove 'fool's gold' in contrast to a smaller proportion of high-spending business customers. Consequently, with this in mind, operators built their tariff portfolio to respond to both emergent opportunities and trends as well as counter the threats of

[146] Operators had to move away from the relatively easily accessible business segment towards the consumer market while having to avoid a cannibalisation of their highly profitable and price in-sensitive business users.

[147] Incumbents adopted an aggressive strategy of cross-market differentiation and offered 'bundled' products which combined both mobile and fixed network services on which they still retained a 'quasi-monopoly' [OECD1996].

competitive rival offers[148]. Controversially, given that each individual has its own usage profile operators may find it difficult to cover all these demands that are partly caused by regional, cultural, demographic or personal preferences and necessities. The proliferation of tariff schemes and prices is over the last two decades is discussed in the next subsection.

5.2.1 Tariff Options

Operators are creative in devising new ways to differentiate themselves from each other. The launch of unique tariff plans and call options are usually the most favoured approaches to create a unique image alongside brand awareness. Most problematically markets in Europe, Asia or America are clearly non-homogenous and have specific national characteristics. Experience revealed that packages which were successful in some European markets notably failed to attract customers in others, due to the local market characteristics. Nevertheless, a number of generic approaches emerged which proved to be broadly successful in stimulating initial subscriber growth in mature as well as new markets. Simultaneously, with increasing competition the mostly private operators intensified advertisement and marketing that surely boosted public awareness for cellular telephony. Expectable, while incumbent operators retained a monopoly on the provision of analogue mobile services in most European countries they subsequently tended to react conservatively, since they were not under the same degree of compulsion to make an impression in the market by means of innovative tariff plans since they want to avoid the potential risk of confusing existing subscribers.

According to the OECD 1997 Communications Outlook there was little tariff differentiation prior to 1992 [OECD1997]. Typically only a single tariff was available for users, almost all of who were from the business sector. Coincidentally, to avoid consumer disarray, the basic components of a mobile subscription mirrored those of the PSTN: fixed charges, such as connection and subscription tariffs, plus call/usage charges. Hence, the anomalies discovered in the relationship between wealth and cellular density may be caused by similar disparities between the prices charged for services; the OECD basket of mobile services allows for making comparisons between the pricing levels on a global scale as depict in Table 5-1.

[148] More significantly, some operators deliberately attempted to build a distinct public perception or image of their organisation as the most innovative company for business customers or the cheapest for a given usage pattern.

Table 5-1: OECD basket of mobile communication service charges, Jan. 1992 (Value express average annual spending by a business user, in 1991 US$ PPP, excluding tax) [OECD1995].

Country	Fixed charge	Usage charge	Total	Ranking (lowest=1)
Australia	380.25	719.05	1,099.30	9
Austria	388.49	948.65	1,337.14	10
Belgium	448.69	885.04	1,369.74	12
Canada (Bell Canada)	374.92	634.16	1,009.09	7
Denmark (KTAS)	103.32	577.89	681.21	2
Finland (HTC)	120.35	778.18	898.53	4
France (Radiocom2000)	929.56	1,168.35	2,097.91	21
Germany (DBP)	440.99	1,880.25	2,321.23	22
Greece	n.a.	n.a.	n.a.	
Iceland	87.96	364.40	452.36	1
Ireland	462.96	1,178.91	1,641.88	15
Italy	461.76	893.36	1,355.12	11
Japan (NTT)	821.33	1,065.19	1,886.52	18
Luxembourg	1,526.72	949.24	2,475.96	23
Netherlands	492.21	997.17	1,489.39	13
New Zealand	511.54	984.60	1,469.12	14
Norway	159.14	755.60	914.74	5
Portugal	660.60	1,311.90	1,972.50	20
Spain	720.26	956.51	1,676.77	16
Sweden (Televerket)	93.37	846.36	939.73	6
Switzerland377.98	381.74	381.74	759.72	3
Turkey	744.85	2,544.82	3,319.67	24
UK (Cellnet)	516.32	1,385.21	1,901.52	19
UK (Vodafone)	508.29	1,305.37	1,813.52	17
US (Nynex)	493.00	558.55	1,051.55	8
OECD[149]	494.89	989.79	1,484.68	

Note: This table shows charges for analogue cellular radio services in OECD countries. The basket is weighted so that fixed charges are one-third of total charges. The fixed charges include monthly rental plus one-third of initial connection charge. The usage charge includes a basket of 855 calls of different distance and duration made at different times of day or week. For full details of the methodology used, please see ICCP Series No. 22, Performance indicators for Public Telecommunication Operators.

[149] The average includes only Cellnet for the United Kingdom

As afore anticipated the charges show a large diversity ranging between US$468.12 for Iceland and US$429.72 for Turkey. Expectable, the Nordic region has the lowest basket costs. To everyone's surprise Switzerland records the third cheapest basket which may be caused by a policy that favours the use of cellular communications in a mountainous environment similar to the one in place in the Nordic region pointing to reasons such as geography for the adoption of mobile telephony. To put the correlation between costs and demand into perspective the basket costs are plotted against cellular density. If prices are perceived as reasonable, demand for mobile telephony can be stimulated as depict in the following Figure 5-2.

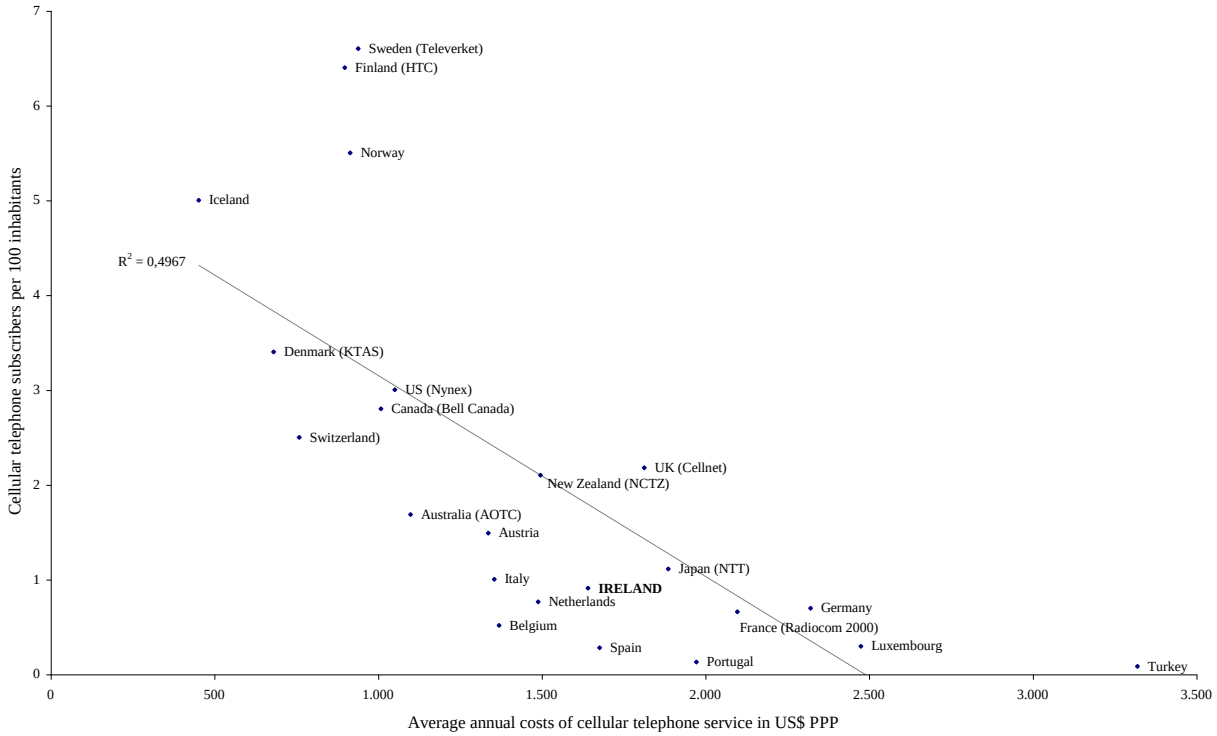

Figure 5-2: OECD basket costs vs. cellular density, Jan. 1992 [OECD1995], [ITU2005].

Interestingly, the resulting coefficient of correlation $R^2 = 0.5$ indicates a reasonable strong link between costs and adoption. Expectable, the benchmark is spearheaded by the Nordics, which features the lowest cost. Interestingly, the Nordic spending level is also shared by Switzerland and a group of overseas countries with a British heritage. Interestingly, Ireland shows lower basket costs than the UK or France that might be an indicator that a duopoly such as in two former countries does not necessarily translate into cheaper prices if operators do not engage in price competition.

It can be assumed that the low service costs achieved in the Nordic region are a clear consequence of the economies of scale provided by the NMT system. This is also evident when looking at the Swiss performance which is based on a NMT-450 network. Likewise, it can be

concluded that Australia and the North American countries also benefited from the saving potential provided by the AMPS system rollout. The same could be said for much of the European countries, particular Austria, Italy, Belgium, and the Netherlands who deployed NMT or AMPS-derived TACS technology. Interestingly, it appears that the UK's two operators ask prices that are not cost-based given their middle-field ranking while achieving a relatively high level of mobile density. Controversially, the Irish situation constitutes the direct opposite, which may be due to the fact that Ireland's spending potential is not as vast as its GDP would suggest. The bottom part is made-up with most major economies countries that developed their proprietary non-standardized systems illustrated by costs of more than US$2,000. The back marker are represented by Luxembourg and Turkey. Luxembourg's performance may be explained by both the operator's strategy to make a profit by asking similar high charges as its counterparts in neighbouring countries such as France and Germany and the high rate of roaming calls with the former countries. The Turkish case demonstrates that cellular telephony was still an expensive novelty in a country that featured long-waiting list for PSTN telephone.

Altogether, it must be noted that the depict data illustrates a snapshot just before the inauguration of GSM technology in Europe in 1992 which could be interpreted as the pinnacle of the analogue systems. Since the thesis is focussed on the analogue era it appears apposite to look at the advancement of the basket costs and subsequent variances after digital networks were deployed on a global scale. For both the purpose of data consistency and its availability it was again decided to use data from the OECD. In particular the OECD basket of analogue mobile telecommunication tariffs of January 1995 were investigated. The correlated data is illustrated in Table 5-2.

Table 5-2: OECD basket of analogue mobile telecommunication tariffs, Jan. 1995 [OECD1995].

Country	Fixed charge	Usage charge	Total	Basket price as per cent of GDP per capita	Ranking (lowest=1)
Australia	319.85	706.97	1,026.82	6.21	10
Austria	385.71	845.18	1,230.89	5.26	13
Belgium	412.87	834.64	1,247.51	5.71	13
Canada	383.52	562.52	946.04	4.56	7
Denmark	108.86	546.35	655.21	2.38	3
Finland	105.35	499.50	604.85	2.88	2
France	929.56	1,046.70	1,976.26	8.58	21
Germany	385.62	1,163.92	1,549.54	6.98	17
Greece	n.a.	n.a.	n.a.		
Iceland	97.97	364.22	462.19	1.81	1
Ireland	390.07	720.91	1,110.98	8.10	11
Italy	435.23	755.53	1,190.76	5.62	12
Japan	630.02	1,019.21	1,649.23	5.59	18
Luxembourg	626.57	972.33	1,598.90	5.15	16
Netherlands	295.88	690.85	986.73	4.67	8
New Zealand	534.22	931.37	1,465.59	11.18	14
Norway	176.98	629.37	806.35	3.06	4
Portugal	606.11	1,186.83	1,792.94	20.94	20
Spain	523.81	966.47	1,490.28	8.84	15
Sweden	152.63	744.62	897.25	3.16	5
Switzerland	372.46	562.04	934.50	2.67	6
Turkey	228.23	1,538.62	1,766.85	67.10	19
UK	496.34	868.57	1,364.91	7.55	13
US (Nynex)	496.07	1,308.88	1,804.15	7.62	21
OECD[150]	395.84	846.36	1,241.68	5.98	

Notes: Greece is excluded because it does not have a comparable analogue service. Average excludes Mexico and Greece; there are 767 calls in the basket. Excluding tax; Data for Germany, Iceland and Spain is for 1994; 1992 GDP per capita data used; Average monthly growth is simple average for OECD; Data for Canada is for one cellular service provider. The results may vary with the tariffs of another mobile communications operator

Again, the data still indicates large diversity of tariffs ranging between US$462.19 per year for Iceland and US$1,804.15 for the US. Still, the Nordic region and Switzerland feature the lowest tariff basket, followed by the British-influenced countries of Canada, Australia and

[150] The average includes only Cellnet for the United Kingdom

Ireland alongside the Netherlands. The bottom of the scale is made up by Turkey, Portugal, the US – and rather surprisingly – France. Once again these figures are plotted against the related cellular density, which may allow for comparison.

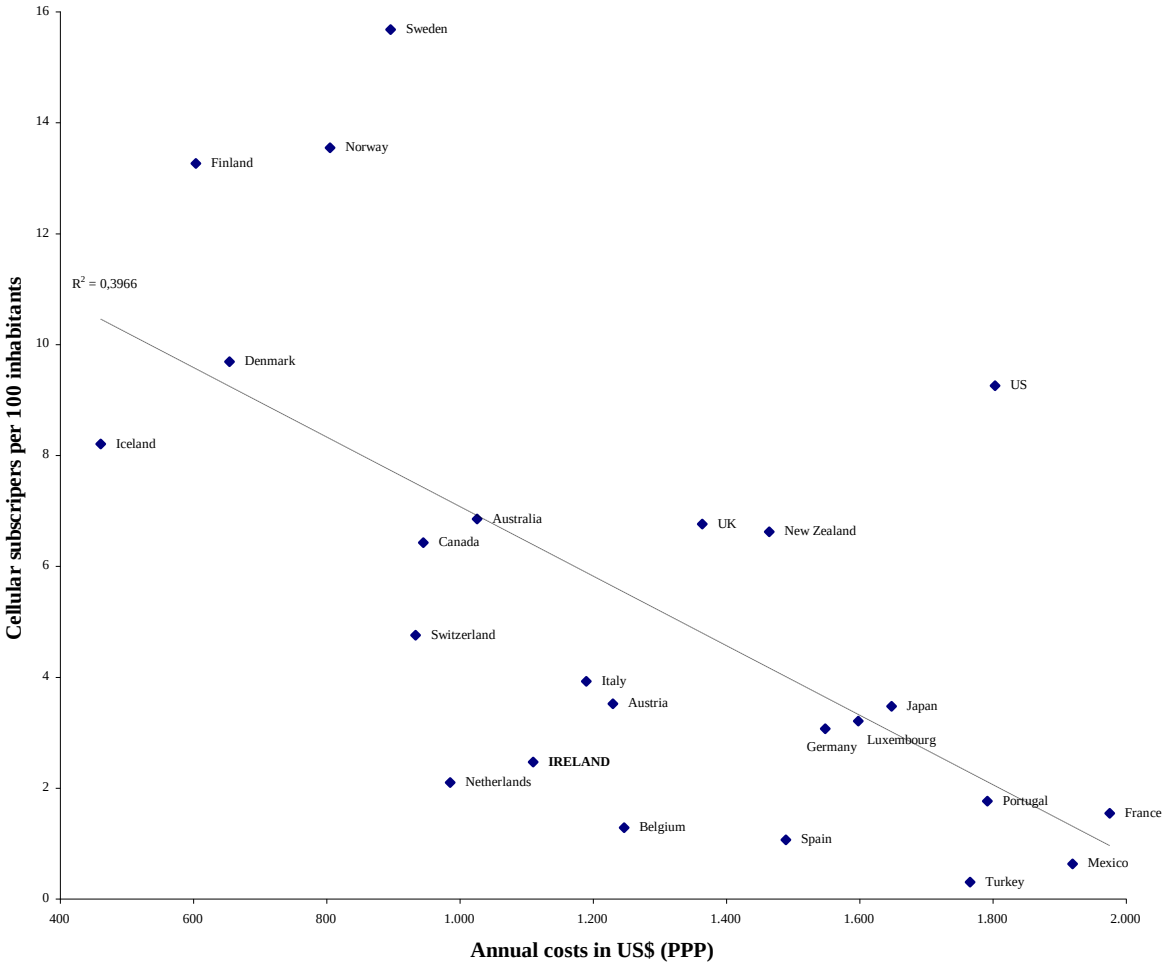

Figure 5-3: OECD basket costs vs. cellular density, Jan. 1995 [OECD1995] [ITU2005].

Significantly, the relationship between the costs of services and cellular penetration has weakened over the three-year period as evince by a smaller coefficient of correlation ($R^2 = 0.4$). Obviously, while the Northern countries effectively form an isolated, high-penetration, group, the ranking of the remaining countries indicates that the price link is not as strong as initially anticipated. The most noticeable change of position is evident with the US that moved up on cellular penetration but also record nearly twice as high basket costs than three years ago. This can be attributed to the traditional offering of 'bucket tariffs', which include a large amount of 'free' minutes, which exceed the number of minutes of the OECD basket. Similarly, Australia moved up regarding density achieving levels as recorded by its country cousins New Zealand, Canada and UK forming a group of countries similar to the one of the Nordic countries. Indeed, this constellation accentuates the benefits of using a global standard that generates economies of

scale. Likewise, the Irish customers again benefited from rather cheap prices when compared with its British neighbour as was the case in 1992. Controversially, the Irish could not adopt mobile telephony at the same rate as its technology choice would suggest. However, it must be mentioned that some operators started to encourage customers to migrate to cellular services which were far more economically with regard to spectrum usage. Hence, these operators have increased prices for analogue telephony. Meanwhile, Turkey changed places with France that now offers the most expensive mobile telephony service within the OECD. Germany and Japan with their legacy of proprietary analogue systems still feature above average expensive tariffs. These anomalies contradict the often-cited allegation of price-elasticity in the market and leads to the conclusion that there is no justification for the generalised assumption of a correlation between the pricing of services and the level of consumer adoption.

Altogether, the [OECD1996a] concludes that countries with low basket prices tend to have high cellular density while some countries with above average prices have also comparable levels of penetration. Consequently, the OECD concludes that this constellation may be due to 'affordability'. Interestingly, the OECD exemplarily chose the US and Ireland to demonstrate the factor if affordability: "*analysis of relative wealth and prices together (basket price as a per cent of GDP per capita) show that mobile telecommunication is more affordable in the United States than in Ireland, even though prices are higher in the United States*" [OECD1996a]. Figure 5-4 figure depicts the relationship between wealth (basket price) and cellular density.

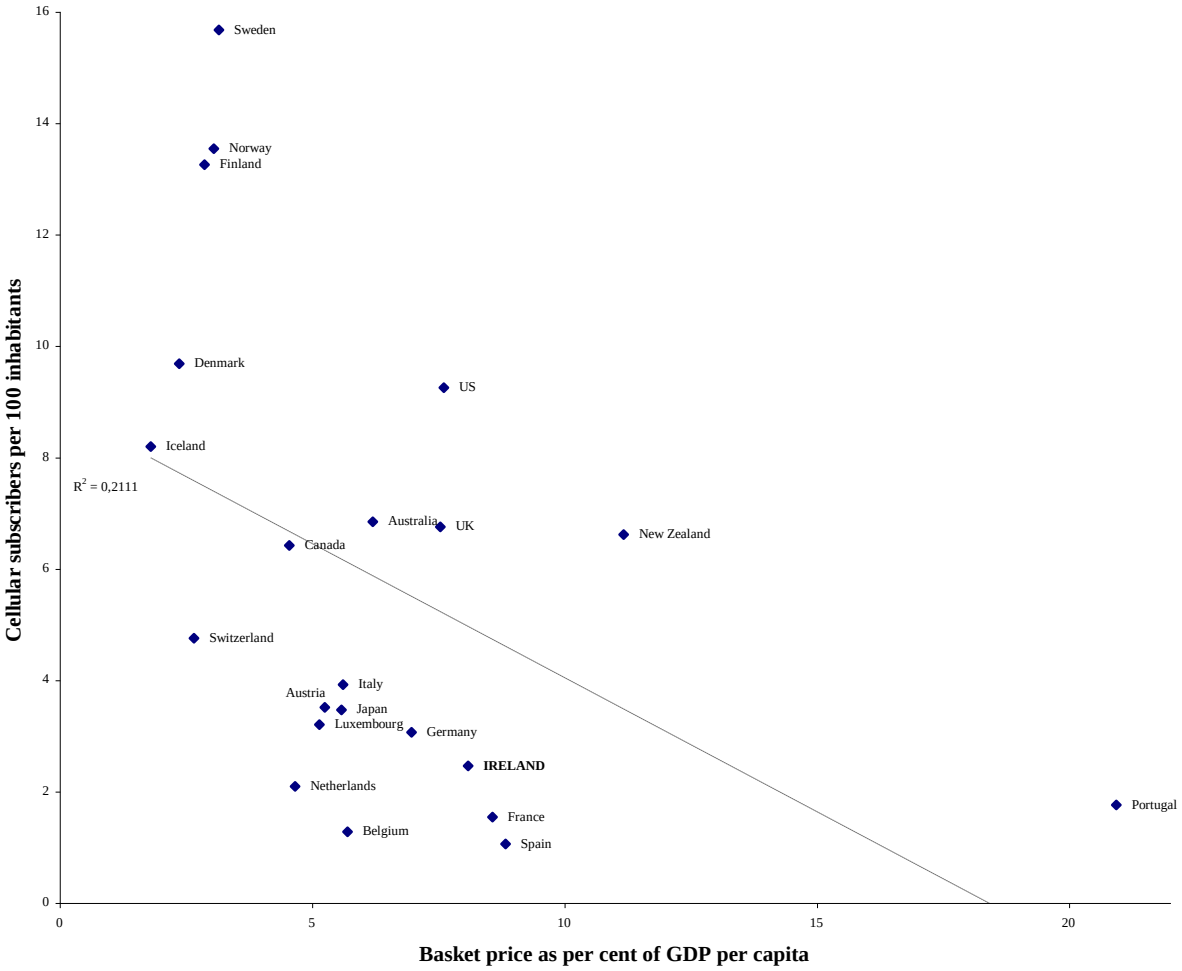

Figure 5-4: OECD Basket price as percentage of GDP vs. mobile telephony density, Jan. 1995 [OECD1995] [ITU2005].

Apparently, the low coefficient of correlation of $R^2 = 0.2$ indicates that the affordability approach may not be the best key to explain the relationship between wealth and mobile telephony adoption. Indeed, this view is confirmed by the OECD that state that affordability "*tends to raise more questions that it answers*" [OECD1995]. It further asks, "*why for example does New Zealand's rate of growth exceed Switzerland by three times even though its basket price as a percentage of GDP per capita is four times higher?*" [OECD1995]. The organisation names several reasons for these anomalies. One reason is the fact that the basket is based on the usage pattern of a business user although it does not include volume discounts aimed at high users. Additionally, as a second reason the OECD found that prices are only one aspect of marketing mobile services while countries with multiple operators "*have proven better able to expand their subscriber base even when they have higher prices. Indeed it is the improved marketing of services and increased attention to customers (often prepared to pay higher prices for the service they want) that explains differential performance rather than price*"

[OECD2012]. This underpins the important role that perception plays in the adoption process of innovations such as cellular telephony.

Indeed, there appears to be some hidden or perceived values combined with mobile telephony that makes it such attractive that people agree to pay a premium over wireline telephony. Obviously, the most striking element that contributes to the mobile phone's handsomeness is the feature of mobility that enables the individual to make and receive calls wherever they are[151]. Controversially, although mobile telephony is one of the most competitive telecommunication segments prices did not decrease by the same extent than its fixed-line counterpart. Rather, the OECD found that the price of an average minute only drop from US$0.50 in 1989 to US$0.40 in 1999, which is a yearly reduction of 3.7 per cent only. Understandably, given the strong demand for cellular telephony operators could still sustain their prices while increasing their level of marketing to establish the cellular telephone as a must-have device. Additionally, customers receive more functionality and features than ten years ago as argued by the [OECD1995]. The significant discrepancies and inconsistencies evident in the results of both analytical approaches highlight the complexity of the demand response and emphasises the need to consider additional factors, such as social and local market structures. It should however, be noted that these data relate to a time just prior to the general period of consumer market expansion and, as the OECD comments, are based on business usage patterns which are recognised to be price-inelastic.

However, with the introduction of competition in most markets in the mid-1990s, significant differences between wired and wireless tariff structures have emerged. PSTN operators have tended to rebalance their charge structures by maintaining or increasing fixed charges while lowering usage charges. The reverse has been true for cellular operators who have sought to reduce entry costs to attract cost-sensitive consumers with prepaid services being the most prominent example. Depending on usage patterns, customers have consequently been able to avail of the convenience and security of mobile phone ownership at a much lower cost resulting in a dramatic surge of subscribers. Simultaneously, revenue figures fell since consumers made fewer calls. The OECD stated that "*in many cases these tariff plans did not greatly reduce the price of mobile service but they did reduce the cost to users [...] because they were better suited to different types of usage patterns*" [OECD2000]. Most importantly, with the right tariff option,

[151] The attractiveness of personal mobility can be regarded as similar significant in the context of the adoption of the automobile half a century ago. Prior the availability of reasonable cars individuals had to use public transport such as busses, trains or trams that travelled only from and between fixed points rather than from the individuals location.

users who made only relatively few calls but valued communications mobility could now obtain cellular services at lower overall cost than under traditional pricing schemes.

5.2.2 Monthly Subscription Plan

Under this scheme the user signs a long-term (one or two years) contract and pays a monthly subscription charge while call charges are levied according to the time of the day. Peak-time calls are charged at higher rates than in off-peak periods. This tariff features terms and conditions similar to those of a fixed-line connection. Unsurprisingly, given the state-owned incumbent's initial monopoly on fixed and mobile telephony, there saw little need to introduce sophisticated or consumer-addressed tariffs. However, this did not hinder some incumbents from offering low-priced services to stimulate growth. Once a subscriber had made an initial payment for the purchase of a handset he was enabled to avail of low call rates while operators avoided the alternative use of high fixed-cost incentives, typically in the form of handset subsidies.

5.2.3 Bundled Airtime Package

Under this option the user is entitled to a certain amount of 'free' minutes or airtime charges, within their monthly subscription fee. It therewith builds on the public familiarity of 'flat-rate' schemes, which makes it easy to understand. After the free time is used up calls are charged on the basis of a per-minute usage rate. The emergence of this type of tariff package and enhanced awareness of the necessity to promote customer care are characteristic of a new market entrant strategy. Moreover, the bundled approach emerged largely as an outcome of companies' search for a unique selling point and their need to project a popular image of an innovative company committed to making the use of mobile communications affordable and commonplace[152].

5.2.4 Prepaid Telephone Service

In contrast to a traditional long-term mobile telephony subscription that include fixed charges such as monthly line rental charges, users of a prepaid service do not have to sign a long-term contract, which comes with certain contractual obligations such as a permanent income or address or credit checks. In its genuine form the customers receive a SIM card and an initial airtime (call credit) voucher. If the available airtime has been consumed further airtime 'Top-Ups' can be purchased in advance of use at anytime using a variety of payment mechanisms such as the internet, at ATMs or shops. Significantly, while customers enjoyed a readily accessible

[152] Eircell's so-called 'Eircell' option also illustrates how customers can get better value for money by bundling more minutes into their monthly subscription charge. Instead of altering its tariffs Eircell merely increased the amount of free bundled minutes by over 50 per cent whilst maintaining its tariffs [Busi2000].

product, which allowed for greater personal control over variable usage costs with no contract formalities operators benefited from low marginal customer recruitment costs since they only had to provide a SIM card. Over time operators started to bundle a reasonably priced handset with the SIM card that resulted in so-called prepaid phone packages[153]. Moreover, the absent of credit checks democratised the access to cellular telephony to reach customer groups formerly not being targeted by operators such as the under-18 (a socially interactive and technically literate market segment), non-credit worthy customers, schoolchildren or people with low or in-regular income. Prepaid's major and distinctive advantage against PSTN tariffs was its flexibility and controllability in paying for its usage upfront as well as its freedom from monthly line rental charge. Therewith, the cost of ownership was reduced to a one-off payment for the handset. Expectable, this freedom came at a price and had to be paid for by higher call rates given that in many markets user continue to pay a large premium for prepaid airtime compared to post-paid. Controversially, it seems that the high rates of prepaid does not detract its popularity, not even in younger demography or low-income groups, which on first sight embodies a contradiction[154].

This observation finds supported by Simon Rees, a former Eircell employee, who attests in his dissertation, titled 'The Strange Success of Prepaid Phone Services', that "*customers consciously paying a premium (higher overall charges) to choose prepaid since the usual absence of rental charges means that in these markets, lower users are often better off with prepaid*" [Rees1999]. Furthermore, Rees found that the anonymous purchase plays a role while "*prepaid mobile facilitates budgeting and control over discretionary spending and that dread of bills, or 'anticipal pain' is also a factor*" [ibid.] of relevance in the adoption decision. Most significantly, Rees postulates that as individuals have an individual array of needs each individual will purchase a prepaid phone for different reasons which may also vary between markets. Hence, Rees hypothesis that the variety in customer's need "*may be related to the degree to which the consumer's need for a mobile phone is based on the one hand on functional need to make and receive calls, or on the other, on the need to have a mobile for other reasons (security, symbolic need, for emergencies, to be handy)*" [ibid.]. Thus confirming a difference between rational needs (i.e. making and receiving calls) and a more emotional need to have a mobile phone. This finding is significant since the value of a mobile phone for certain individuals appears not to be in its functionality and its subsequent potential to achieve a higher

[153] Consequently, the cost of acquiring customers had increased with the offering of subsidized handsets, intensified marketing and commission payments to retailers. For example [Care2001] states that Eircell had paid out IRP130m in commissions in the 18 months to September while it added 612,000 new subscribers which translate into acquisition costs of IRP212 per each new subscriber.

[154] Its acceptance is indicated by the use of nicknames[154] such as 'le G' in France (for GSM) or 'handy' in Germany.

level of productivity or flexibility against which the investment costs are weighted (by a business user). Instead, it seems that certain consumer segments purchase a mobile phone regardless of its usage benefits and value ownership as a cure for their 'have'-need a top priority. Hence, it comes as no surprise that these customers' needs are served best by prepaid phones since they minimize the cost of ownership to a one-off payment without the requirement of monthly charges but still allow for limited functionality – receiving calls and text messages – even when call credit is used-up. In particular, it seems as the factor of 'reach-ability' is just sufficient from a certain customers' point of view while the cellular phone's functionality could be exploited by the purchase of call credit. The significance of attractively priced handsets is underpinned by a study that found that "*equipment prices – and not airtime prices – are used to create markets*" [Paet1993]. The prepaid mobile phone concept therewith resembles the purchase and usage profile of an automobile. After a (mostly large) initial payment for the car itself the driver buys fuel depending on the travel distance to be covered in advance.

Significantly, while the fixed-line telephone required the customers to meet certain criteria alongside long-term contractual burdens and financial commitments the prepaid mobile phone in contrast offers a flexible, simple and, for many people, both the first and the most economical way to get connected to the global village that the information society became. Hence, it can be presumed that prepaid was the perfect remedy in countries that lack a decent PSTN infrastructure. A conjuncture in place in many countries, even in developed ones such as Ireland which asks for deeper investigation; indeed, prepaid is the best opportunity to date for allowing universal access given that it removes many of the economic, technical, and social barriers. Moreover, in regions such as Africa, South-America or Asia many countries feature a cash-based society, which more than welcomes the rather simple prepaid card concept as an alternative to an expensive, and sometimes not even available wireline telephone.

The following abstract will examine Eircell's prepaid tariff and its strategically features that set it apart from its European counterparts. Again, the relevance of cost of ownership is of major importance for cellular telephony's adoption given Ireland's relative wealth.

5.2.5 Eircell's Ready-to-Go Prepaid Service

With the launch of Esat Digifone in March 1997, price competition emerged and consumers were presented with the option of a wider choice of services. Consumer interest in mobile phones was fuelled by campaigns of short-term offers directed through retail agents. Up to this point the attained penetration rate of 11 per cent was largely associated with (niche) business customers. However, it was evident that future growth was moving in the direction of mass (business and social) market segments. Since the volume of social calls had doubled during the

18 months prior to the entry of Esat Digifone, Eircell was already looking for ways to tap into this new user segment [Saac1998]. It was obvious that many potential customers were unwilling to be restricted by a monthly billing contract. It was also clear that another major group, typically under 18 year olds and those without a bank account, were excluded from contract-based services and represented a large untapped market which had previously been ignored due to possible depression of ARPU figures. Hence, Eircell strategically decided to launch prepaid services in an approach to serve the above mentioned 'want gap'. Significantly, Eircell saw the far-reaching potential of this innovative move in creating an entry point into cellular telephony;
Finally, at the end of October 1997, Eircell launched its Ready-to-Go prepaid package on its analogue TACS system in the run-up to Christmas and therewith pioneered the idea of Pay-As-You-Go, which is the general term for the concept of a prepaid cellular telephony. Eircell's prepaid package offered a handset and comprised a pre-loaded amount of call credit for an up-front payment of IR£99 [Cárt1998]. The scheme opened-up the '*cellular door*' to the mass market by its particular appeals to the female and youth markets, which had previously been difficult to target [Saac1998]. Stephen Brewer confirms this strategy: "*This is aimed at people who wouldn't normally use a mobile phone because they don't want the hassle of signing contracts and so on.*" [McCa1997]. This was particular attractive for teenagers as reported by [Inge1997]: "*The Streets are alive with the sound of mobile phones and now they are likely to belong to laid-back teenagers as high-powered men in suits.*" Stephen Brewer further underpinned the broader vision behind the launch of Eircell's prepaid card service: "*Eircell's mission is to enable every Irish household to have access to a mobile phone.*" [Cárt1997]. Eircell simultaneously managed to limit the impact of Esat Digifone's market entry nine months ago despite high call rates and the levying of a 7p service charge on each call on every operation, the scheme was a huge success and helped the operator to maximise the return of investment on its analogue network [Celt2012]. Eircell's successful strategy in signing-on as many potential customers as possible before Esat Digifone's mobile service launch was most evident by the increase in Eircell's network congestion. Steve Brewer claims that his company has been "*a victim of its own success*" [McEn1996], confirming that the potential of mobile telephony in Ireland was underestimated. The tremendous growth is also recognized by figures provided by Brenda Moriarty, Eircell's head of marketing: "*It took us 10 years to get to our first 100,000 customers, and 10 months to get the next 100,000.*" [Cárt1986].

The following table compares Eircell's prepaid package with offers from its European counterparts in the period October 1996 to September 1998.

Table 5-3: Prepaid packages in Europe, 1996-1998 [Zoll1996a], [Hand1996], [Zoll1996b], [Szan1997], [Zoll1997], [Litt1997], [Mobi1997], [Hand1998], [GoCu2012].

Operator	Name	System	Launch date	Price (domestic)	Price (US$)	
TIM (I)	Timmy	GSM	Oct. 1996	ITL 570,000	376	
Vodafone (UK)	PrePay	TACS	Sep. 1996	GBP 100-150	156	GBP 30 connection fee
T-Mobile (D)	Xtra	GSM	Feb. 1997	DEM 299	179	Users have to top-up by at least US$ 29.9/month
One-2-One (UK)	Up 2 You	GSM	Aug. 1997	GBP 199.99	321	
Orange (UK)	Just Talk	GSM	Oct. 1997	GBP 179.99	293	
Eircell (RoI)	Ready-to-Go	TACS	Oct. 1997	IRP 99	145	
Vodafone (UK)	Pay as you Talk	TACS	Nov. 1997	GBP 99-119	167	
Cellnet (UK)	Easylife	GSM	Jul. 1998	GBP 120	197	Reduced to GBP 99 in Sep. 1998
Vodafone (UK)	PrePay	GSM	Aug. 1998	GDP 99-120	162	

Obviously, Eircell's package was the most reasonable priced offer at the inaugural phase of prepaid mobile telephony. Further, while Eircell's counterparts launched their prepaid packs in an already liberalised hence competitive environment the Irish operator introduced its package while still featuring a monopoly market what contributes to the uniqueness of the Irish market.

A vital factor in this success was the fact that, unlike Digifone's digital network, the TACS network provided almost complete geographical coverage of the country. The phenomenal success of Eircell's prepaid service on its TACS network is obvious when comparing its network growth-rate performance with the average growth rates of other European analogue networks as depict in Figure 5-5:

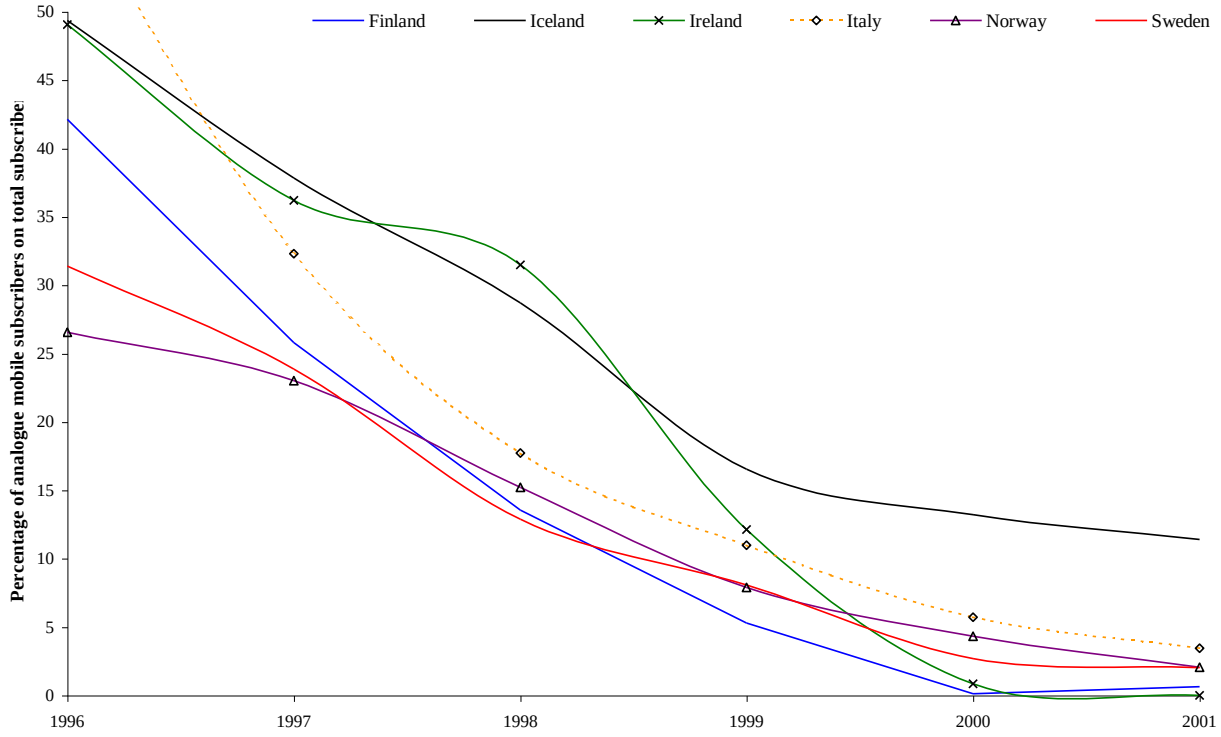

Figure 5-5: Growth of analogue networks, 1996-2000 [ITU2005a].

According to Eircell its prepaid customer base rose by 241 per cent within two years of launch [OSul1999]. Whereas countries with a traditionally high percentage of analogue subscribers, such as those in the Nordic region, experienced a significant decrease in the corresponding subscriber base due to the impact of digital systems, Ireland managed to maintain a virtually stable growth rate over a two-year period. Indeed, with 70,000 units sold by 31st December 1997 the package achieved an outstanding sales figure (projection: 40,000 by end of March 1998), due to a clever presentation of Ready-to-Go as the ideal Christmas gift under the advertising slogan 'Mobile Thrills Without Bills' [OSul1999]. Its major promotion provoked a negative response from Barry Maloney, Esat Digifone chief executive: "*Ireland is the only country in Europe which is still growing its analogue network*" [OKee1998a]. Maloney further demanded that the regulator should announce when the analogue system would be discontinued.

Nevertheless, impressed by the prepaid growth figures Esat Digifone countered Eircell's offer with its equivalent 'SpeakEasy' option in the run-up to Christmas 1998 [Caro1999]. According to Maloney, research indicated "*one in five people who did not own a mobile phone today planned to get one in the next 12 months. Up to 70 per cent of these new customers would opt for a prepaid service*". Similar results were obtained by the Trendwatch Technology Survey, carried out by Amárach Consulting, which found that more than one in seven of those who did not have mobile phones said they thought they would get one in the next 12 months; interestingly, some 35 per cent said they wanted a mobile phone for social reasons [Cárt1999]. The phenomenal

growth in cellular usage generated by the two operators' prepaid services led Jamie Smith, reporter at the Irish Times, to the conclusion that, "*mobile phones could soon replace the pint of Guinness as the quintessential symbol of Ireland*" [Smit2000].

Altogether, with the Ready-to-Go prepaid scheme Eircell lowered the financial adoption barrier, which positively changed the traditional stigma of mobile telephony being excessively priced for serving exclusively the business customers. Coincidentally, cellular prepaid services have gained a perception of being affordable even though usage rates were priced relatively high. Simultaneously, it altered the image of the incumbent, which had formerly been regarded as slow moving and nothing but non-innovative.

This chapter showed the importance for a widespread diffusion to alter the traditional perception of an innovation as being extensively priced at a level that could only be afforded by wealthy individuals. This was exemplarily demonstrated in the case of the North American region where the MPP billing arrangement was applied to mobile telephony since it represented the most gently chance to implement it not only into the existing PSTN infrastructure but also into the regional calling habits.

Furthermore, it was shown using OECD data that the annual basket costs of mobile telephony are forming a strong correlation with mobile telephony penetration levels; this is particular true in the analogue era when services were primarily targeted at business customers. This traditional philosophy changed when liberalisation and competition were globally introduced and new entrants required operators not only to differentiate themselves from their competitors but also to attract new customer segments. This chapter demonstrated that the variety of tariff schemes and options were used to satisfy this demand. At the same time, the image and perception of mobile telephony was transformed from being an exclusively means of communications reserved for the more affluent individuals in a society towards a rather democratic tool of everyday communication.

This metamorphosis is most dramatically depicted with the introduction of prepaid services which did not ask potential subscribers to be engaged in annual contractual commitments, credit checks or to be of legal age. It was proven that on one hand this concept was crucial in Ireland's strong growth in mobile telephony density given Eircell's marketing of its prepaid card service as a 'mobile-in-a-box' that can be purchased right from the shelve at various locations. One the other hand the wireless carrier strategically launched the service in the run-up to Christmas just months before the start of its private competitor to collect as many potential customers as

possible. The success of such schemes is even more surprising when considering that overall charges are higher than those of a subscription contract. This work furthermore, demonstrated that prepaid users are prepared to pay a premium for the freedom that comes with a prepaid service since it makes mobile telephony more accessible to many low-income, low-usage and young individuals. Altogether, prepaid services helped to neutralize and even eliminate the long established stigma of the mobile telephone as being excessively priced for serving exclusively business customers. Coincidentally, prepaid services empowered individuals to gain access to a reasonable priced wireless version of the traditional wireline telephone.

6 Mobile Phone Usage Patterns, the Role of Language and Culture, Radio Broadcasting, and Cost Awareness in the 'Celtic Tiger' Era

"Well, we all know the Irish love to talk…"

Stephen Brewer, Eircell's chief executive, The Irish Times, Feb. 7, 1996

While the previous chapter concentrated on the evaluation of factors and policies that drove the growth in penetration rates this Chapter now looks at the underlying usage pattern that contribute to Ireland's astonishing high ARPU performance. It will be demonstrates that the exceptional high ARPU figures are a consequence of the anomalous high usage levels of prepaid customers. It will be shown that overall consumption of both airtime and data services marks the Irish mobile telephone users as one of the most enthusiastic people in the world[155].

Additionally, this chapter will show that on one hand the Irish's legacy of story-telling and sharing knowledge might have survived in their talkative behaviour. On the other hand that the ruling of the British invaders which suppressed the Irish culture and language might also have caused the Irish to conserve their identity by means of using their mother tongue. This need to express their tribal origin is also been mirrored by the large number of speech-radio or 'pirate' broadcastings. Altogether, it was proven that the high ARPU levels are a consequence of the Irish's 'love to talk' rather than of expensive tariffs.

Finally, evidence was found that in an affluent society such as in place in the era of the 'Celtic tiger' cost awareness was not regarded as important which might have further contributed to the extensive Irish usage pattern.

The most commonly used measures of operator profitability is ARPU, which mirrors a customer's consumption. The following Figure 6-1 illustrates the particular levels of usage and related revenues:

[155] Despite the thesis's focus is on the early era of mobile telephony the year 2004 will be examined given the availability of data from Merrill Lynch's Global Wireless Matrix (GWW) of 2nd quarter 2004 [Meri2004].

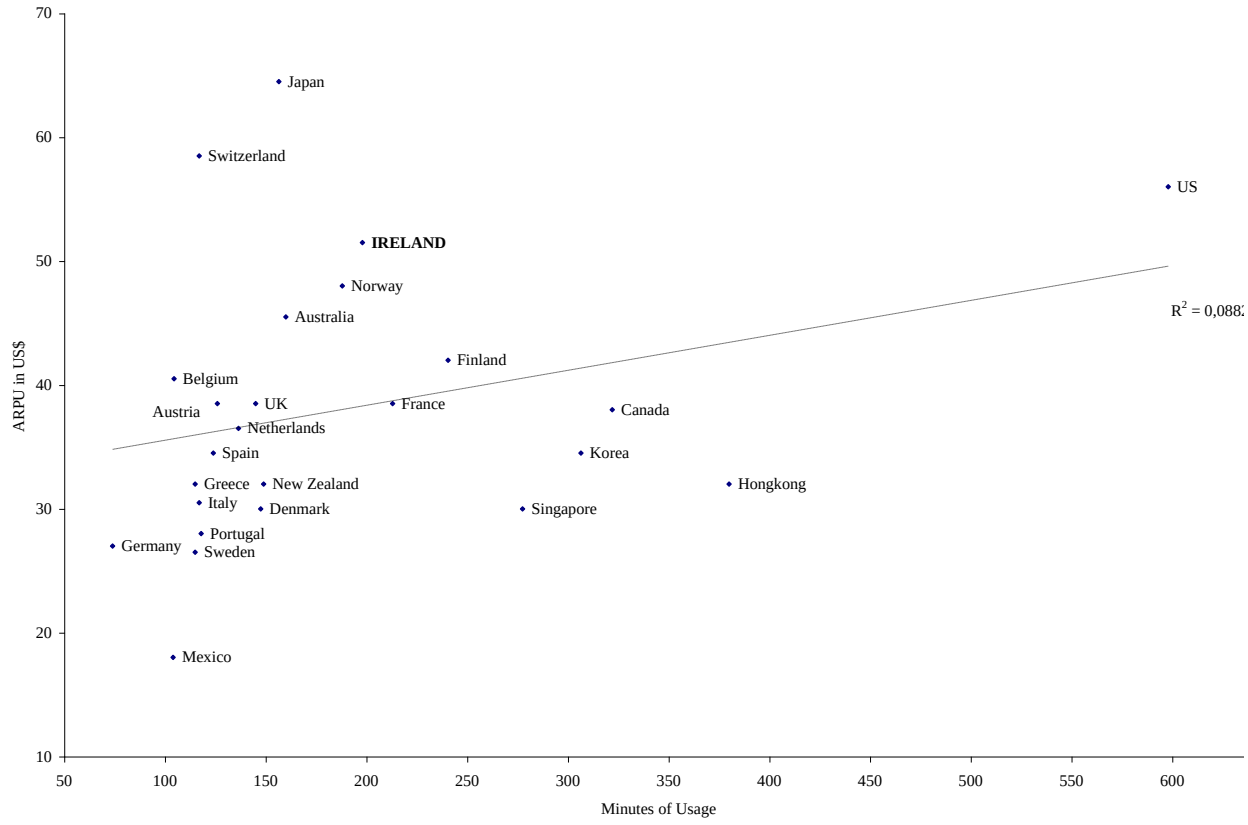

Figure 6-1: MOU vs. ARPU, Q2 2004 [GWM2004].

Surprisingly, the correlation between MOU and related revenue is not as strong as assumed which points to the existence of other criteria. One of these factors may be the underlying billing arrangement; the high MOU values achieved by the North American region, Singapore and Hongkong are a direct consequence of the deployed MPP scheme that forced wireless operators to launch 'bundled airtime' schemes (with large amount of 'free' minutes) that replicate the flat-rate pricing plan of the wireline network[156]. Another factor is the miss-leading impression that ARPU can be equated with MOU, which is not the case given that revenue from data services contributes to ARPU figures also. Finally, differences in both economic systems (purchasing power, taxes, etc.) and communications market (competition, tariffs) are at play that may act to

[156] Waverman illustrates the historic reason behind it: "*In much of the United States and Canada local calls are free (i.e., the price of a local call is zero). The pricing system dates to the beginning of last century when the Bell system was engaged in fighting for dominance of telephony against independent competitors. The Bell system's strategic advantage was its ownership of long distance lines and by refusing to interconnect with independent telecoms and by pricing local calls at zero while charging (tolling) for long distance calls, it was able to achieve dominance. Even when the Bell system became a regulatory monopoly, the practice of free local calls (i.e., bundled with the access subscription) was maintained. This, however, impacted mobile networks. Because the charging model for fixed lines, using a mobile for a local call was costly compared to free fixed-line calls.*" [Wave2007].

blur the monetary link. However, a look at the European group of countries might provide a better basis for interpretation. Obviously, Switzerland, Ireland and Norway form the top-three with ARPU levels resembling those of the US, although consuming less than half of the airtime. This translate into prices being more than twice as high in Europe than in the US – yet these relatively cheap US tariffs could only be enjoyed by those wealthy individuals who could afford the highly priced 'bundled' offers. Concurrently, it could be anticipated that tariffs in Finland and France offer a better deal since ARPU levels are lower although MOU values are similar or even higher. On the other hand, regional and cultural attributes may also be at work, as illustrated by the North American region (Chapter 6.2).

6.1 Evidence of a '*rip-off*'?

The very high ARPU figures recorded by the Irish mobile operators were noted by telecommunications regulator ComReg, who questioned the competitiveness of the cellular telephone market [ComR2003]. In October 2003, Deputy Eamonn Ryan TD of the Joint Committee on Communications, Marine and Natural Resources asserted that the conduct of V-IR and O2 was a '*rip-off*' [Parl2003]. A new regulatory framework issued by the European Commission identified access and call origination as well as call termination on individual networks as two competitive markets that required regulation. [ComR2005a] subsequently determined that V-IR and O2 were jointly dominant[157]. ComReg's finding was based on several benchmarks that are commonly used to identify the existence of joint market dominance. One of these is the Herfindahl Index [Chin2010], which describes the extent of market concentration. This index is a measure of the size of firms in relationship to the industry and is considered to be an indicator of the degree of market competition. Decreases in the Herfindahl Index generally indicate a loss of pricing power and an increase in competition. Figure 6-2 samples the relationships between Herfindahl index and ARPU on a national aggregate basis.

[157] In order to reduce tariffs, the regulator has since imposed several restrictions on mobile termination rates.

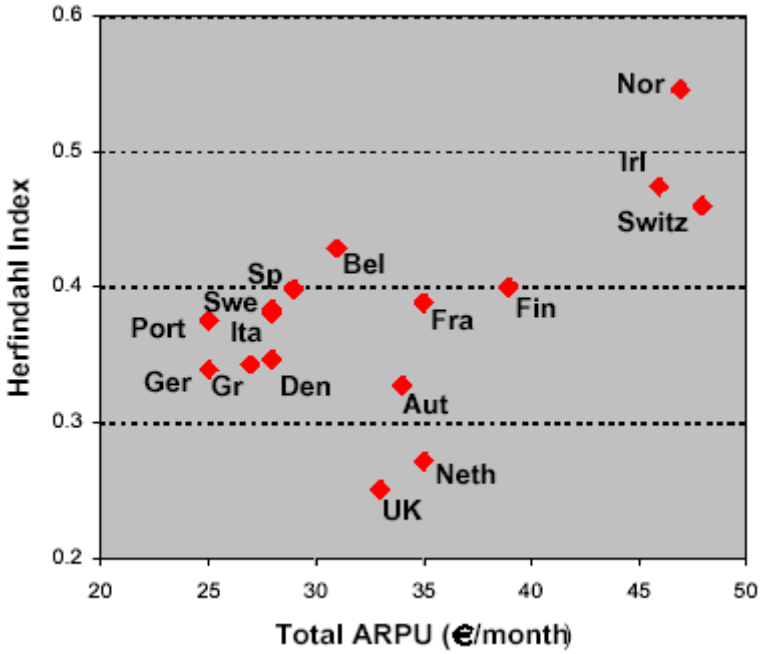

Figure 6-2: Market concentration and ARPU in Europe, Q3 2004 [ComR2003].

The picture that emerges is somewhat confusing and, at best, provides evidence of a weak positive correlation between the surrogate competitiveness index and revenue. In particular, the graph fails to provide information about usage parameters such as airtime or mobile data service consumption. It is clear however that the positions of Norway, Switzerland and Ireland, with only two or three operators, are exceptional. Low levels of competition and unusually high values of ARPU are indicative of joint dominance in these national markets.

Following ComReg's examination of the market in December 2004, the regulator proposed that the networks of V-IR and O2 should be opened for use by alternative providers such as Mobile Virtual Network Operators (MVNO) and this proposal was endorsed by the EC in January 2005 [ComR2005b]. The EC argued that this move would lead to lower prices for Irish customers[158]. As expected, in July 2005, V-IR asked ComReg to reverse the decision that denounced both V-IR and O2 for using their joint dominance to create a market, which was not "*effectively competitive*" [OBri2005]. Fahy argued "*Eircom's confirmed intention to purchase Meteor brings a new, formidable player to an already competitive marketplace*". With the additional entry of Three, V-IR insisted that the market had become more competitive than was portrayed in

[158] Controversially, Meteor, the country's third operator claimed that MVNOs would make Ireland's mobile sector less competitive. Andrew Kelly, director of corporate affairs at Meteor, said that 75 per cent of Irish mobile phones are prepaid while their charges are the fourth lowest in Europe. Coincidently, Meteor gained most of its market share in the prepaid sector and this prompted Kelly to argue that MVNO entry "*would have a disproportional affect upon Meteor*", since MVNOs would target the prepaid market, whereas the two larger operators might actually benefit from MVNOs, since they would earn revenue from leasing time on their networks [Burc2005].

December 2004. Fahy asserted that: "*We believe that this is, and has been for some time, a demonstrably competitive environment and promises to become even more so in the months* ahead" [ibid.]. Stephen Brewer, Eircell's chief executive, may provide a plausible explanation for this enthusiasm by saying: "*Well, we all know the Irish love to talk…*" [Jone1996]. This statement is supported by Barry Maloney Barry Maloney, CEO Esat Digifone, who confirms that "*Irish people love to talk*" and that this is reflected in the Irish's tendency to spend on average 25 per cent longer on each call than most other European countries [Cárt1998].

Following ComReg's finding it seems appropriate to mention that ARPU performance is generally considered to be directly related to a mobile carrier's customer mix between contract and prepaid subscribers. Operators typically report that the ARPU generated by the average contract customer is two to three times higher than the average prepaid customer[159]. The following Figure 6-3 illustrates the ARPU breakdown between the different customer segments:

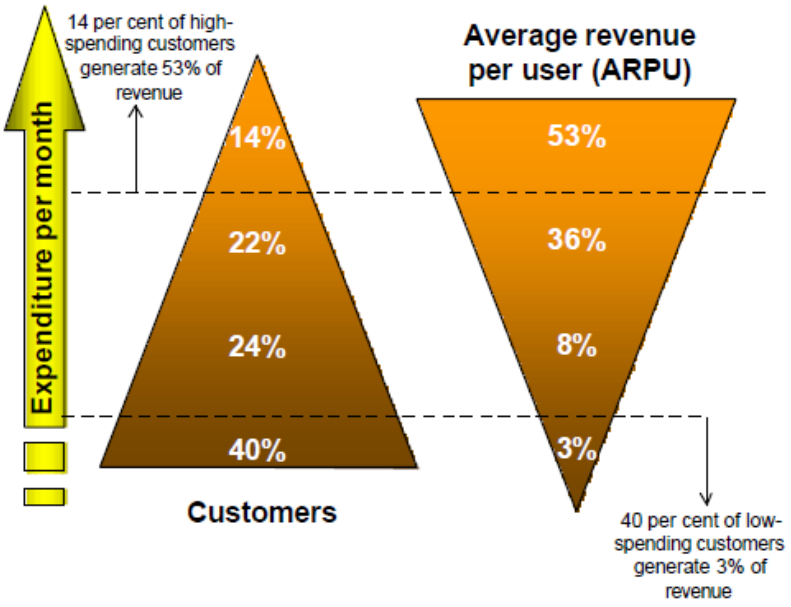

Figure 6-3: Revenue breakdown, by quartile, of ARPU in Canada [ITU1999b].

The figure above illustrates rather obvious the crucial implications the right customer mix had on the profitability of a mobile telephone network operator.

The following Figure 6-4 plots the share of prepaid customers against the level of ARPU.

[159] The [OECD2001] states that prepaid MOU is 60 minutes whereas contract MOU is 180 minutes. Operators almost always record a higher ARPU in the 2nd than in the 1st quarter of the year due to fewer holidays and more working days. An ARPU increase in the 3rd quarter may be due to increased roaming from holidaymakers.

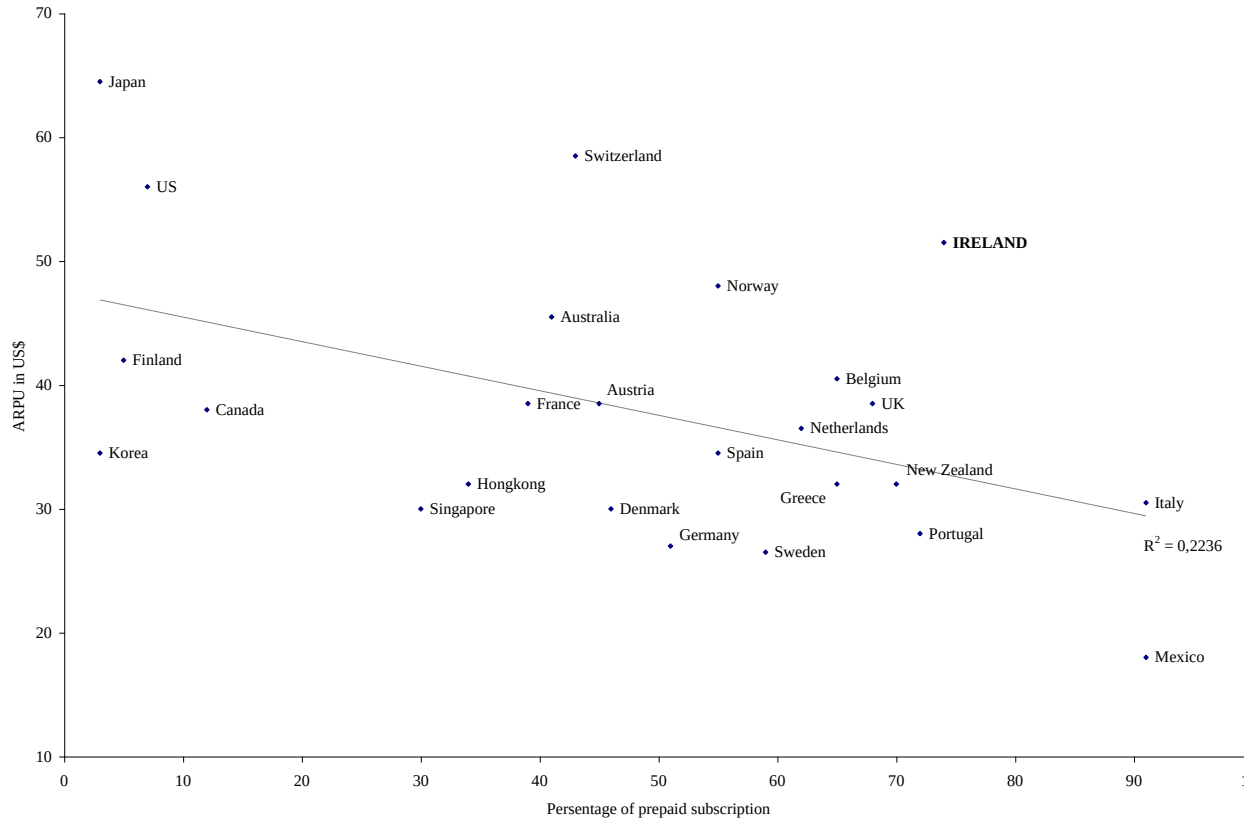

Figure 6-4: Share of prepaid subscriptions vs. ARPU, Q2 2004 [GWM2004].

As expected, there is clear evidence of a negative correlation between the two factors. Countries with a smaller share of prepaid users generally record higher revenue figures than those with a higher percentage of prepaid customers. Countries with a relatively low proportion of prepaid users (below 10 per cent), such as Japan and the US, generate among the highest revenues per user. Surprisingly, Switzerland and Norway prove that a comparable performance can be achieved with a medium share of prepaid customers. Expectable, nations with a traditionally high base of prepaid users, such as the Mediterranean and South American countries, exhibit ARPU figures, which are half the level of the former group. In the mid range there is evidence of some diversity. Countries such as Denmark or Spain record higher revenue figures than Germany although all have similar shares of prepaid users. Most controversially, the Irish cellular market recorded a performance that is virtually *on-a-par* with those in the US and Japan despite having a prepaid share of 74 per cent. Ireland's performance is clearly significantly at variance with the general trend and places Ireland in a unique position.

Ireland's performance may partially be explained by demographic factors. Ireland has the largest proportion of young people in its population within Europe, which has in recent years been boosted by some 250,000 migrants [ESRI2007]. The needs of this user segment,

comprising teenagers, students and migrants residing in rented and institutional accommodation, are particularly addressed by prepaid packages due to the limited ability of this group to qualify for a contract subscription. Ironically, whereas ownership cost of a prepaid cellular phone is relatively small, usage costs are rather high – a conjuncture that is reflected by ARPU and MOU statistics[160]. Most notably, V-IR's prepaid ARPU alone is *on-a-par* with most European composite ARPU figures, a fact which supports the widely held view that Irish mobile subscribers are among the most active users. Besides, the strong growth in the Irish economy may well be mirrored by mobile telephony usage. Nevertheless, the similarly concentrated Norwegian and Swiss market revenue performance is broadly consistent with expectations contradicts explanations of high earnings based upon the effects of strong market concentration. Indeed, overcharging is a recognised feature of monopolistic or duopolistic markets in which competition is restricted. Evidence may be seen from a comparison of ARPU per minute of usage (US$ per MOU) as depict in Figure 6-5.

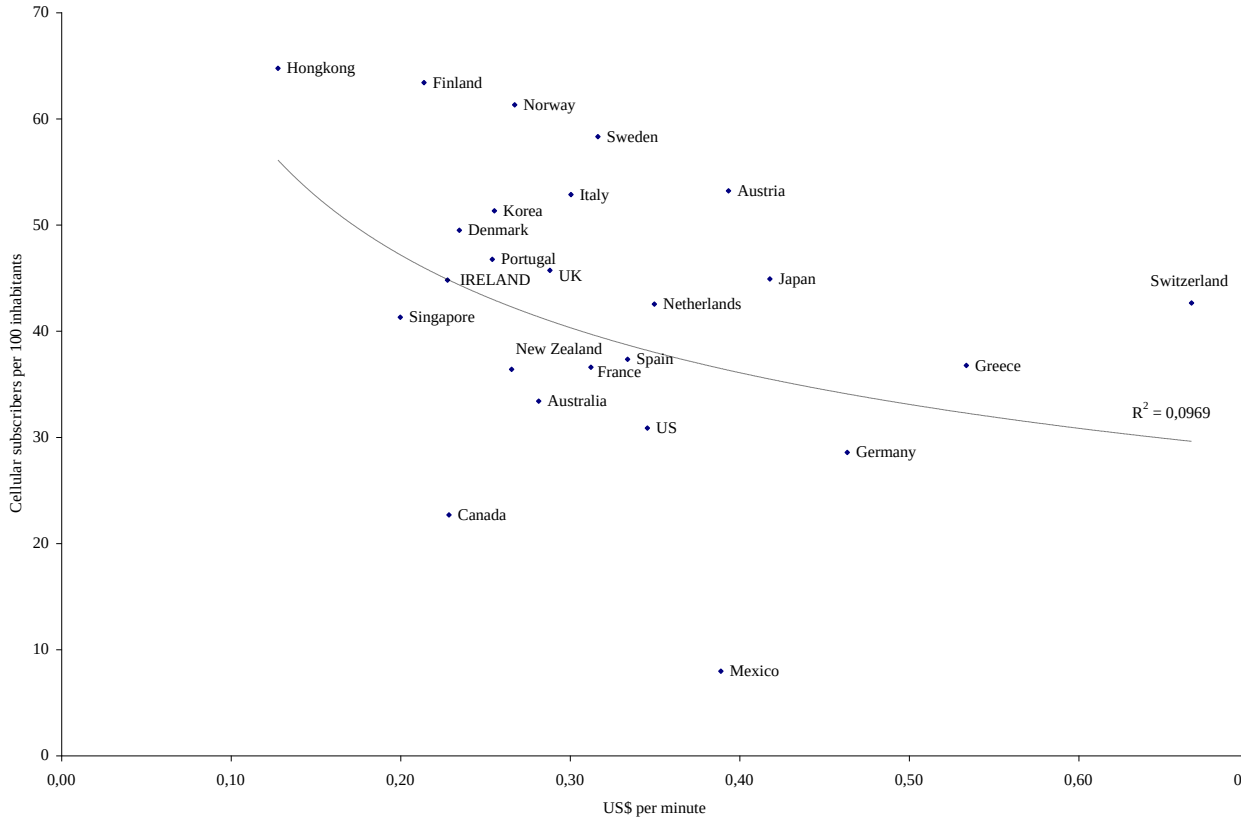

Figure 6-5: Minute rate in calculation based on ARPU in US$, 1999 [GWM2004].

[160] Vodafone Ireland recorded a prepaid ARPU of €364 while post-paid ARPU was €1150 for the year 2003. the resultant composite ARPU was €582 [tele2004].

Given that the minute rates vary from US$0.128 in Hongkong to US$0.667 in Switzerland while the Irish figure of US$0.228 appears consistent with its European counterparts. Hence, it could be anticipated that high usage levels substantially account for relatively high operator revenue earnings despite the climate of increased competitiveness. Significantly, data services revenue is also included in the ARPU figure, which disturbs the former computation. Hence, a comparison of mobile telephone tariffs may provide another dimension for analysis[161]. Given the popularity of prepaid cards, Irish performance on the basis of this basket type may help to provide an explanation for the high level of ARPU since expensive call charges combined with extensive levels of usage will result in high revenues. The following Figure 6-6 illustrates relative Irish performance, on each of the four types of usage baskets, in comparison with 18 other EU states. In this figure rank '1' signifies the least expensive and rank '19' the most expensive.

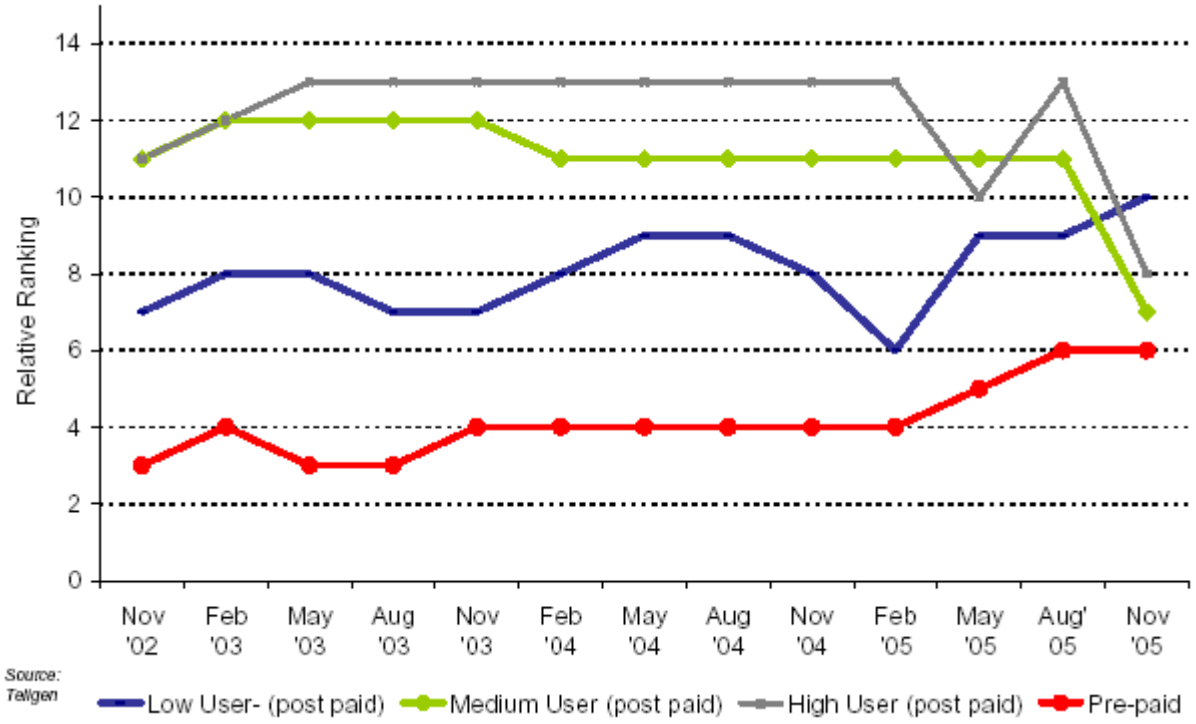

Figure 6-6: Ireland's rank on the OECD baskets relative to EU19, Nov. 2002-Nov. 2005 [ComR2005c].

Controversially, the assertion that Irish call charges are extraordinary high is difficult to sustain. In particular, its low user and, foremost, prepaid basket is among the most affordable[162]. Clearly, on the basis of the OECD basket approach, Irish wireless charges may be considered to be moderate, with no evidence of over-charging.

[161] Given that operators introduced various tariffs to suit their different target groups, the OECD established four baskets to represent the most common patterns of usage: low-user, medium-user, high-user and prepaid user.

[162] Controversially, the data was published by [ComR2006] which argued that the market is not competitive enough.

While the Irish's large volume of voice calls massively contributes to the country's strong ARPU it appears necessary interesting to investigate the link between revenue and the usage of non-voice services. Indeed, with more and more markets maturing to saturation operators turn to new revenue sources such as non-voice services. This holds even truer since high levels of MOU do not necessarily translate into correspondingly revenue[163]. The following Figure 6-7 illustrates the percentage of non-voice revenue on total revenue for selected countries.

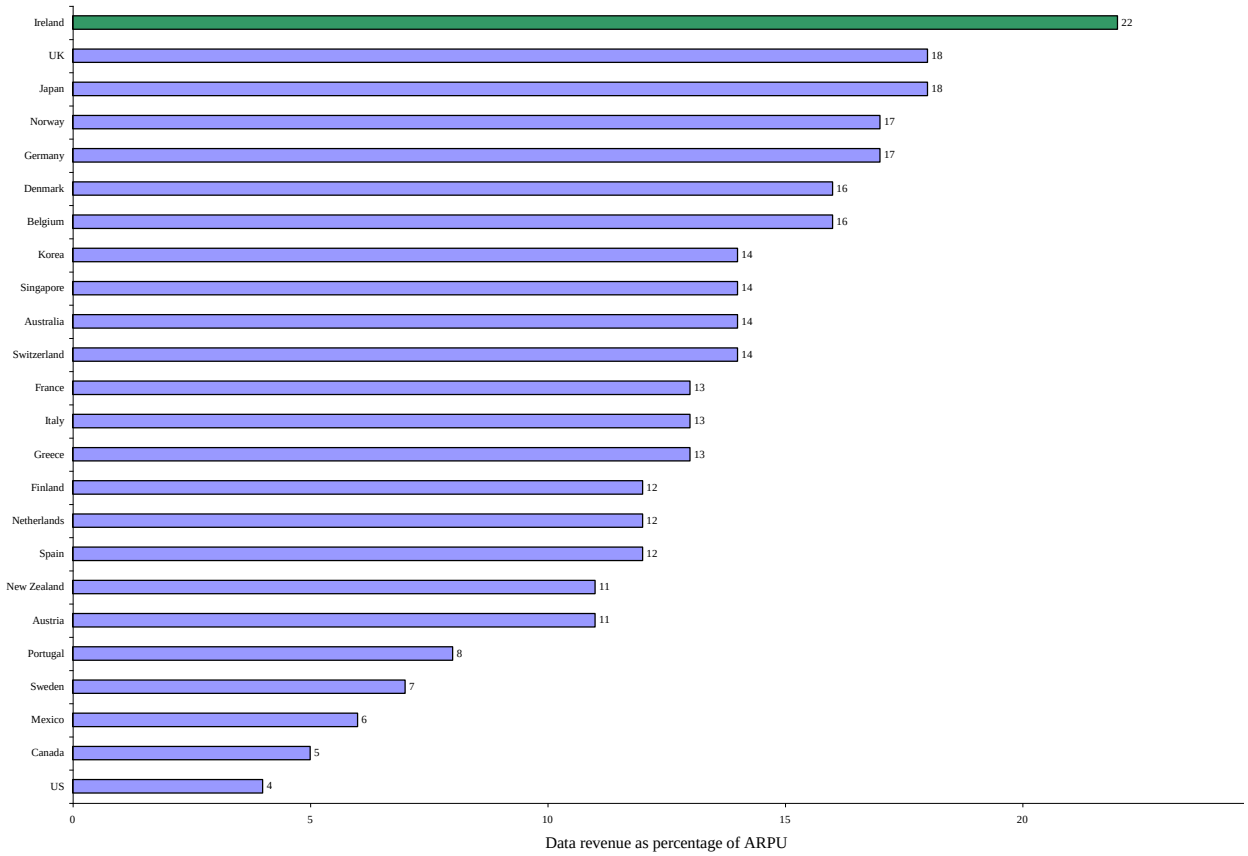

Figure 6-7: Data revenues as percentage of total revenues in Europe, Q1 2006 [ComR2006].

Startling, Irelands ranks at the top of the benchmark followed by the UK and Japan (due to its internet-enthusiastic 'imode' customers). Surprisingly, internet-savvy North America ranks at the bottom end underpinning the legacy of its advanced PSTN network which fortifies the reliance on wireline infrastructure. ComReg assumes that the Irish level is largely attributable to the

[163] An increasing in MOU is likely a reflection of decreasing prices and of a generally wider acceptance of, and reliance upon, wireless services. Carriers believed that major market segments were significantly price-elastic and that therefore, falling prices would serve to stimulate both demand and use of services; increased usage would be sufficient to offset per-minute price declines and cause ARPU to rise. Decrease in ARPU may also be attributed to more offers of *free-minutes* pricing plans, promotions and an increase in low-spending customers.

increased use of data cards and the exceptionally high levels of SMS [ComR2006]. Most significantly, the data indicate that the Irish user do not compensate voice calls with data services.

6.2 Regional and Cultural Aspects that contribute to talkative Behaviour

As suggested in the previous section regional, or cultural factors may also influence the usage level of mobile telephony as demonstrated in the following cases.

6.2.1 The Role of Language

Some evidence for these hypotheses is provided by [Itoh1991] who claims that regional climate has an influence on the level of people's likeliness to talk. [Itoh1991] quotes [Haga1979] who writes, "*if you take a train in Tokyo and go to westward (actually, 'westward' means southwest in Japan), you will notice that the train becomes quiet noisy.*" Although this might be a stereotype [Itoh1991] state, "*in northern Japan temperature in winter is so low that people try not to open their mouths so as to not lose heat […] because northern Japanese dialects requires less mouth movement than southern dialects.*". Subsequently, high temperature may stimulate individual's motivation to talk as evidenced by the talkative Italians or Spaniards[164].

The Finish performance shown in Figure 6-1 contradicts the stereotypical assumption of the 'Silent Fin'. According to [Leht1994] the "*Finnish silence is more a virtue than a cultural norm*". Hence, [Leth1995] argued that these stereotypes do not reflect actual communication habits. Moreover, [Heik1996] reports that the Finns were amongst the most enthusiastic users of libraries in the world, thus supporting the notion of the Silent Fin. Their natural reluctance of Finns to converse may derive from 100 years of Swedish rule under which use of the Finnish language was prohibited[165]. Coincidently, Risto Linturi, of Helsinki Telephone Company, points to the importance of information sharing for the Finnish population[166]. Indeed, the efficient optimisation of information is the key to surviving Finland's long, dark winter. As evidence, Linturi refers to Finnish folk tales in which the heroes are characters whose principal talent is in

[164] On a similar note the territory might also have some influence on the method of communication as observable in the melodic yodelling practice of residents in the Alpine regions of Switzerland. The origin of the yodelling dates back until the pre-Celtic era and was a way of communication between shepherds, hunters and gatherers on the Alms [WSJV2012].

[165] Interestingly, the Irish nation experienced similar suppression by their English neighbour which might have translated into identical implications.

[166] This networking approach is also evident in Finnish Nokia's slogan 'Connecting People'.

storing and utilising information: "*To survive through the winter in a country like Finland, you don't need heroes and you don't need power. You need information. You need lore. […] If you share your winter survival optimisation techniques with others, they may well be more likely to share their information with you*"[167], [168] [Leon2000].

Of similar importance is the central role of the national language that can not stressed enough given that it forms part of a culture and is also "*the symbolic representation of people, since it comprises their historical and cultural backgrounds as well as their approach to life and their ways of thinking.*" [Jian2000]. The close link between the two elements is supported by [Brow1994]: "*A language is a part of a culture and a culture is part of a language; the two are intricately interwoven so that one cannot separate the two without losing the significance of either […]*". This relationship is most prominently illustrated in the case of France. As depict in the benchmark of Figure 6-1 France scores the second highest voice communication usage level which may not come as a big surprise given that the strong nationalism among the French society. Given the above made statements it is understandable that the French language is "*seen as a pillar of the nation-state, as 'cement'*" [UNC2012].

Now, against the Irish background Barry Maloney's, ESAT Digifone, notion that the "*Irish people love to talk*" provides incentives to investigate the crucial link between culture, language and the 'talkative' tradition of the Irish people. "*Ireland is a society of strong literacy and verbal tradition*" [Kenn2012] which contributed to the sense of nationalist identity. Unequivocally, "*Ireland is famed throughout the world for the art of storytelling*" [Stor2012]. It is an ancient art form and *"has a multifaceted history of use including, education of both children and adults, history keeping, law making, conflict resolution, community decision making and mental healing.*"[169] [AnSg2002]. Indeed, story-telling plays a vital part in spreading information to people at the time of the druids[170] since reading was largely restricted to the elites [Swee2012].

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[167] The Linux operating system as an example of the optimum use of information. Linux continues to develop on the basis of an Open Source philosophy and, despite being criticised as non-innovative, it represents a significant improvement on Unix, its much older, proprietary, antecedent.

[168] Curiously, the idea of sharing information could also be seen to be deeply routed in the Swedish identity given that a group active in file-sharing has officially registered as a religion under the name 'Church of Kopimism' – derived from the words 'copy me'. This even more crucial since the world's largest file-sharing website 'Pirate Bay' was founded in the country [Reut2012].

[169] [Libr2012] provides more details: "*The tales were brought into direct touch with the people, not by reading—for there were few books outside libraries, and few people were able to read them—but by recitation: and the Irish of*

Another historical event that may have influenced the Irish's relationship with both their culture and their language was the English invasion and suppression. Significantly, the 'Statutes of Kilkenny' and the harsh 'Panel Laws' restricted most activities for Catholic (later Irish) people: *"[…] much of Catholic Church services and education and record keeping was forced underground, to operate only under extreme secrecy. The religion and culture were kept alive by secret open-air masses and illegal outdoor schools, known as 'hedge' schools*[171]*. All Irish culture, music and education was banned.*" [Ance2011]. Further, it was against the law to speak or write in the Irish language [Donn2001]. The hedge schools therewith were a medium to conserve and to keep their culture and identity alive.

6.2.2 Pragmatic Use of Unlicensed Radio Broadcastings

Hence, it can be assumed that the Irish similarly consider their language as a fundament of their culture. Given the long period of oppression of the mother tongue/culture it does not come as a surprise that rebels of the Eastern Rising made themselves heard by using a Marconi ship transmitter[172] [Sext2005e] therewith expressing their lust for freedom and free speech.

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all classes, like the Greeks, were excessively fond of hearing tales and poetry recited. There were professional shanachies and poets whose duty it was to know by heart numerous old tales, poems, and historical pieces, and to recite them, at festive gatherings, for the entertainment of the chiefs and their guests: and every intelligent person was supposed to know a reasonable number of them, so as to be always ready to take a part in amusing and instructing his company. The tales of those times correspond with the novels and historical romances of our own day, and served a purpose somewhat similar. Indeed they served a much higher purpose than the generality of our novels; for in conjunction with poetry they were the chief agency in education— education in the best sense of the word—a real healthful informing exercise for the intellect. They conveyed a knowledge of history and geography, and they inculcated truthful and honourable conduct. Moreover, this education was universal, for though few could read, the knowledge and recitation of poetry and stories reached the whole body of the people. This ancient institution of story-telling held its ground both in Ireland and Scotland down to a period within living memory.

[170] In ancient Ireland the Druids were the high priests of the Celts and "*were responsible for the social fabric of Celtic Life,*" since they advised and taught kings and chieftains while supervision rituals, diving, the future, astronomy, mathematics, medicine, law, and the history of the Celts themselves [Swee2012].

[171] "*The Hedge School had done what was needed to demonstrate that the Irish would defy laws that where aimed at destroying their culture and they demonstrated the love of the Irish for learning. They also give us many romantic visions of children and a Hedgemaster studying Greek and Latin with the sky as their ceiling and the emerald green turf of Ireland as their floor. (John Walsh)*" [Gymn2000].

[172] Marshal McLuhan: "*1916 was the year of the Irish Eastern rebellion and the first radio broadcast (in Europe). The Irish rebels used a ship wireless to make not a point-to-point message, but a diffused broadcast in the hope of getting word to some ships that would relay their story to the American press. And so it proved.*" Controversially, R. J. Levey, who was surveying 'pirate' radio and TV stations, replies to McLuhant: "*Such a broadcast may well have*

The appearance of "*known deliberate misuse of wireless broadcasting*" seems not be a phenomenon restricted to political issue as an article in the Irish Times in 1935 regarding an 'mysterious announcer'[173] indicates. However, it took until the 1960s that pirate radio came in the broader awareness of the public with the launch of off-shore station that transmitted from vessels such as the British 'Radio Caroline[174] or marine structures. In particular, the rather conservative policy on both music choice and licensing of private broadcaster next to public national broadcasters [h2hg2007] were among the contributing factors for the emerge of off-shore radio stations. This view is also shared by Mr. Cooke, of 'Radio Dublin' at the time: "*If you are turn on R.T.E., nine times out of ten somebody's talking. Your chance of hearing some one talking on Radio Dublin are very slim; if they are talking they're probably introducing a record. R.T.E. doesn't understand what people want in music.*" [Arms1977]. While demand for younger generation music was a clear driver so was Irish language programme as illustrated by 'Saor Chonamara' radio, ran by the Gaéltacht Civil Right's Movement, following the "*government's fauilure to provide a long-delayed Irish language station.*" [Iris1970].

Expectable, the wireless medium was also utilised in the most dramatic times of 'The Troubles'. Indeed, Belfast featured several pirate stations such as 'Voice of Ulster', 'Radio Orange' or 'Radio Free Belfast' but the Army tried to "*jam stations selectively, as when they are thought to be putting out particularly inflammatory material.*" The Belfast Telegraph even described the illegal stations as "*a new and sinister factor in the religious-political war.*" [Iris969]. In contrast, the situation in the Republic were more lax given that only 'search and seize' operations were carried out by the DPT under the Wireless Telegraphy Act, 1926-1972[175]. It took until the Broadcasting and Wireless Telegraphy Act 1988 which provided significant changes such as the possibility of local radio stations, a new national station and independent TV

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been a 'first' but its real significance was perhaps not that attributed to it by McLuhan. More importantly, it was the first known deliberate misuse of wireless broadcasting and a sad precedent for the decades to come." [Sext2005e].

[173] "*It was learned t-day that a 'pirate' radio station is being operated in Limerick […]. The mysterious announcer can be heard at intervals; and, as well as broadcasting his own views on topical events and commenting on political personages, he gives unwilling listeners the benefit of his vocal abilities in the form of popular songs. So far the authorities have failed to locate the station, although a detection van patrolled the city.*" [Iris1935].

[174] Its founder was the Irish businessman and music manager Ronan O'Rahilly; his grandfather was Michael Joseph O'Rahilly who fought with the GPO garrison during the Easter rising [Cois2010].

[175] Controversially, the penalty of IRP50 for the unlicensed possession of transmitting apparatuses and the inaction of the Government in enacting appropriate legislation encouraged the pirate to postpone a constitutional challenge which would have provided them with the right to broadcast similar to their right to publish the printed word.

station [Iris1988] which should both reduce the attractiveness of illegal stations[176]and the opportunity to get legalised. However, matters did not alter much given that over 40 pirate stations were found operating in 1997 given that "*the Department of Communications has not prosecuted any illegal station since 1992.*" [Iris1997]. Following large-scale raids in the mid-2000s [Indy2003] alongside an increase in private stations and the internet's streaming features unlicensed broadcastings still appear to have a significant presence in Ireland as illustrated in Table 6-1.

Table 6-1: Number of unlicensed Broadcaster in CEPT countries, 2003 [WGRA2004].

Country	Number of unlicensed Broadcasters
Bulgaria	46
Germany	27
Hungary	32
Ireland	70
Netherlands	800
Slovenia	10
UK	248

The Regulatory Affairs Working Group (WGRA) notes that in Scandinavia the phenomenon of unlicensed broadcasting is "*virtually unknown*", in contrast to the Netherlands, which features 800 unlicensed, stations [WGRA2004]. Most significantly, the WGRA analyses that "*in practice, the cultural differences seem as important as the legal penalties and the power of the Enforcement Authorities,*" for the differences in the results between the countries which underpins the significant role of culture.

Still, the Irish's excitement for the spoken word is evident by the popularity of privately owned broadcaster Today FM's most controversial program 'The Last Word' or RTE's Radio 1 program that predominantly host speech programming and features listeners opinions by means of call-in contributions [Ken2012]. Altogether, the described phenomenon of 'pirate' and speech program broadcastings can be seen as a consequence of the century long suppression of their language which forms an essential part of their identity. Hence, the society celebrates their gained freedom of expression by raising their voice to air their opinion and thoughts. In the light of the accumulated data presented in Figure 6-1, it can be concluded that the high levels of

[176] Unfortunately, 85 applications for only 25 licences were received which left most of the pirate stations with the choice to proceed illegal or to cease operation all together.

ARPU occur as a result of exceptionally high levels of both voice and data service use due to the Irish's national tradition of talking which is currently unmatched in Europe. Consequently, the Irish emerge as the most enthusiastic cellular phone users in Europe, which again highlight the unique characteristic of the Irish cellular telephony market. Hence, it can be assumed that the high ARPU figures criticised by some institutions and parties are a matter of the astonishing high levels of cellular phone usage. It may be that in an affluent society at the time of the Celtic tiger cost awareness was not a top priority, which might have further contributed its part to the relatively high revenue figures.

6.3 Cost Awareness During the 'Celtic Tiger' Era

Although users are generally aware of the higher call charges applying to mobile calls relative to fixed-line telephony, it appears that some customers still favour mobile telephone calling due to convenience factors or peer-group influences even if more economic alternatives are available. Despite the economic irrationality of their decision, customers are evidently willing to pay a premium to make a call 'right here right now'. While mobile telephone users in poorer economies may closely consider tariff and cost-saving options, their counterparts in affluent societies are less price-sensitive and may not investigate alternatives to the same extent. However, while proving such behaviour traits is beyond the scope of this work, differences in cost awareness were highlighted in a joint ODTR/Oftel study from 2002 on mobile roaming [ODTR2002]. A principle result of the study was that RoI customers (38 per cent) tended to use their mobile phone abroad more frequently than their counterparts in the UK (19 per cent) or NI (23 per cent).

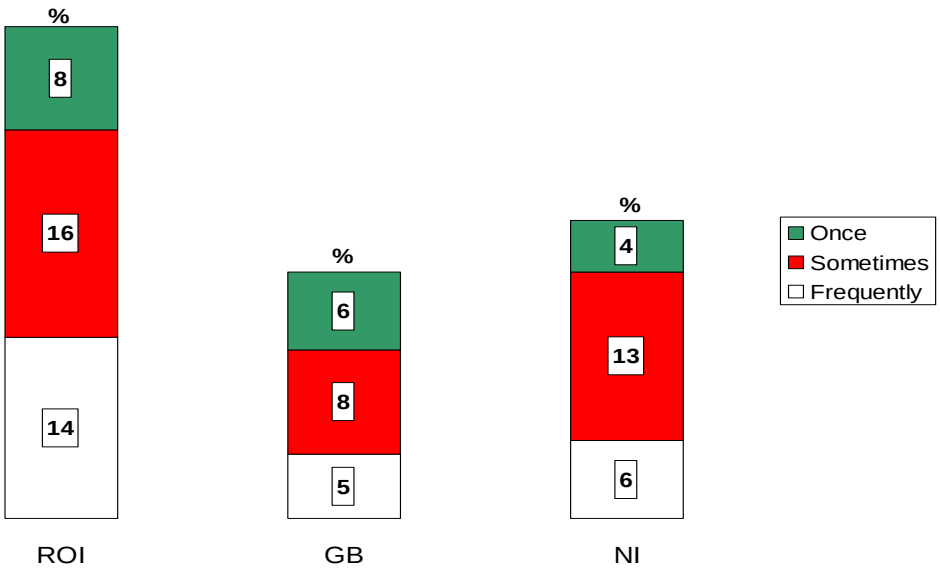

Figure 6-8: Frequency of mobile phone usage abroad [ODTR2002].

The higher reported level of roaming activity of RoI users may be largely due to a high level of cross-border travel. Controversially, although RoI mobile users are more used to roaming, they are less aware of, or sensitive to, the increased costs. A higher percentage of mobile roaming customers in the UK (69 per cent) and NI (76 per cent) display at least an approximate knowledge of their roaming costs in comparison to an RoI figure of 57 per cent.

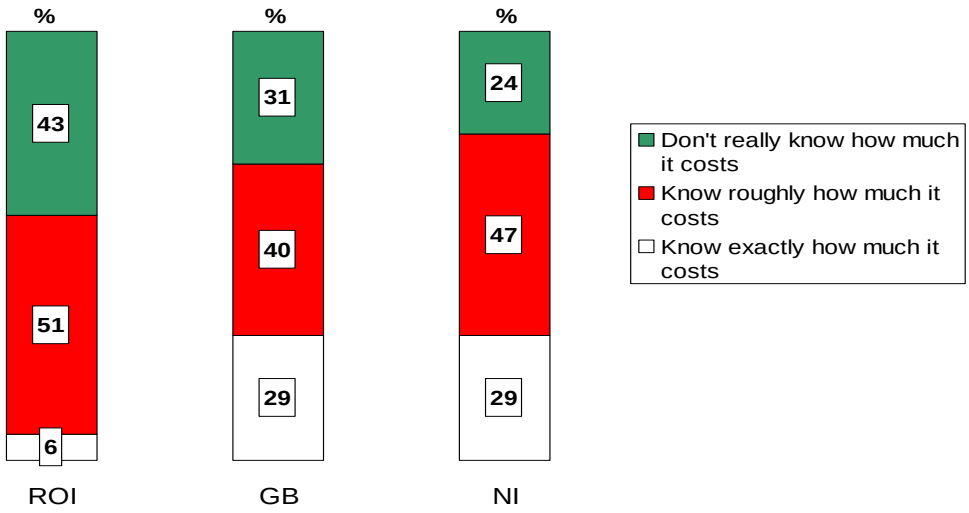

Figure 6-9: Roaming customers' awareness of costs when abroad [ODTR2002].

The study found that, despite the fact that 90 per cent of the RoI roamers were aware of at least one method of reducing roaming costs, compared to 76 per cent in the UK and 81 per cent in NI, the latter countries make greater use of these reduction methods than customers in the RoI [ODTR2002]. Significantly, it may be argued that, although mobile phone users in the RoI are broadly aware of methods to reduce their costs, only a mere 31 per cent actually avail of them, compared to 43 per cent in the UK and 42 per cent in NI. Consequently, it may be controversially argued that mobile phone users in the Republic are so prosperous that they just do not feel the need to optimise their spending.

The findings of the joint ODTR/Oftel study finds support from the EU Commission-compiled Eurobaromater survey concerning mobile phone usage when travelling in the EU. According to the survey 81 per cent of Irish cellular users favour SMS messages whilst only 24 per cent of Portuguese do [Iris2011]. Consequently, it appears that Irish cellular telephony subscribers show relatively cost insensitivity behaviour in relation to roaming activity, which add to the phenomenon of the overall high mobile phone revenue performance.

This chapter has shown that the exceptional high levels of ARPU generated in Ireland are a consequence of a variety of usage patterns as well as cultural factors. This work demonstrated that the Irish growth in revenue figures during the period 1999-2004 was unmatched by any of its European counterparts which gave rise to the assumption that Irish users were victims of a '*rip-off*' phenomenon. However, it was shown that its performance was on one hand influenced by a disproportional ratio of high-usage prepaid customers which are traditionally expected to be low-spending users; when recalling that these costumer segments are willing to pay a premium for the flexibility and freedom that comes with prepaid card service the impact is likely to be seen. On the other hand it was shown that by using operators' key performance figures that the Irish minute rate is fully in line with its global cohort and therefore, neglecting the existence of a '*rip-off*' scenario. This finding was underpinned by OECD statistics which state that the Irish rates are moderate with no evidence of over-charging – particular the case for the costs of the crucial prepaid basket.

Indeed, this thesis confirmed that the high revenue figures are a result of above average both airtime as well as data service usage. Hence, a link between the extravagant standard of airtime consumption and the Irish culture was established. In particular, it was shown that Ireland's legacy of story-telling as well as the British domination, which suppressed the practice of the native mother tongue, contributed to its central role in Irish history. This was seen as the fundament and source of identity that could not be eliminated like other comparable domestic goods or rights such as churches, property or occupation. Another prove of the significance that language has in Ireland was found in the high presence of speech radio programs as well as the pragmatic approach towards 'pirate radio', both forms can be interpreted as the Irish's means to make themselves heard as well as taking their matters into their own hand to express their identity as well as a celebration of their culture.

Finally, this chapter has shown that the tremendous Irish performance figures are likely to be influenced by a narrowed view on the area of cost awareness, a phenomenon that is helped by an affluent society during the 'Celtic tiger' era that translate into a sphere of cost insensitivity.

7 Conclusion

This work has primarily been concerned with identifying and assessing the impact of the principal factors which influence the diffusion of mobile telephony and its level of usage among selected OECD countries, and in particular in the Republic of Ireland. It has been shown that the point of introduction and rate of adoption of such technological innovations varies between countries and regions. Benchmark analysis has revealed that, in the selected countries, overall mobile telephone penetration has been rapid and does not follow a single, traditional, S-shaped diffusion curve pointing to the existence of national, and cultural, factors influencing the adoption and diffusion process. Indeed, penetration performance have been shown to be influenced by the selected system standard and the state of the legacy telephone network of the region. It has also been demonstrated that culture and socio-demographic aspects are important determinants of diffusion and that appropriate tariff options are capable of unlocking major potential market segments. Simultaneously, the level of usage did show large deviations among the selected countries indicating similar local dependencies. Additionally, comparative investigation has revealed that competition, as represented by the number of wireless operators within a country, does not necessarily lead to higher levels of mobile phone penetration. Clearly, what has emerged is a picture of the complex interplay of diverse factors which act to moderate the diffusion of mobile phone technology and which vary significantly in impact between economies and cultures thus making the establishment of general predictive rules for market behaviour exceptionally difficult. Most significantly, the Irish case illustrates most prominently the determine role of cultures that is derived from historical events up until ‘Celtic tiger’ times.

Following Roger’s theory certain Irish attributes emerged as favourable in supporting the diffusion of an innovation. One of the most crucial elements were the living structure of Irish households coupled with their share of households with children which appear highly receptive for word-of-mouth communication since it this constellation forms a close knitted network. Additionally, Ireland’s long history of immigration appears to have created a cosmopolite society since immigrants around the world interchange information about subject of their new host country with their relatives and friends in the home country. This phenomenon was recently re-fuelled by the country’s strategy towards an open economy to attract foreign companies which again created multiple ways and links for the exchange of new ideas. Most crucial, Ireland was found to have a ‘classic early adopter market’ characteristic, partly due to its small population which reacts fast to new technologies indicating a significant level of innovativeness.

Controversially, in contrast to Roger's generalisation of early adopters being not different from late ones this study found that age plays an import role in the adoption process of innovation if the new technology if priced reasonable which is the case for prepaid phones. The extent of the correlation between GDP, and GDP growth performance, and mobile technology penetration has not been shown to be homogenously observable, probably due to an analytical inability to compensate for the impact of market maturity factors. Indeed, a regression model revealed that a strong correlation between wealth and mobile phone adoption could not be established and that wealth is not as important among the selected OECD countries than in a global contemplation. This gives rise to the assumption that in poorer countries people have to weight the 'luxury' of a mobile phone against more vital needs such as food or travel. Finally, the influence of culture was confirmed with uncertainty avoidance having the most prominent impact on cellular telephony adoption. By widening the scope to include religion it has emerged that Catholic countries tend to be naturally more conservative than their Protestant or other Christian counterparts and consequently have been observed to be relative laggards in terms of innovation adoption. Controversially, Ireland, the most Catholic country in Europe, has been shown to behave anomalously in that it is characterised by a level of uncertainty avoidance similar to that encountered among its Nordic neighbours or British-influenced nations and to have similarly experienced exceptional levels of cellular phone adoption and usage. Given that Ireland was one of the few places in Europe to escape Roman occupation, it can be suggested that the Irish did not adopt the beliefs and conservative value system of the Romans (Catholics). Altogether, this contradiction puts one of the most common stereotypes associated with Irish culture into perspective.

Expectable, technological aspects such as the legacy telephone networks and the mobile telephone system standard might play a pivotal role in the diffusion of cellular telephony. The status of the fixed-line telephone infrastructure within a country has been shown to be a driving factor behind the adoption of cellular telephony. A clear correlation between the availability and quality of a PSTN connection and the level of mobile subscription has been established. Typically, poorer economies are seen to have outperformed richer countries in terms of mobile penetration performance as a result of high levels of substitution and an absence of a viable communications alternative. As for the Irish case it emerged that applicants for a fixed-line telephone suffered from a slow moving incumbent operator resulting in long waiting lists. Controversially, while this in part may reflect of the ignorant behaviour of the incumbent it was found that the Irish government underestimated the potential and the benefits of the telephone, particular for rural Ireland. Consequently, people welcomed the launch of mobile telephony

services and took matters virtually in their own hands by migrating towards cellular telephone services since its inauguration in the late 1980s. Ironically, this happened at a time when the government had recognized the fundamental importance of a state-of-the-art telecommunications infrastructure and upgraded its network to attract foreign companies to locate in Ireland. Unfortunately, it appears that the negative experience with the unavailability of a fixed-line telephone was so profound that Ireland still records one of the lowest PSTN density levels among its European cohorts while its mobile telephony penetration overtook its fixed counterpart in 2001.

A cellular telephone system's underlying network standard is found to have been one of the most crucial influencing factors in the process of mobile diffusion. As a result of an examination of the historical market impact of various analogue system standards and of their global level of acceptance, it has been found that the deployment of a 'global' standard tend to result in more rapid technological acceptance and adoption than proprietary solutions. This was most successfully demonstrated by the Irish's decision in favour of the global TACS technology which assured attainment of economies-of-scale and of consequently affordable costs for equipment and services. Additionally, it enabled the Irish incumbent to strike an advantageous deal with its privately-owned British counterpart that enabled the former subscribers to enjoy a flavour of international roaming with the UK, a novelty outside the NMT arena at the time, a fertile result of the ambivalent relationship between the two countries. Curiously, it also encouraged the Irish people to take advantage from the global availability of TACS handsets in that they sourced handsets from non-domestic markets.

In parallel with technological developments and increased network deployment it has been shown that operators paid increased attention to market segmentation and introduced a variety of tariff schemes designed to meet the needs of specific business and general consumer groups and consequently increase the public attractiveness of mobile telephony. From a global perspective it emerged that national calling patterns of PSTN customers have an influence on the underlying billing arrangement (MPP in North America and some Asian countries CPP in most of the remaining regions) of mobile telephone calls which in return influence the attractiveness and subsequent likeliness of mobile telephony adoption. A key finding has been that it was vitally important for operators to embed mobile telephony as gently as possible in the traditional environment of the PSTN and simultaneously being able to create a positive and risk-free perception of the new way of making a telephone call. At the same time, operators had to present the mobile telephone as an convenient interpretation of the established traditional fixed-line

telephone. Hence, a variety of tariffs options are on offer that lower the cost of ownership to cost-sensitive and low-usage customers, the most innovative being prepaid card services which account for about 75% of all subscriptions. Astonishingly, although the prepaid concept was not developed by an Irish operator, Eircell took a revolutionary approach in selling these kind of product. Backed by a massive media campaign and strategically perfectly launched in the run-up to Christmas the operator offered its prepaid card service as a 'mobile-in-the-box' which could be purchased right from the shelve without the need of credit check or registration, transforming the cellular telephony to a democratic tool of communication affordable for virtually anybody.

Controversially, investigations have revealed that customers were not as cost-sensitive and their spending profile was not as homogenous as anticipated. Again, the underlying billing arrangements account for the general variances between MPP and CPP countries. Among the CPP group of nations, Irish prepaid subscribers spent, on average, even more on mobile telephony than contract subscribers elsewhere. Moreover, the high operator revenues are found to have been significantly derived from high levels of usage rather than from the imposition of premium charges. Accordingly, an in-depth investigation of the usage patterns of mobile subscribers and of the associated revenue stream earnings has been undertaken to allow the identification and comparative examination of the mobile industry's most important benchmarks, the average revenue per user (ARPU) and the minutes of use (MOU). As a result of this examination it has been found that Irish operators have attained leading positions, on a global basis, with regard to both their levels of MOU and their ARPU performance. In particular, the high ARPU figures caused the national regulator ComReg to express concern about possible anti-competitive 'joint-dominance' in the mobile market in the face of claims by some commentators of a '*rip-off*' of Irish users by both operators. However, it has also been found that voice telephony airtime consumption is an inadequate basis on which to explain clear differences in ARPU performance. Instead, a combination of MOU and mobile data service (non-voice) usage has been shown to provide a better basis for differential attainment. Again, the Irish users are among the world's most active mobile data users and this has been shown to have contributed significantly to Irish operators' remarkable ARPU earnings performance. Significantly, the combination of voice and non-voice service usage patterns has made the Irish the most enthusiastic mobile telephone users in Europe – which is more a consequence of the young demography as it is of a prospering society rather than a '*rip-off*' from operators.

Given the unique Irish usage pattern it was attempted reasons that contribute to this tremendous level of performance were identified. Following an investigation of certain tariff

schemes that may encourage individuals to make more use of their phone it was soon realized that particular tariffs were not exclusive to one country but rather widely distributed or even global nature. Based both on the stereotypical notion that ‘the Irish like to talk’ but also on the famous tradition of Irish story-telling an investigation on similar statements in other countries was conducted which indicated the interwoven relationship between language and a nation’s culture. Whereas the French regard their language as ‘cement’ the Irish under the British rule soon realized that their mother tongue would represent both a way to conserve their cultural foundations and to keep their identity alive. From this viewpoint the pragmatic use of unlicensed radio broadcastings following the country’s independence could be interpreted as the much-anticipated chance to raise their voice as a sign of regained freedom. It can be assumed that the mobile telephone is the latest tool to express the Irish identity.

Given the complexity of the performance scenario described in this thesis it was shown that a single or simple explanation for the observed variability in mobile phone penetration growth rates and levels of usage can not be formulated. This situation is not help with the added flavour of cultural artefacts which contribute to the establishment of a domestic *mobile culture*. From this viewpoint the Irish performance may not be regarded a sole outcome of a young, prospering society in the era of the ‘Celtic tiger’ but as a consequence of regional habits which resonate satisfying with the offered characteristics of a mobile telephone.

This thesis has investigated the unprecedented growth of the Irish mobile telephone market throughout the ‘Celtic tiger’ area, which was unseen in any other OECD country. It was shown that traditional models used to explain the market behaviour of the other OECD countries failed to explain this unprecedented growth. Therefore, initially the very high MPU and ARPU was attributed to the existence of a duopoly, which actively limits the markets competitiveness. However, this thesis has clearly shown that this was not the case and that the unique MPU and ARPU are in fact a sole result of regional, social and most important cultural factors. In particular they were a mix out of the young population of Ireland, strong inward emigration and most important the cultural and historical heritage of the Irish nation.

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9 Appendix

9.1 Appendix A: TV Reception in Ireland

One illustrative example of the Irish's hands-on approach of problem solving, which is in large parts influenced by the islands geography, is the evolution of TV broadcasting. According to Hall "*public interest in television [TV] in Ireland was heightened by the opening in December 1949 of the BBC transmitter at Sutton Coldfield. This transmitter enabled television programmes to be received at places along the East coast of Ireland*[177]." [Hall1993a]. Similar events are reported by Richard Logue: "*television had been available in Ireland as early as ten years previously when some enthusiasts set up aerials to receive BBC signals from the Holme Moss transmitter in North England.*" [Logu1996]. The first TV broadcast on the Irish island took place by BBC Northern Ireland from Belfast in 1953[178] [Line2012]. The reception of the signal was possible due to spill over signals from NI and Wales, which made the BBC, programme available to 40 per cent of the population in the Republic[179] [Enot2012]. Hence, the location of the Emerald Island enabled technological savvy and interested individuals to achieve their goal of watching TV long before its domestic launch[180] [Hall1993a]. On the other hand the government followed the indicated demand of the early enthusiasts and provided an "*Irish solution to an Irish problem*" [ibid.]. Following the economic growth in the 1960s some 50,000 TV sets had been sold in Ireland [Hoga2001] while initial community access television (CATV)

[177] "*Early owners of television sets in Ireland were classified by the Department of Posts and Telegraphs as 'mainly radio enthusiasts and people with sufficient money to indulge a craving for novelty.*" [Hall1993a].

[178] The Republic followed with the inauguration of Teilifís Éireann (RTE) in the VHF band on December 31, 1961[178] [RTE2012]. Controversially, months earlier the Televion Committee "*considered the issue of a television service being provided by means of a permanent link with the BBC via its station in Belfast,*" but was the proposal was rejected since it would "*prove to be a considerable and constant source of embarrassment.*" [Hall993a].

[179] The parts of Ireland that could not receive the British channels (so-called 'one channel land') were "*frequently slagged off by the Dublin media as a zone of ignorance, especially as the output on RTE in the 70s was often pretty poor, relying heavily on American imports and poor production values.*" [Logu1996].

[180] The influence of the close proximity of the two islands is also evident in the Irish provisional selection of the 405-line standard (invented by Marconi in England) at the Stockholm International Radio Conference in 1952 mainly due to the likelihood of interchange of programmes between both islands: "*It was obvious that the European 625 line system was probably the best but all TV sets at the time in Ireland used the British 405 line system. It was therefore decided that that a 405 line service would be used in areas that picked up the British signals but the rest of the country would use the technically superior 625 line system.*" [Logu1996]. Logue calls this strategy as an "*Irish solution to an Irish Problem*" [ibid.].

or cable TV services[181] were licensed [Hall1993b] given the "*attraction of British channels and hence more choice, and better reception for many people, analogue terrestrial signals cover about 90% of the population.*" [Enote2012]; Hall states, *"the demand for cable television in Ireland has been linked with fortuitous 'off-air' availability of British broadcasting programmes in what was called the multi-channel area.*" [Hall1993b]. Simultaneously, with the allocation of UHF frequencies for a second channel (RTE2 or Network2) debate[182] arose about its content. it was decided to re-broadcast BBC1, which would satisfy public demand for alternative (British) TV in 'one channel land' [Logu1996]. While the nation-wide deployment of a cable-based network would not be economically viable due to the scenery the government decided to opt for a multi-point microwave distribution systems[183] (MMDS) in 1989[184], or 'wireless cable' [Hall1993c].

[181] Services must carry RTE1, Network2, TV3 and TG4 while re-broadcasting the UK's three terrestrial TV channels given the large public interest. Interestingly, one licence was awarded to RTE "*to compensate for loss of advertising revenue which would follow from an anticipated decline in the viewing of RTE's programmes. It was anticipated that the 'foreign' channels would attract many viewers away from RTE.*"

[182] Although Network2 appeared to be in breach with the Constitution "*that specified that the State shall ensure that organs of public opinion 'shall not be used to undermine public order or morality or the authority of the State'*", John Kelly, TD, then Parliamentary Secretary to the Taoiseach, found that the arguments were "*unreasonable and hypocritical.*" Further, Kelly argued that "*re-broadcasting BBC was so minimal, so tiny, so imperceptible compared with the substantial culture conquest which has been made that it is not worth arguing about …*" [Hall1993a].

[183] Historically, "*MMDS started in the USA a number of years ago – the frequency allocation was 2.5 to 2.7GHz. The original idea for this frequency was for Pay TV, for use where people could not get cable (because usually it would be a semi rural location) and digital or satellite was probably not available. The 200MHz of spectrum could offer up to 12 channels of TV carrying local and national programmes as defined by the local broadcaster.*" [COBh2000]; MDS, its forerunner, developed in the 1970s, was primarily used for business data [Catl1995].

[184] William Dinan reports that "*for the purpose of franchise allocation Ireland was divided into 29 areas, each requiring a separate and exclusive cable operating licence [which] requires that the four national terrestrial channels […] must be carried[…].*" [Dina2001]. Chorus was among the largest licensees [Enote2012].

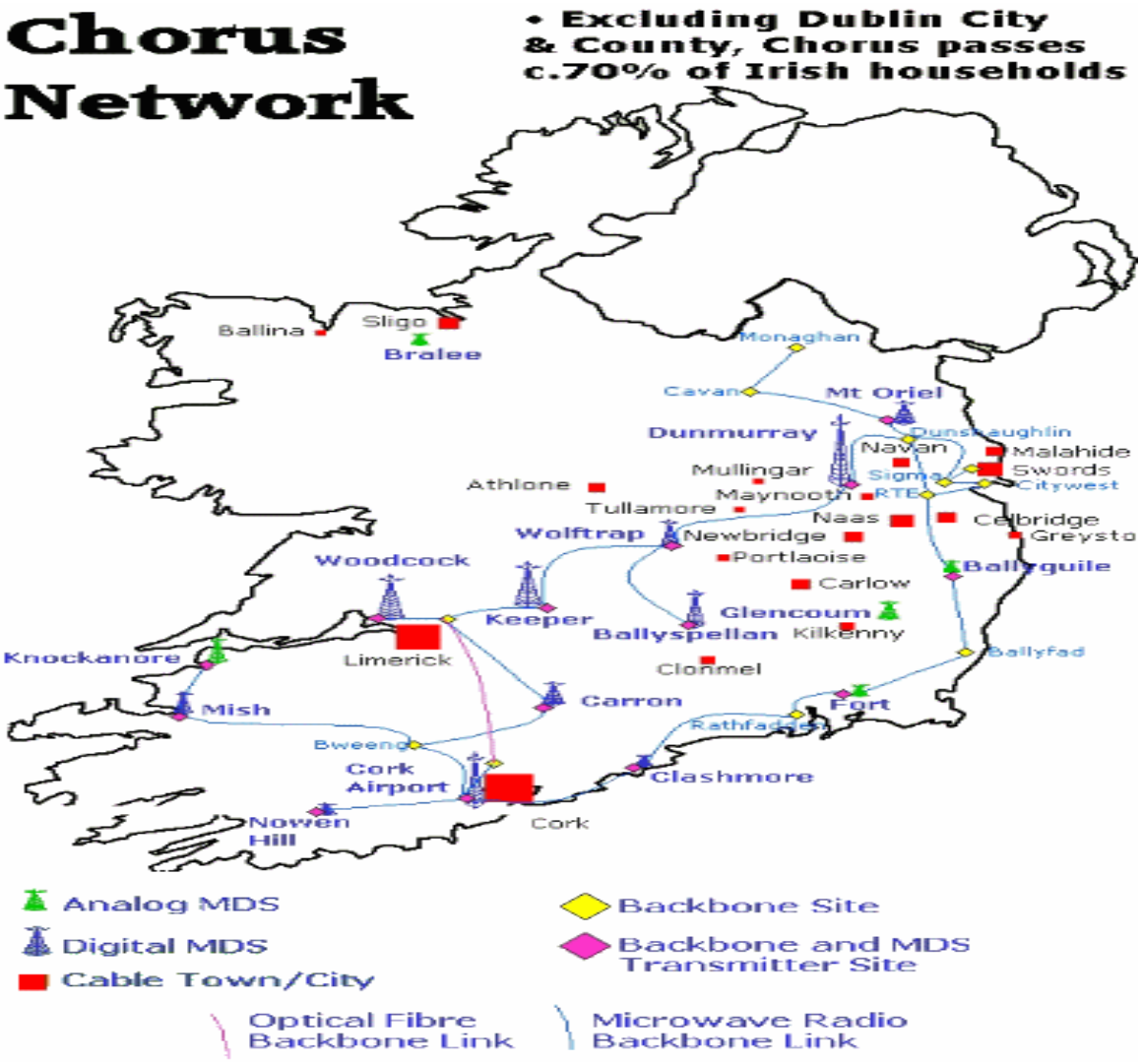


Figure 9-1: Chorus Cable/MMDS network, date unknown [Spon20210].

The government was enthusiastic about MMDS "*they felt they would be European pioneers*" [ICDG2002] but only the US enjoyed widespread adoption [ibid.]. The government answered the people's request for a wider TV choice while catering the territory needs: "*This is mainly due to two percurly Irish factors – we like British TV, and there is such there is such a low housing density in rural areas that cable would be impracticable.*" [ibid.]. The territorial particularities are evidently mirrored in the network structure; while the MMDS main transmitters generally cover an area of 20-30 miles radius the transmission has to be backed up by relay devices such as 'Beambenders', which will improve the reception in black-spot areas[185] [Cork2012a].

As a third example for the Irish's adventurous spirit and lust for innovative solutions the phenomenon of 'deflector TV' – or local aerial community TV – is examined. "*Originally, deflector services operated by receiving a 'spill over' analogue signal from Northern Ireland or*

[185] On a global scale, MMDS is used in countries such as the US, Canada, Mexico, Dominican Republic, Iceland, Russia, Slovenia, Brazil, Australia, Nigeria, Pakistan, Thailand, Uruguay, India, and Cambodia [Digi2008].

Wales at a high site, boosting that signal, and then retransmitting it locally." [ComR2012]. Given that cable systems proved uneconomically in an urban environment and MMDS operators asked for a services charge it comes by no surprise that "*in the early Eighties, entrepreneurial spirits […] began to work out that, with the right equipment, it should be possible to pick up British TV signals beamed down from the Northern Ireland at a local vantage point, and boost and re-broadcast them through out the community. The deflector era was born. In some cases, deflector systems were co-operative groups of local people pooling their resources to provide a communal service. In others, the service was provided by the local TV shop, which covered its cost through the sale of aerials and amplifiers, or by imposing a small annual charge, usually between pounds 10 and pounds 50. The deflector systems operated on a minimum output, both in terms of power and costs.*" [Wate1997]. Figure 9-2 depicts a deflector site in Coumaraglin[186].

Figure 9-2: Deflector site in Coumaraglin/Comeraghs, 2010 [Moun2010].

Given that "*many unlicensed operators in rural areas set up UHF retransmission, or deflector, system to receive UK terrestrial broadcastings*" [Dina2012], the ODTR had to issue temporary licences to those deflector operators/communities, that would comply to tax and

[186] The accompanying text says: "*csd: Unfortunately Coumaraglin hasn't escaped the blight of TV deflector systems that litter the summits of the Comeraghs and surrounding area. I presume this is an example of one such enterprise, there being no security fence or signage proclaiming ownership by one of the established companies. Indeed, if the shoddy wiring and discarded leaky car batteries are anything to go by, the builders of this 'masterpiece' take no pride whatsoever in their workmanship. One for Waterford County Council to remove!*" [Moun2010].

planning regulations[187], following the lobbying of licensed MMDS and cable operators[188] [Dina2001]. This time the pragmatic community-driven approach to advocate public's interest, in this particular case what John Waters of the Irish Independent calls an "*Irishman's do-it-yourself right to watch British TV.*" [Wate1997] managed even to find political support.

Finally, the launch of the Irish Digital Terrestrial Television (DTT) platform 'Saorview' marks the latest example of providing a nation-wide broadcasting service. Similar to all earlier discussed means of terrestrial broadcasting also Saorview did not achieve 100% coverage due to the Irish topography. "*This is because terrestrial signals need a line of sight and cannot for example go through mountains or down into valleys.*" [Saor2012b]. Expectable, Saorview "*is available to 98% of Irish people*" [Saor2012a] replicating analogue broadcasting's coverage level [Kenn2010]. Consequently, RTE decided to tackle the remaining white spot on its coverage map with 'SAORSAT'[189], its "*infill free-to-air satellite television service*", to deliver services to the 2% of homes not covered [Saor2012b]. Simultaneously, the SAORSAT solution is a unique installation among other European public broadcasters. Hence, Ireland once again proved that it could respond an Irish problem with an Irish solution.

Altogether, the changing face of TV reception in the Republic was in large parts influenced by the public's demand for British channels, which was initially served by pragmatic approaches driven by enthusiastic communities, which took matters into their hands. Eventually, the government followed these initiatives and supported them by means of legislations – a unique phenomenon within Europe that underpins the Irish strong desire for freedom of choice.

[187] ODTR's decision was a consequence of the strong advocating by TD Tom Gildea for the "*legalisation of the pirate TV services*" [Molo1999]. Significantly, the "*legislation will provide a 'patch' to cover Donegal and other areas with reception difficulties until the arrival of digital broadcasting.*" [ibid.].

[188] Understandable, reflector systems were "*much less expensive*" [Cork2012b] since only small or no charges apply given the "*communal service*" character [Wate1997].

[189] SAORSAT is transmitted from EUTELSAT's KA-SA satellite: "*KA-SAT, the first High Throughput Satellite (HTS) in Europe, marks a new generation of multi-spotbeam high-capacity satellites. Built for Eutelsat by EADS Astrium, KA-SAT's revolutionary concept is based on a payload with 82 narrow Ka-band spotbeams connected to a network of ten ground stations. […] As a powerful new platform for delivering high-bandwidth services to users beyond range of terrestrial networks, KA-SAT can deliver cost-effective and competitive solutions." [Eute2012].*

9.2 Appendix B: Level of Illiteracy and Newspaper Readership

The Figure illustrates a benchmark of the countries with the lowest level of illiteracy in the greater European region. In particular, as shown above the South-European show a considerable lack in literacy levels making it difficult to reach all segments of the population via print media; hence marketing initiatives such as off-the-page business, which has proved to be very popular in the UK, difficult to implement in countries. Accordingly, operators in these countries have had to find attractive and easy-to-understand methods of reaching potential customers. This need to develop viable regional alternatives clearly prompted the Portuguese mobile operator TMN to promote cellular telephony by means of its prepaid scheme in 1995 [Port2005]. The benefits of this novel type of tariff model were clearly apparent to the technically unsophisticated majority of the population. Just months later, TIM, the mobile service arm of Telecom Italia, copied TMN's approach with its own prepaid offer [Zoll1996a]. In both countries there is a culture of interdependency based on traditionally strong family and community ties and maintained through a vibrant system of inter-personal communication and interaction. Consequently, it may be concluded that, in both regions, information was principally disseminated by means of word-of-mouth.

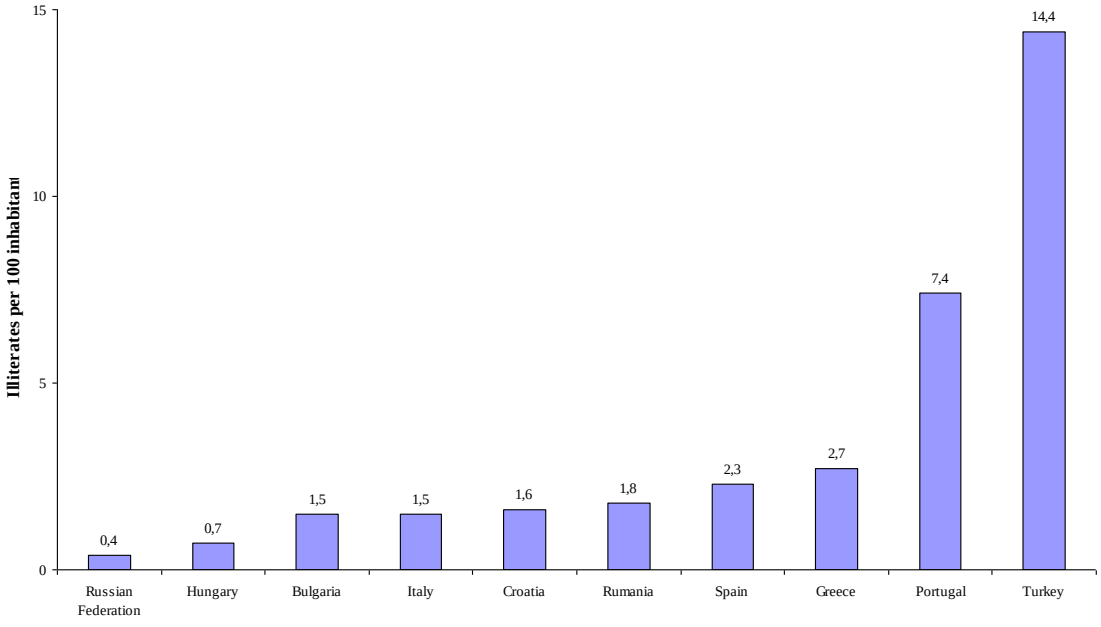


Figure 9-3: Level of illiteracy in Europe, 2001 [Stat2002].

Simultaneously, the relatively high rate in illiteracy is mirrored by relatively low levels of newspaper dailies as depict in Figure 9-4. Overall, the figures indicate that the Scandinavians are the largest consumers of mass media. The experience of relatively underdeveloped countries like

Greece and Portugal however shows that it is not necessary to focus strategy on the use of mass media approaches and that alternative means, such as offering simple packages of attractive tariffs, can be effectively used to address and educate the population.

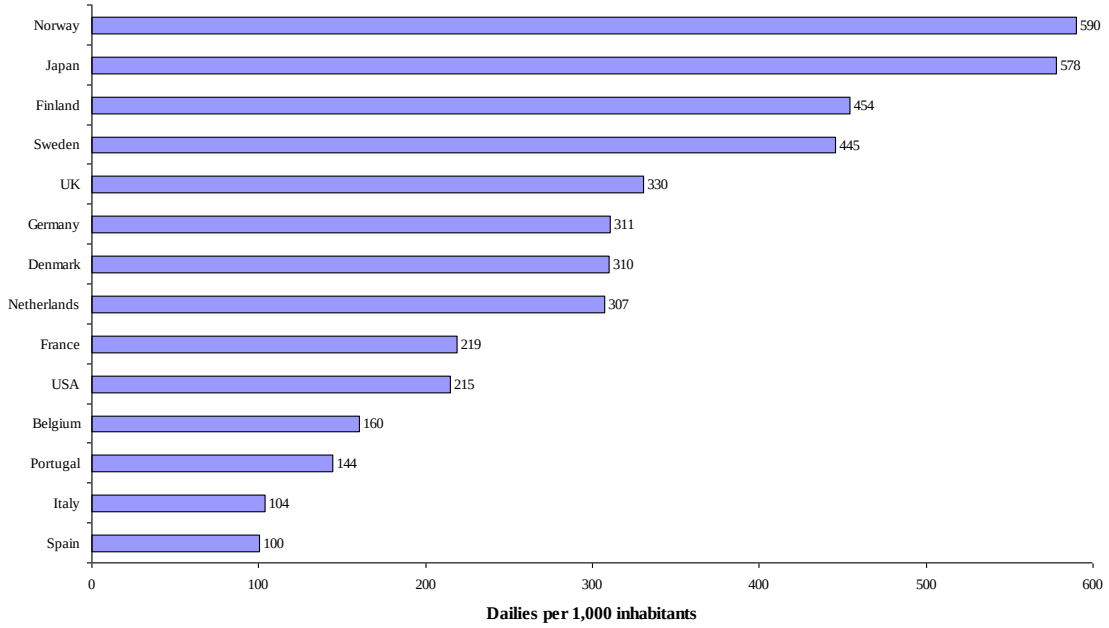


Figure 9-4: Newspaper dailies per 1,000 inhabitants, 1997 [Stat1999].

Additionally, Ula Johnsson-Smaragdi, professor of media and communication at Vaxjo University in Sweden, reports on the research findings in a study from 12 countries on children and the changing media environment in Europe [John2002]; she concludes "*that the availability of media somewhere in the home is not sufficient to ensure use: it must also be socially and/or psychologically attractive to the user*." Furthermore, "*However, physical accessibility does not ensure the use of a medium. It is just as much a matter of social, cultural and psychological attractiveness. Comparison between countries shows that the greatest ranges in the proportion of non-users occurs for the older print media. In the United Kingdom, for example, two-thirds of those surveyed do not read a newspaper. In Finland and Sweden, on the other hand, the proportion of non-newspaper readers is only 8 and 9 percent respectively. Similarly, books are used by an overwhelming majority of the young in Finland, Switzerland and The Netherlands, while in the UK there are many young people who do not read books at all.*" [John2002].

Indeed, the Nordic region's strong exaltation for information and print media is also observable in its deployment of library bus services as exemplarily outlined by the Finish Ministry for Education's public library strategy 2010 with the subheading 'The policies of the accessibility of information and culture' [Scan2010]; the strategy puts an emphasis on a "*cultural information society infrastructure, the fundamental rights of citizens and civics.* […] *Finland is a sparsely populated country, but well equipped library buses improve equal access for citizens to library*

and information services. […] Through information and resource guidance, the state encourages municipalities in joint purchases of library buses and in cooperation, to enable library bus services to reach the entire country in the future as well. […] The joint service bus provides traditional library and information services as well as other electronic Internet transactions. Business partners include the employment office, the National Pensions Institute, local banks and tele-operators." [Scan2010].

9.3 Appendix C: The Purpose, Reasoning and Importance of Standard-setting

Wireless communication first publicly emerged in the 1890s when Marconi and other researchers conducted groundbreaking experiments with radiotelegraphs, which later developed into radiotelephone system[Simo1996]. During the first half of the 20th century mobile radio (telephone) systems came to be used for marine and air communications and navigation, for military communication, and to provide vital links for local public services such as the police, fire brigades and taxis. Indeed, these were single channel 'over-and-out' systems with a single radio tower serving a small number of customers due to the limited frequency in the dedicated rather local coverage area. Hence, many local *de-facto* standards emerged over time, each developed for a particular purpose or region. There was little real perceived need for standardisation since regional user groups could be easily distinguished on the basis of transmission frequency band allocations. National governments regarded most of these developmental activities as peripheral and hence the primary initial impetus for standardisation emerged largely from end-user markets and the research policies of national Postal Telegraph and Telephone (PTT) administrations [Paet1993]. This resulted in an initially confused situation whereby the various types of equipment in use remained unapproved at both regional and international levels. Government policies primarily aimed to protect the national positions of incumbent PSTN monopoly carriers, and consequently that of principal national champion manufacturing suppliers, indeed, standards were employed as a tool to preserve the status quo. Governments consequently saw little benefit in directly promoting mobile standardisation as such a move would potentially encourage unwanted competition and undermine their adopted protective policy stance.

Meanwhile, with the launch of mobile telephone services, public demand for wireless services increased. This gave rise to a need for some form of central regulation and standardisation to establish orderly development and to ensure reliability and non-interference of co-existing services and equipment, achieved largely through the establishment of an efficient system of frequency spectrum management. Increased network capacity, improvement in the quality of service and the introduction of new features were key determinants of mobile communications mass-market penetration [Paet1993]. Consequently, technical and market progression necessitated the definition of appropriate performance standards that met the requirements of all parties involved. Standardisation is however arguably more a feature of commercial risk-reduction than of regulation. Without the certainty of meeting standardised requirements

equipment may be rendered useless almost as soon as it is deployed. Indeed, the future compatibility of their existing equipment is of major concern to customers; any uncertainty about compatibility may deter users. Hence, customers are normally unwilling to rigorously search for the best technology; they preferably look for the proven technology that offers the most immediate pay-off. This conservative market attitude compounds the difficulties of commercialising advanced forms of R&D. Additionally standardisation is the key element in the reduction of costs due to economies of scale [Nasi2009].

Further, standards are promulgated to ensure that the equipment provided adheres to defined performance specifications and requirements [Paet1993]. Once a standard is established, customers can benefit from a consequent reduction in market and technical uncertainty, lower product costs and a wider range of potential suppliers to choose from. Ironically, although many parties may participate in the definition of a given standard this does not guarantee that a dominant adopted standard will necessarily reflect technically superiority. Indeed, there are two principal ways by which a technologically inferior standard can dominate the market. The first is based on the idea of the 'snowball effect' or the 'bandwagon': The more users choose a particular standard, the greater is its appeal relative to alternative standards. Although the user selection process may be initially arbitrary, one standard will generally assume market dominance due to a mix of market forces. Standard dominance may also emerge due to market risk and uncertainty aversion. Given the alternative availability of two competing standards, but whose value is not transparent to the public and therefore not technically understood, then an early adoption of one over the other could lead to the choice of an inferior standard out of a simple need to reduce uncertainty, according to [Basa2003]. Additionally, in rapidly changing areas of technology, many formal standards experience premature obsolescence as a result of the rapid pace of technological development. This opens up the possibility for proprietary systems to emerge and gain dominance thus establishing *de-facto* standards[190]. Significantly, standardisation should allow consumers to select on the bases of cost and quality rather than on the alternative basis of an uninformed judgement on competing systems of different technical design.

[190] *De-facto* standards may be deliberately promoted by developers so that widespread adoption will compel competition to adhere to a proprietary form of implementation (e.g. Microsoft Windows). Alternatively, de-facto standards may also emerge by good fortune where a proprietary standard is widely adopted (e.g. Microsoft MS DOS) or by the concerted action of a group of manufacturers (e.g. the VHS video system).

In contrast to proprietary system standards, which are developed and effectively controlled by specific dominant manufacturers and operators, open-standard systems and architectures play a vital role in promoting development, gaining acceptance and ensuring support evidentially illustrated by the NMT system of the Nordic region. Open standards provide a level playing field for interested participants alongside low barriers to entry for the industry through the non-integrated nature of associated products. The larger the degree of openness is the greater the number of manufacturers of equipment that in turn provides the potential for economies of scale.

The European telecommunications industry has traditionally been dominated by national PTT governmental agencies and by key domestic manufacturers, who respectively monopolise national telecommunication service markets. The hegemony of the PTTs resulted in excessive protectionism, lack of specialisation and economies of scale, burdensome regulation of customer premises equipment and high prices [Paet1993]. Standards were in most cases set by a process of close collaboration (arguably, collusion) between the national incumbent service provider and a key domestic manufacturing supplier. Consequently, a wide variety of non-standardised equipment was deployed throughout Europe, albeit overseen by the Conférence des Administrations Européenes des Postes et Télécommunications (CEPT) which was the first European standard-setting body[191]. Hence, with the possible exception of the NMT and the TACS, local European system standards largely failed to impact on international mass markets and to consequently achieve the economy of scale required to allow the production of reasonably priced handsets. In 1984 the European Union consequently advised its member countries "*to stop the fragmentation of the European market, reduce prices, and expand the market*" in an attempt to avoid further fragmentation and contingent negative effects on interoperability and competition in the provision of services. This initiative led, in 1987, to one of the most influential steps towards European telecommunications liberalisation, *The Green Paper on Telecommunications* [EUCo1987]. Besides its emphasis on the provision of access for private companies, interconnection and interoperability between countries and fairer licensing procedures, it also recognised the crucial role of standards formulation in the promotion of unification and uniformity. Hence, the paper recommended the creation of the ETSI, which was founded in 1988. ETSI's mission is "*to determine and produce the telecommunications*

[191] This organisation is represented by 32 PTTs from all over Europe. Unfortunately, the ideal of creating a more standardized European environment was not fully realized, largely since no manufacturers or industrial partners were invited to participate in the standards-setting process and as formal adoption of CEPT recommendations by member countries was optional.

standards that will be used for decades to come". In the context of the growing strategic importance of the telecommunications sector, the general policy advocated in the Green Paper Towards a dynamic European economy – the development of the common market for telecommunications services and equipment was dictated by the overriding goal of creating a single European market by the end of 1992. The European Commission "*determined that the current market structure simply couldn't satisfy the legitimate expectations of the European consumers and industry*". Furthermore, it emphasised that, if European countries wanted to stay competitive in a global market, "*the Commission cannot leave it to the existing national monopolies to organise everything: regulations, supplies, operation,* [and] *pricing*" [Paet1993].

9.4 Appendix D: Cellular Telephone Systems in Europe

Table 9-1: Cellular telephone system in Europe, 1992 [Mobi1996].

Country	NMT-450	NMT-900	TACS-900	Other systems	Launch
Andorra	X				Jul. 90
Austria	X				Nov. 84
			X		Jul. 90
Belgium	X				Apr. 87
Cyprus		X			Dec. 88
Denmark	X				Jan. 81
		X			Dec. 86
Finland	X				Mar. 82
		X			Dec. 86
France				RadioCom2000	Nov. 85
	X				Aug. 89
Germany				C-450	Sep. 85
Iceland	X				Jul. 86
Ireland			X		Dec. 85
Italy				RTMS	Sep. 85
			X		Apr. 90
Luxembourg	X				Jun. 85
Malta			X		Jul. 90
Netherlands	X				Jan. 85
		X			Jan. 89
Norway	X				Nov. 81
		X			Dec. 86
Portugal				C-450	Jan. 89
Spain	X				Jun. 86
			X		Apr. 90
Sweden	X				Oct. 81
		X			Dec. 86
				Comviq-450	Aug. 81
Switzerland		X			Sep. 87
UK			X		Jan. 85

9.5 Appendix E: Table 9-2: CPP, MPP and switching countries [Krus2010].

CPP countries	Switching countries to CPP	MPP countries
Australia	Venezuela (1991)	Albania
Austria	Brazil (1994)	Barbados
Belgium	Colombia (1994)	Cameroon
Belize	Israel (1994)	Canada
Botswana	Dominican Republic (1995)	China
Cyprus	Uruguay (1995)	Croatia
Denmark	Costa Rica (1996)	Hongkong
Estonia	Czech Republic (1996)	Mauritius
Finland	Mongolia (1996)	Russia
Germany	Peru (1996)	Singapore
Gibraltar	Cambodia (1997)	St. Kitts and Nevis
Greece	Panama (1997)	Ukraine
Hungary	Ecuador (1998)	USA
Iceland	Romania (1998)	Sri Lanka
Ireland	Argentina (1999)	
Italy	Bolivia (1999)	
Japan	Chile (1999)	
Korea (Rep.)	El Salvador (1999)	
Lithuania	Guatemala (1999)	
Luxembourg	Mexico (1999)	
Madagascar	Antigua and Barbuda (2000)	
Malaysia	France (2000)	
Malta	Honduras (2000)	
Moldova	Jamaica (2000)	
Netherlands	Cayman Islands (2001)	
New Zealand	Pakistan (2001)	
Norway	Trinidad and Tobago (2001)	
Philippines	Dominica (2002)	
Poland	Grenada (2002)	
Portugal	Saint Lucia (2002)	
Slovak Republic	St. Vincent (2002)	
Slovenia	India (2003)	
Spain		
Sweden		
Switzerland		
Turkey		
UK		
Zimbabwe		

9.6 Appendix F: Cultural Dimensions – MAS vs. IND and UAI vs. PDI

A clearer picture on the countries' cultural dimensions may be obtained from the plots of Figure 9-5 and Figure 9-6.

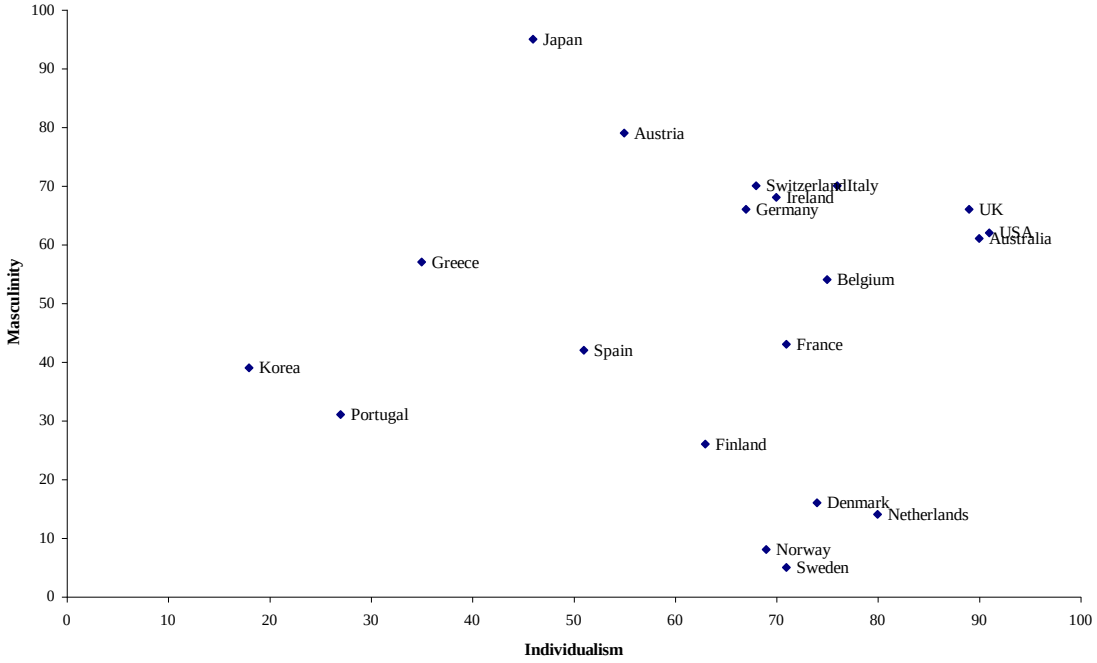


Figure 9-5: Ranking of countries according to their level of MAS and IND [Lagr2005].

In terms of IND, the British-influenced countries rank highest, being more task-orientated and pragmatic, which might be partly, influenced the experience of the enlightenment. The US is well known for its tradition of self-reliance and individualism, which may have derived from the early settlers who were given land that they had to clear to farm on. In contrast, Japan is a group-orientated country that has its roots in early agricultural village life where co-operation is needed to grow a successful rice crop, according to [Stap2005]. In between are the Nordic and central European countries. The Mediterranean countries rank at the collectivism end of the scale since individuals are bound by strong personal and protective ties based on loyalty to the group and the extended idea of family. Nevertheless, in general, individualism is dominant in most of the surveyed countries. On the masculinity dimension Japan, still a male-dominated society is the most prominent, followed by the central European and Mediterranean countries. With their well-know social tradition, the Nordic countries and the Netherlands emerge as most feminine group of societies.

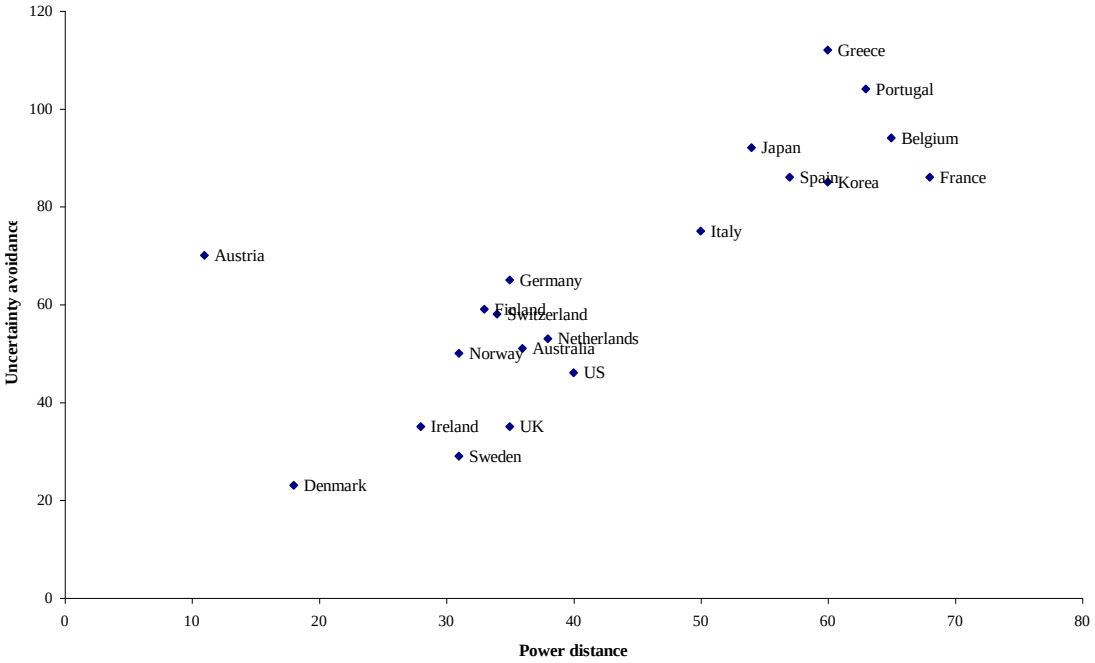
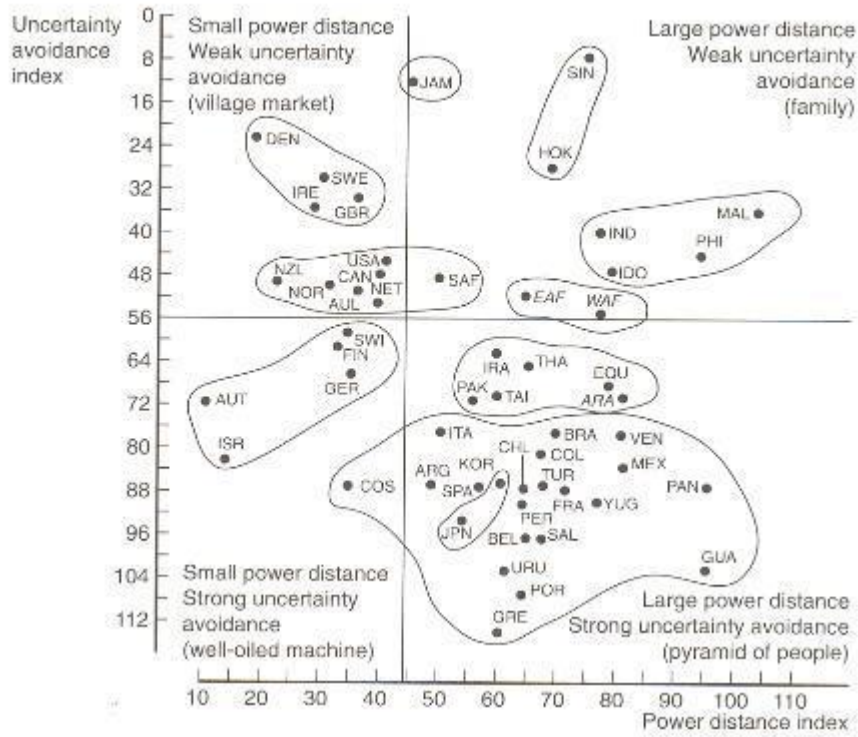


Figure 9-6: Ranking of countries according to their scale of UAI and PDI [Lagr2005].

In contrast to the relatively diffuse distribution of countries depicted in Figure 9-5, their position on the bases of uncertainty avoidance and power-distance indicates a high degree of attribute correlation as shown in Figure 9-6. The Mediterranean region and most of the Asian countries together with French-speaking (ex-colonial) nations exhibit high levels of both power-distance and uncertainty avoidance. At the other end of the scale are regions such as Scandinavia and the British influenced societies. Investigated together, the two figures illustrate on one hand common attitudes, ways of thinking and patterns of behaviour among specific national groupings, while also illustrating significant disparities between the groups themselves.

9.7 Appendix G: Hofstede's Dimensions and Parameters [Laof2010].



Key

ARA	Arab-speaking countries (Egypt, Lebanon, Lybia, Kuwait, Iraq, Saudi Arabia, United Arab Emirates)
ARG	Argentina
AUL	Australia
AUT	Austria
BEL	Belgium
BRA	Brazil
CAN	Canada
CHL	Chile
COL	Columbia
COS	Costa Rica
DEN	Denmark
EAF	East Africa (Kenya, Ethiopia, Tanzania, Zambia)
EQA	Equador
FIN	Finland
FRA	France
GBR	Great Britain
GER	West Germany (formerly)
GRE	Greece
GUA	Guatemala
HOK	Hong Kong
IDO	Indonesia
IND	India
IRA	Iran
IRE	Ireland (Republic of)
ISR	Israel
ITA	Italy
JAM	Jamaica
JPN	Japan
KOR	South Korea
MAL	Malaysia
MEX	Mexico
NET	Netherlands
NOR	Norway
NZL	New Zealand
PAK	Pakistan
PAN	Panama
PER	Peru
PHI	Philippines
POR	Portugal
SAF	South Africa
SAL	Salvador
SIN	Singapore
SPA	Spain
SWE	Sweden
TAI	Taiwan
THA	Thailand
TUR	Turkey
URU	Uruguay
USA	United States
VEN	Venezuela
WAF	West Africa (Nigeria, Ghana, Sierra Leone)
YUG	Yugoslavia (formerly)

9.8 Appendix H: Table 9-3: Hofstede's Dimensions and Religion [Hofs2012].

	PDI	IDV	MAS	UAI	LTO	Atheist	Buddhism	Catholic	Christian	Hindu	Jewish	Muslim	Other
Arab World	80	38	52	68					4			91	4
Argentina	49	46	56	86				92	2		2		4
Australia	36	90	61	51	31			26	50				24
Austria	11	55	79	70				78	5			17	
Belgium	65	75	54	94				75	25				
Brazil	69	38	49	76	65			80					20
Canada	39	80	52	48	23			42	40				18
Chile	63	23	28	86				89	11				
China	80	15	55	40	114	90			4			2	4
Colombia	67	13	64	80				90					10
Costa Rica	35	15	21	86				76	17				7
Czech Republic	35	60	45	60		40		40	8				13
Denmark	18	74	16	23				2	96			2	
East Africa	64	27	41	52	25			8	44			34	15
Ecuador	78	8	63	67				95					5
El Salvador	66	19	40	94				83	12				5
Finland	33	63	26	59		9			90				1
France	68	71	43	86		4		83	2		1	8	2
Germany	35	67	66	65	31			34	34			4	28
Greece	60	35	57	112					98			1	1
Guatemala	95	6	37	101				70	5				25
Hong Kong	68	25	57	29	96				10				90
Hungary	45	55	79	83	50			68	25				7
India	77	48	56	40	61				2	81		12	5
Indonesia	78	14	46	48			1	3	5	2		88	1
Iran	58	41	43	59								99	1
Ireland	28	70	68	35				92	3				5
Israel	13	54	47	81					2		80	15	3
Italy	50	76	70	75				80	7			8	5
Jamaica	45	39	68	13				4	62				34
Japan	54	46	95	92	80		84		1				16
Malaysia	104	26	50	36			22		2	10		63	3
Mexico	81	30	69	82				89	6				5
Netherlands	38	80	14	53	44	39		31	21			5	4
New Zealand	22	79	58	49	30	30		15	52				3
Norway	31	69	8	50				2	87				11
Pakistan	55	14	50	70	0				1	1		97	1
Panama	95	11	44	86				85	15				
Peru	64	16	42	87				90					10
Philippines	94	32	64	44	19		1	83	9			5	2
Poland	55	60	65	78	37			95	5				
Portugal	63	27	31	104				94	6				
Singapore	74	20	48	8	48		75		2	7		14	2
South Africa	49	65	63	49					68	2		2	28
South Korea	60	18	39	85	75		47		49				4
Spain	57	51	42	86				94					6
Sweden	31	71	5	29	33				87				13
Switzerland	34	68	70	58		9		46	40				5
Taiwan	58	17	45	69	87		93		5				2
Thailand	64	20	34	64	56		95					4	1
Turkey	66	37	45	85								99	1
United Kingdom	35	89	66	35	25			22	70	1	1	3	3
United States	40	91	62	46	29	10		28	56		2		4
Uruguay	61	36	38	100		31		66	2		1		
Venezuela	81	12	73	76				96	2				2
West Africa	77	20	46	54	16				38			42	20
World Average	55	43	50	64	45								

It should be noted that the scores are standardised on a scale from 0 to 100. Because some countries were added after the initial research project, some scores may be above 100 due to prior normalisation. Scores for Germany refer only to the former area of West Germany.

9.9 Appendix I: Economic Growth and the Gini Index

Given the insufficient and non precise characteristic of GDP per capita in describing the dispersion of wealth the Gini coefficient[192] is commonly used as a measure to determine the extent to which income is or consumption among households or individuals deviates from a perfectly equal distribution. Generally, it is believed that nations with high rates of economic growth show an increase in income inequality as illustrated by the trend towards globalisation through free market reform. Particularly, "*such policies have jump-started development in chronically poor nations such as China and India but benefits of this development likewise have not been well distributed. Moreover, the use of poorly paid labour in such countries constitutes pressure to keep manufacturing wages low in developing economies*" [news2009]. The same trend can similarly be observed in the US in recent years which became the most unequal Western nation[193]. The following Figure 9-7 provides a global view on the Gini coefficient.

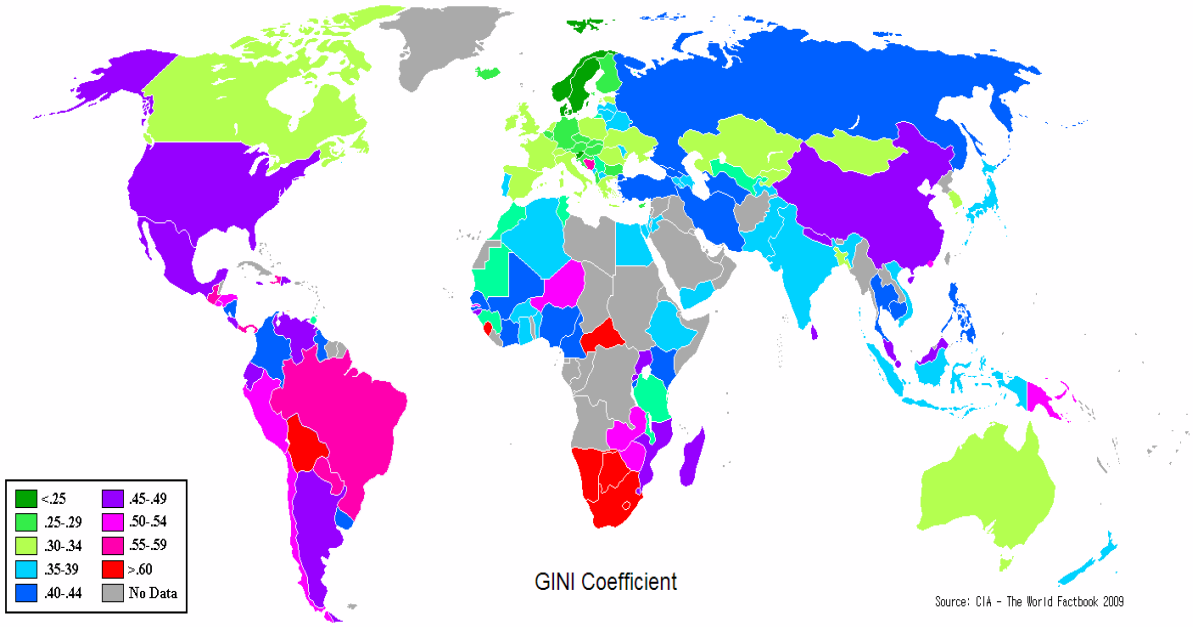


Figure 9-7: Gini coefficient world map [Fish2011].

[192] The coefficient was developed by Italian statistician Corrado Gini (1884-1965) and represents a measure of statistical dispersion. It is zero if all data are identical, and increases up to one as the data becomes more diverse. The Gini coefficient is usually defined mathematically based on the Lorenz curve, which plots the proportion of the total income of the population (*y* axis) that is cumulatively earned by the bottom *x*% of the population. A low Gini coefficient indicates a more equal distribution, with zero corresponding to complete equality, while higher Gini coefficients indicate more unequal distribution, with one corresponding to perfect inequality [Monf2008].

[193] While some critics blame the world economy to have disadvantaged domestic workers in manufacturing jobs others argue that the service sector with pay schemes close to the minimum wage being the cause.

On a global view the European region – particular the Nordic area – hosts the most egalitarian countries what might be explained by the general socialist tendency within the area[194], hence, the gap between rich and poor is regarded as not beneficial for the society as a whole. Similar low Gini levels can also be observed in Canada and Australia pointing to their European legacy. Surprisingly, low Gini levels can be observed for the two former Soviet Union nations Kazakhstan and Mongolia also which might be due to their communism heritage[195]. In contrast, other former communist countries such as China and Russia have a Gini score similar that of the US which can be explained by the economic boom in the 2000s, illustrating their transformation towards a capitalist society[196]. In contrast, higher levels of inequality can be observed in Mexico and South-America while the Asian countries feature also rather high scores of inequality, as does the African continent despite some exception. Obviously, countries with a relatively high Gini coefficient are all developing countries. According to many social scientists this is in part due to the colonial political systems that once dominated these nations. Subsequently, this resulted in such rigid social classes, which are existent even today. For example, these countries have land ownership systems that evolved under colonial influence which created a small wealthy landed class[197]. Expectable, a high Gini index also indicates a high level of social inequality that can contribute to more crime and political instability [UNDP2011].

Altogether, the variances in Gini indicate differences in political and economic systems not only between developed and developing regions but also within developed economies. This stresses economic as well as cultural deviations within regional markets such as Europe or America which result in different characteristics of consumer behaviour and market approach. Significantly, it has to be noted that the above graph represents a snapshot only since the countries' Gini coefficient are not a constant. Instead, their value changes over time given the influence of several variables such as demography[198], geography, economy and so on which

[194] Controversially, an investigation into the Swedish culture reveals that "*independence, personal responsibility and individual capability*" are highly regarded while the "*ability to accomplish things unaided is always held as ideal.*" [Expa2010]. This characteristic is well illustrated by the saying "*A good man can take care of himself*" [Expa2010].

[195] One key goal that communism tried to accomplish was the distribution of equal wealth per citizen.

[196] Recent development of countries such as the UK and the US with its economic freedom and open marketplace policy saw these countries moving up the inequality route which is observed with fear and scepticism.

[197] The colonial influence is further stressed by John Weeks: "*The current discourse on inequality within countries, and especially within the developed market economies of the OECD, must be placed in historically context. A long period of the growth of international trade within a laissez-faire framework and colonial expansion characterized the second half of the nineteenth century, with the United Kingdom the dominant country, being overtaken by a group of later developers, principally the United States of America, Germany, and France*." [Week2005].

[198] The UN report states that one of the most important factors determining inequality in the US is race [Dudl2008].

should be noted when making generalizing propositions based on comparisons of wealth on a global scale. Hence, the examination of correlations appears more appropriate between countries that are hosted in similar economic environments that feature identical frameworks and policies. Indeed, the changing face of economic characteristics of a country is most obvious observable on the example of Ireland. On a global level, either overall income inequality and income distribution or earnings rose sharply during the 1980s, 1990s and 2000s in many industrialized countries, most observable in the UK and the US. In contrast, the Irish performance regarding inequality is somehow unparalleled.

Table 9-4: GDP and GNP[199] vs. Gini[200] coefficient [CSO2006], [EURO2005b].

Growth (%)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GDP current	13.1	10.3	15.6	15.5	15.6	14.8	11.8	11.4	7.1	6.5	8.8
GDP constant	9.7	8.1	11.1	8.6	11.3	10.1	5.9	6.4	4.3	4.3	5.9
GNP current	11.6	10.4	14.6	15.4	12.5	14.9	9.9	8.7	10.5	6.5	8.3
GNP constant	8.2	7.8	9.7	7.9	8.9	10.2	4.0	2.9	5.7	3.7	4.9
Gini	0.33	0.33	0.33	0.34	0.32	0.30	0.29	0.30	0.31	0.32	0.32

Years 2001-2005 referenced to 2005, years 1995-2001 referenced to 1995

As depict in Table 9-4 above the Irish Gini coefficients is quiet high throughout the second half of the 1990s until it levels-off in 1999 to reach its minimum of 0.29 in 2001. [Nola2000] claim, that the decline in social welfare transfers in total income and greater inequality in the distribution of income from self-employment as the main drivers behind the dramatic increase in inequality between 1994 up to 1997. Controversially, the sudden decline in the Gini coefficient comes as a surprise given the two-digit growth rates in the years 1999 and 2000, since income inequality often rises as economies improve. On the other hand, the economic boom in the last two decades reduced unemployment from a high of 15 per cent in the labour force in 1993 to less than 5 per cent in the year 2000, which is a fact that puts the concomitant drawbacks into

[199] Gross National Product (GNP) measures the output generated by a country's enterprises (whether located domestically or abroad) its GDP counterpart measures the total output produced within the country's border, whether produced by that country's own firms or not.

[200] The Gini coefficient is commonly used as a measure to determine the extent to which income is or consumption among households or individuals deviates from a perfectly equal distribution. A low Gini coefficient indicates a more equal distribution, with zero corresponding to complete equality, while higher Gini coefficients indicate more unequal distribution, with one corresponding to perfect inequality [Monf2008].

perspective. In particular, increases in inequality may cause crime to rise as well as the extent of social welfare levels might be affected. [Call2000] states that Ireland has inherited its traditionally modest social welfare system from the United Kingdom at the time of its independence in 1922 and still holds many characteristics in common with its neighbour.

Ireland's welfare expenditure rates of 5.7 per cent of GDP remains far below the EU average of 14.4 per cent in the year 2000 and therewith, at similar level as that of Great Britain and the United States, emphasising the cultural link between these nations. Consequently, given Ireland's economic success in the last twenty years there "*was heated debate as to the appropriate levels of taxation and social welfare*", which has to be balanced "*between welfare and incentive in order to enhance its prosperity without decreasing the competitiveness of the Irish workers and marketplace*" [Webe2001]. Given the decrease of the Gini coefficient in 1999 to 2001 it appears as the Irish government has taken adequate measures[201] to fulfil the aforementioned criteria[202]. Finally, on a global scale the OECD figures show a trend of increasing inequality among OECD member countries in the period Mid-1970s to Mid-2000s. Significantly, four British-influenced nations are among the top-10 countries with regards to inequality with the US taking the lead and Ireland marking the most egalitarian country[203].

[201] The Irish government outlined a concrete strategy to combat poverty as early as 1997, resulting in the National Anti-Poverty Strategy (NAPS) which is aimed to reduce the number of those who are 'consistently poor' from 9-15 per cent below 5-10 per cent. Besides, welfare measures such as old age pensions, child benefits and cuts in taxation payments have also been introduced in the year 2000. Nevertheless, trade unions and the EU argued that the package favours the rich and did not give enough additional resources to poor. Significantly, children's right groups pointed to a study by the Institute for Public Policy Research that argues that "*Ireland the second-worst place in Europe to be a child.*". Following the release of the 2001 budged, the Council for Religious in Ireland (CORI) claims that according to a statistic Irelands was ranked 17th on a poverty index of 18 industrialized nations.

[202] Altogether, the increase in social welfare expenditure in both 2000s and 2001's budget might have had a stabilizing effect on the arising increase in inequality in the 1990s. Finally, the study [Webe2001] confirms that while the richer are getting richer the poorer are not getting poorer but their wealth is not improving as fast as that of the wealthy. It appears as "*taking everything into account, Ireland so far seems to have escaped the worst of the growing inequality problem normally associated with rapid economic growth*" [Webe2001].

[203] Additionally, Ireland's performance is further examined in a report by the Economic and Social Research Institute (2006) who concludes that while "*income inequality was not dramatically changed by the economic boom*", Ireland is still in a substantial cluster of OECD countries with relatively high levels of income inequality – but not "*one of the most unequal*". However, "*some gaps have widened, but real incomes have grown substantially throughout the distribution*". A EUROSTAT benchmark in the year 2003 finds a relatively high Gini coefficient of 0.31 for Ireland compared to the EU25 average of 0.29 while both the UK and Greece rank highest with a score of 0.33. Again, Ireland's close position to its British counterpart can be seen as a further supportive factor for the hypothesis that culturally close countries share similar social values and policies [EURO2005].

9.10 Appendix J: The 'hacked' iPhone Phenomenon

Controversially, the sourcing of mobile phone from the grey-market is not a phenomenon of developing countries only. With the launch of 3G phones such as the Apple iPhone recent reports from China or the US indicate that a grey-market for high-end cellular phones and accessories has emerged [WDS2008]. Surprisingly, the grey-market is not exclusively driven by price sensitivity but also by desirability, which is particularly the case for the Apple iPhone. According to estimates by Bernstein Research's Toni Sacconaghi, there is a great disparity between the number of iPhones sold (3.75 million) and the number AT&T actually activated (approx. 2 million) [Elme2008], as depict in Figure 9-8 below.

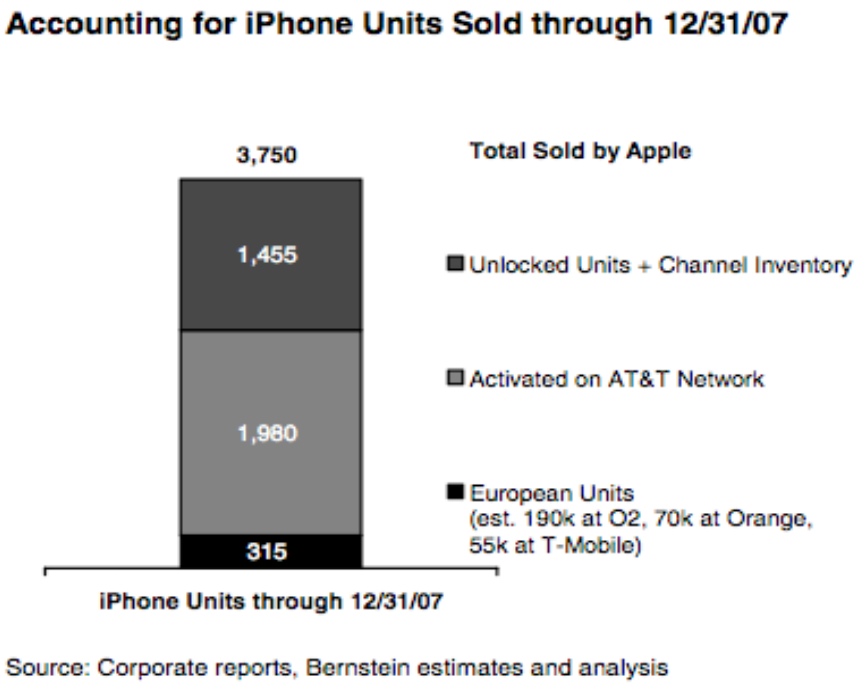


Figure 9-8: Accounting for Apple iPhone units sold through Dec. 31, 2007 [Elme2008].

Sacconaghi argues that as many as 1 million iPhones have been hacked by resellers and not been registered with one of Apple's network providers which have to establish a revenue sharing model with Apple. This would in turn translate into a loss of US$300 to US$500 in revenue [ibid.]. Gene Muster, analyst at investment bank Piper Jaffray, claims that the rogue iPhones are being bought by organized gangs which unlock the handsets and sell them overseas predominantly to Asia, given that the exchange rate difference makes the purchase of the phones more attractive in the US[204] [Thom2008]. However, whereas the purchase of an iPhone through

[204] Munster reports that "*The majority of the people who were buying more than one phone were Asian, and they were bringing small buses of people who all buy more than one phone*."

grey-channels might not be allowed and supported by Apple in countries where no revenue-sharing models are established with a network provider it certainly helps to rise the awareness for an iPhone among early adopters and elites to such an degree that the market is already readily prepared until its official launch. Hence, the same could be said about the impact of the grey-imports on the Irish market. Whereas cellular telephony was initially targeted at business users, innovators and the prestige class the sourcing of the gadget on the grey-market enabled the broader public to gain access to this new means of communications.

9.11 Appendix K: Population Density and Urbanisation

At first sight population density appears a good criterion for the chance of word-of-mouth usage as an interpersonal channel since it could be assumed that the chances of personal contact between individuals increases with its density.

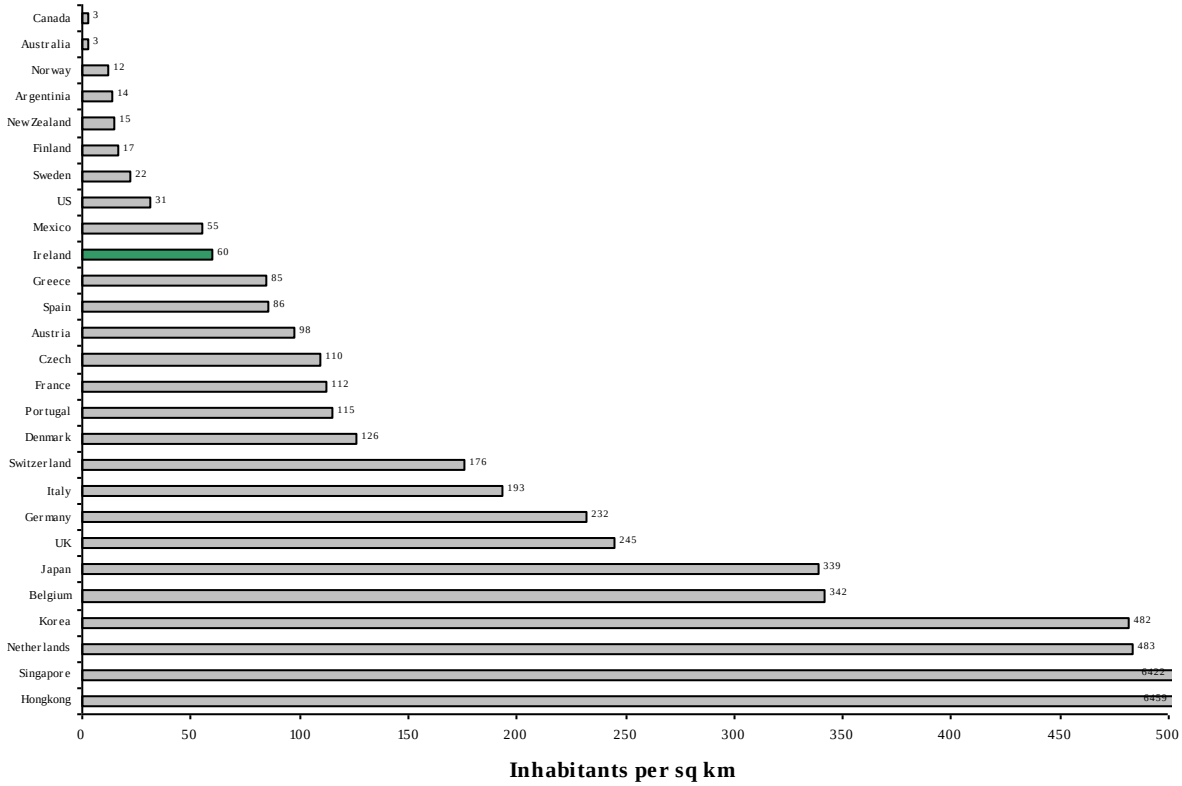


Figure 9-9: Population density, 2006 [Stat2006].

Expectable, overseas area states such as Canada and Australia form the bottom on this benchmark followed by Norway and other Nordic and South American countries as seen in Figure 9-10. Interestingly, the Nordic countries are world leader in technology adoption, which put the former made hypothesis into question. In contrast, city-states such as Hong Kong or Singapore mark the top end of the comparison, which have relatively high levels of cellular density. Contradictory, the ranking of the Nordic countries illustrate that a low level of population density can also translate into high cellular density. Unfortunately, given its aggregate nature it is clearly of little practical use since it does not identify the concentration of individuals within a country. Hence, urban concentration may provide a better scale of the likeliness of WOM communication[205]; due to data availability urbanisation is measured as the share of people living in the five largest cities, as shown in Figure 9-10.

[205] Population density plays a more determining role for network operators regarding network rollout and coverage.

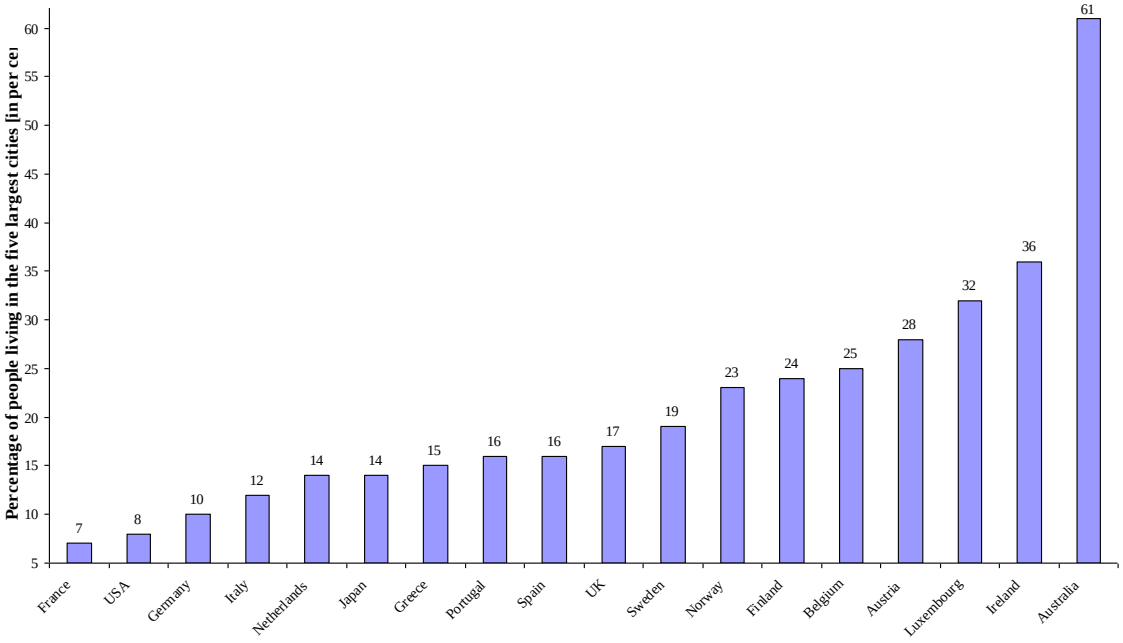


Figure 9-10: Proportion of people living in cities, 1999 [Stat1999].

Surprisingly, (or expectable), Australia ranks at the top spot what can be attributed to its exceptional geography. Ireland follows second with a more expectable rate of urbanisation. Then come some central European nations and the Nordic countries. At the bottom end rank the large territorial states of North America, France, Germany and Italy.

The positive correlation between population density and communication through interpersonal channels is supported by Smoreda and Thomas: "*The spatial diffusion of a technical innovation like the SMS most often starts in urban systems in major cities, and then spreads to provincial centres and finally to peripheral regions.*" [Smor2000]. Indeed, it could be assumed that urban areas act as epicentres of innovation largely because related information is enabled to be exchanged and disseminated rapidly due to ease of personal access to a variety of alternative means of communications (e.g., pay-phones, cellular technology). People have both the ability and opportunity to meet due to their relative proximity, access to transportation, availability of social outlets, and relative affluence. However, a clear pattern cannot be established given the data in Figure 9-10.

9.12 Appendix L: Main Line and Cellular Telephone Density vs. Wealth

Despite the outlined criticism it was agreed to use GDP as the indicator for a country's wealth for benchmarking purposes, not only but due to its statistical availability and widespread application. Among others the [OECD1995] states that there is a close correlation between telecommunications (traditionally measured by tele-density, or fixed-lines per 100 inhabitants) and economic development (as measured by GDP per capita) given that low-income levels may create an important adoption barrier for a new product, service or technology. Hence, the main line telephone penetration is often referred to as an example to proof Rogers' assumption [Roge1995]. Hence, the main line density in relation to GDP was examined against the level of cellular telephone subscriptions, respectively. The year 1985 was chosen for the snapshot of the fixed-line density since it marks the point in time around which cellular networks were launched in most major economies[206]. The following Figure 9-11 depicts the relationship of main lines and GDP with the respective coefficient of correlation (R^2) – or goodness of fit – of 0.74.

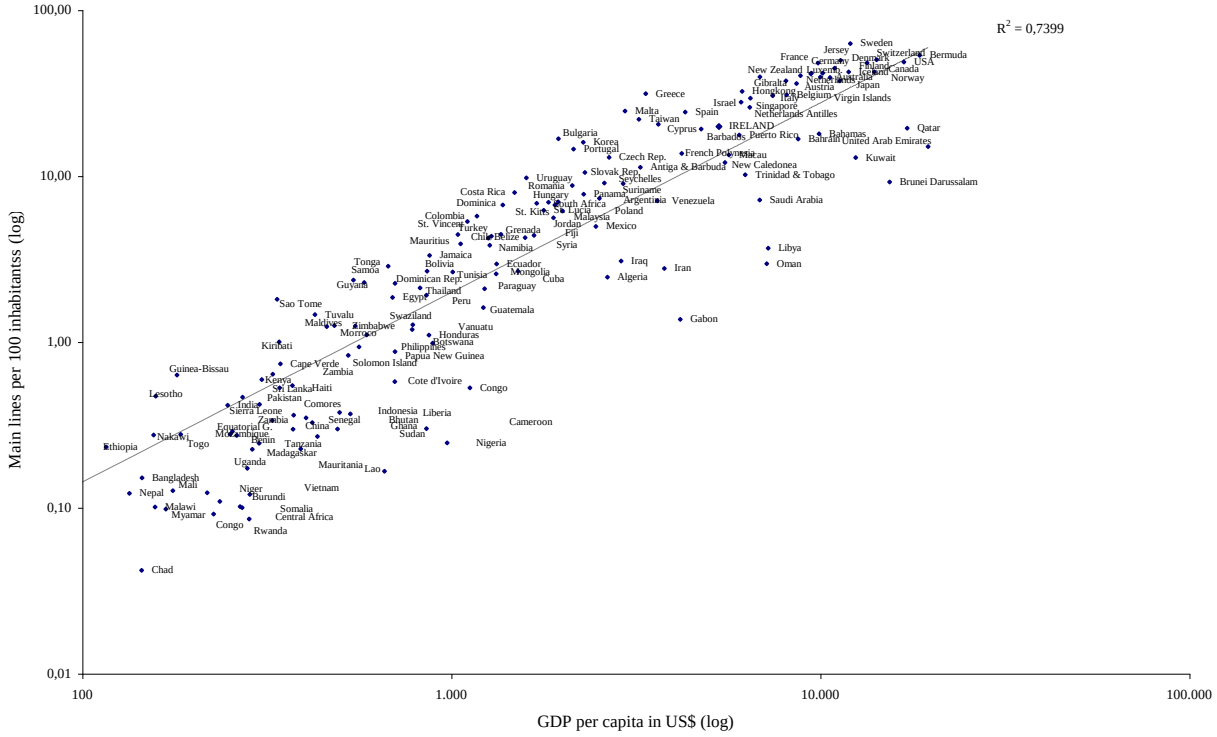


Figure 9-11: Main lines per 100 inhabitants vs. GDP in 1985, [ITU2005].

[206] A further reason was the insufficient availability of corresponding data. The ITU (2005) states data about cellular networks were available for 18 countries only (data for main line networks is available for 161 countries). Although there is no official figure published it can be assumed that at least 22 cellular networks were operational at the time (besides the depict countries services were operational in Saudi Arabia, Bahrain, Brunei Darussalam and Qatar.

The resulting graph is dubbed the '*Jipp Curve*', probably the most familiar diagram in the economics of telecommunications[207] [Jeun2000]. Although the relationship is sometimes interpreted as Jipp's Law, implying some measure of causality, the [ITU2002] mentions that "*it would be more accurate to note that fixed-line tele-density tends to be correlated with a host of other factors that also rise as a nation's wealth rises (e.g. average disposable income, level of education, level of investment, degree of electrification, etc). These different factors tend to reinforce the basic fact that more money means greater access to telecommunications.*" [ITU2002]. Indeed, this coherence can be observed in Figure 9-11 above given those countries which perform better than their GDP would indicate rank above the trend curve while those nations that lack behind their GDP level below the curve. When examining the top end of the graph it comes at no surprise that countries above the curve are the wealthy economies such as the US, Canada, Switzerland, the Nordics, Japan and Australia followed by a group of Central European countries alongside Hong Kong, Singapore, Gibraltar and New Zealand. Surprisingly, Ireland performs above the trend curve given the extensive network upgrade program in the early 1980s. Controversially, relatively small islands such as Bermuda, Jersey, Virgin Island, the Bahamas, Antigua & Barbuda, Malta and Taiwan show a similar performance – obviously, all mentioned countries feature some form of British-influence legacy – whether as trading partner, protectorate or as British colony[208]. It can be assumed that the colonisers established parts of their domestic frameworks, policies and cultural values and habits incorporating engineering processes and related equipment. Hence, the natives were confronted with formerly unknown mechanisms and technology that were embedded in the natives' every life at best. The [ITU2002] claims that these small nations often have a good tele-density due to "*their dependence on communications, for instance for tourism or banking*".

Countries below the trend curve at the upper end of the scale are for the most part the Arabic nations such as the United Arab Emirates, the Emirates of Qatar and Kuwait, the Sultanates of Brunei and Oman, the Kingdom of Bahrain and Saudi Arabia. Controversially, despite their close British links of the former mentioned list of countries they do not perform as their wealth may suggest. This perplex situation further underpins the assumption that other factors such as economic strength influence the diffusion. Again, the [ITU2002] provides an appropriate explanation arguing that their "*GDP per capita is inflated by natural resources [such as oil] or […] diamonds*". The other end of the graph is compromised by (mostly) East European and

[207] Named after Professor A. Jipp, who was one of the first researchers to publish about the relationship in 1963.

[208] It should be noted that larger countries such as the US, Canada and New Zealand have also a British heritage.

Asian-Pacific countries alongside nearly all African nations[209]. Controversially, when looking at countries with a GDP of US$2,000-US$6,000, such as Costa Rica, Puerto Rico, Korea, Taiwan or Ireland their main lines density is equal to most of the richer Arabic countries. Consequently, if GDP were the only significant factor developed countries would exhibit comparably similar levels of diffusion. Hence, the above discussed observation may be regarded as first indicator that the claimed proposition is not homogenously valid across all countries. This former contradictions give rise to the assumption that the applicability or need for this kind of technology is not as high as in other (even less wealthy) countries. The reason might be inhospitable terrain or a general lack of basic infrastructure such as electricity or that income inequality.

Next, the Jipp curve for cellular density is depicted in Figure 9-12 for the same year (1985).

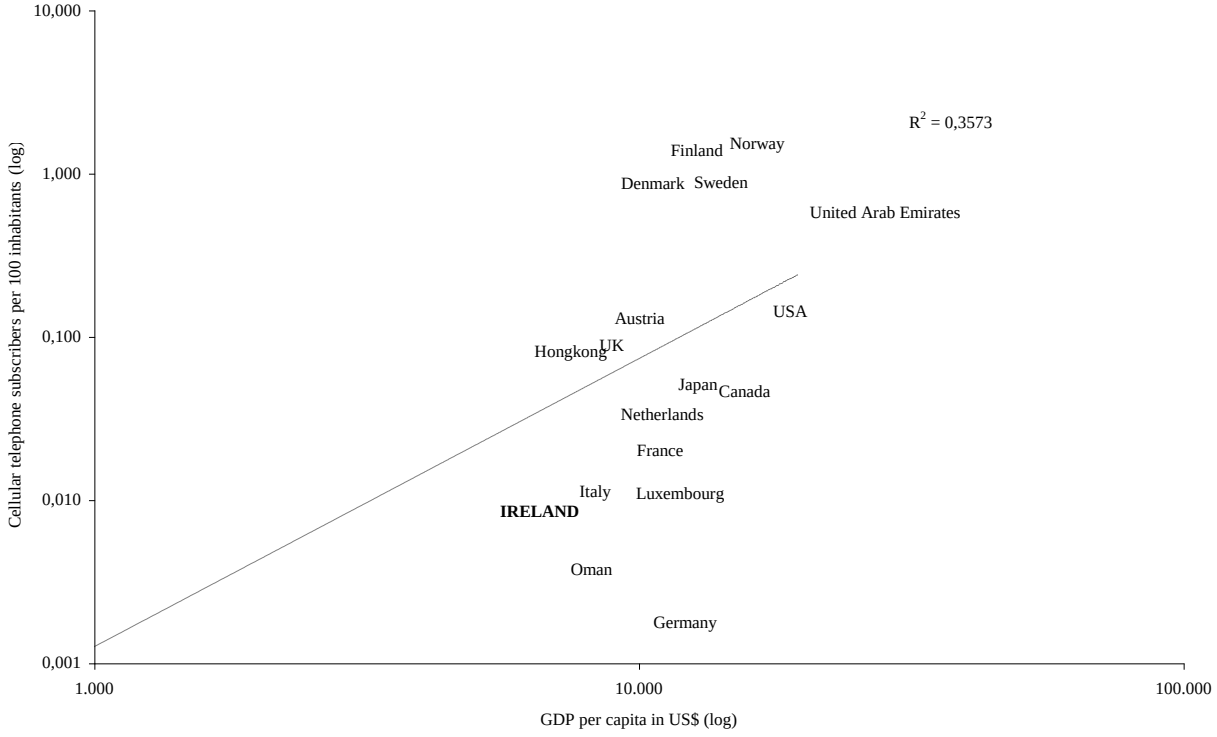


Figure 9-12: Cellular telephone subscribers vs. GDP, 1985 [ITU2005].

Given the relative scattered position of the various countries it is no surprise that the coefficient of determination (R^2) is just 0.36. Expectable, the Nordic region scores the highest penetration rate given their legacy of mobile telephony development despite being not the richest countries in the benchmark. In contrast, although the United Arab Emirates and the US are the wealthiest countries in the above benchmark they do not show a related performance regarding

[209] The low of tele-density is a result of a general lack of basic infrastructure such as power supply or road networks.

the cellular phone density with the later and are even placed below the trend curve, a fact that may point to other underlying factors than GDP as determining variable. At the same time, Austria has a penetration rate that is on the same level like the US, although the later has a GDP twice as high underpinning the aforementioned suspicion. Alongside, the UK and its former colony Hong Kong – which shares the same standard– achieve a similar level of cellular density.

Interestingly, the countries under the trend curve do not support a close link between mobile telephony adoption and wealth with countries such as Canada or Luxembourg that clearly performs worse as expected given that its cellular density is at a similar level as that of Italy or Ireland which are far less affluent. This phenomenon is clearly linked to the nature of the GDP definition, which disguises the country's real wealth and its diversity. Ireland's performance is rather astonishing given that it recorded a penetration rate of (0.009) which is four times as high as in Germany (0.002) although the latter has a GDP twice of the Irish GDP. Controversially, although Ireland has also followed the British route they did not achieve a similar performance of adoption, however, thanks to the TACS deployment the Irish managed to score levels of penetration that were close to the ones achieved by Italy and Luxembourg or even a higher one than Germany which has a GDP twice the size. Hence, it can be concluded that the deployment of the TACS technology (which offered the benefit of economy of scale) helped it to outweigh its low financial potential. Altogether, this examination revealed that cellular telephony adoption is not as strongly correlated to wealth than initially anticipated stressing the assumption that other factors are at play that foster the diffusion of mobile telephony.

Despite the controversial findings depicted above researches mostly tend to formulate simple relationships based on wealth as suggested by Rogers to capture the rather complex diffusion process. Indeed, the graph illustrates that at least in the initial phase of service Rogers' postulation of wealth's determining role is not a good predictor for cellular telephone adoption. Most vital, it appears that the diffusion theory has a tendency to regard any deviation from the proclaimed static relation between wealth and diffusion rates as an exception from the rule rather than a consequence of the innovation's nature and its perception by the consumers[210]. Compared with its rather static-diffused main line counterpart the cellular phone is even in the sense of diffusion theory a mobile or non-static innovation which behaviour is not as easy both to describe and to forecast while its adoption pattern appears to be influenced also by non-

[210] This is due to the fact that the cellular phone managed to establish itself in everybody's life faster than any device before, changing the way people live and work, creating new routines resulting in the 'Cell Phone Culture'. Indeed, the Japanese mobile operator NTT DoCoMo even describes the mobile phone as the "*key to daily life*" [NTT2006].

economic factors during its diffusion. Consequently, the correlation between wealth and cellular telephone adoption is complex and not as homogenous as claimed by the economic scholars[211].

Altogether, these examinations reveal a mixed picture, which does all but proof the validity of Roger's claimed assumption between wealth and innovation adoption, which might also be due to the statistically small base of mobile subscribers given that the technology's recent launch. Hence, the years 1990, 1995 and 2000 were chosen as point of time for snapshots[212].

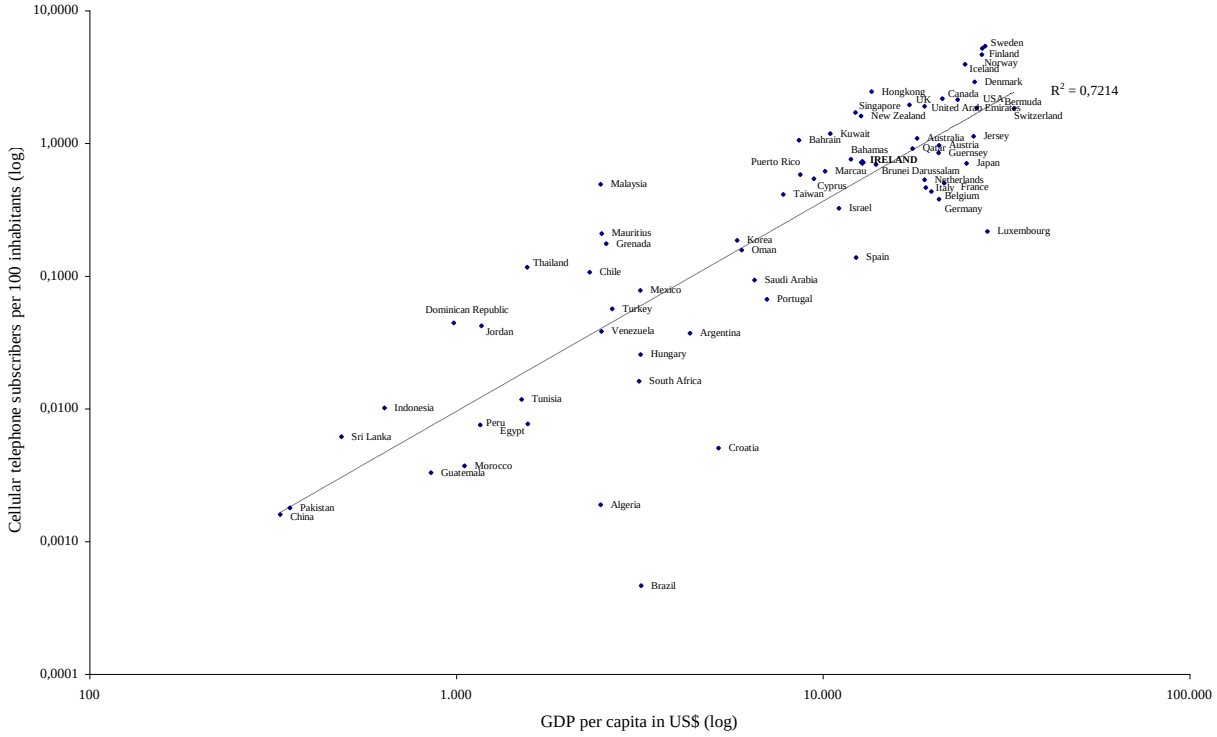


Figure 9-13: Cellular telephone subscribers vs. GDP, 1990 [ITU2005].

[211] As an exaggeration of this phenomenon one can refer to the Swiss economist and historian Jean Charles Leonard Simonde de Sismondi (1773–1842), who was credited with being the father of the business cycle theory and the first economist to attempt a macro-theory of under-consumption based on the distribution of income between the owner of capital and workers. He deplored economists' tendency to make wild generalizations while neglecting reality and relying on abstract calculations to the point that economics became 'an occult science' [Baks2008].

[212] The years were chosen for the following reasons. Firstly, the year 1990 was chosen since it marks the last year prior to the digital era. 1995 was the last year that featured an organic grown industry nearly unaffected by prepaid card services and/or subsidies handset offers which surely have a blurring impact on diffusion. The year 2000 was the last year before statistics were blurred by a density of more than 100% and the year of the launch of 3G services (on October 1 2001 SK Telecom Korea launched the first cdma2000 network while NTT DoCoMo launched the first WCDMA network on the same day, followed by the first UMTS network launch by Telenor on December 1).

In contrast to the scenario five years ago the graph above depicts a growing correlation between cellular subscribers and GDP – indicated by the relative high coefficient of correlation (R^2) of 0.72, which is similar to the situation in the wired realm. Expectable, the Nordic region leads the benchmark again. Most surprisingly, some countries with a GDP of around 5,000 US$ such as Thailand, Chile or Malaysia score comparable levels of cellular penetration than nations which have ten times their wealth and even rank above the trend curve, controversially. Similarly, countries such as Turkey, Mexico, Korea, Saudi Arabia, Oman, Puerto Rico and Taiwan record levels of mobile phone subscriptions that also match or even supersede those of richer mostly Western countries. Closer inspections reveal subtle local dependencies. For most of the British-American influenced countries (colonies, protectorates, etc.) such as Grenada, Malaysia, Taiwan, Puerto Rico, Bahrain, Macao, Bahamas, Ireland, Kuwait, Singapore, New Zealand, Hong Kong, the US, Australia, Canada and Bermudas the mobile penetration rates correlate well with GDP as does it for the Mediterranean region thanks to the use of AMPS-based technology. Clearly, other regional factors act to significantly dislocate the economic dependencies. From a technological perspective, the choice of system standard may act to promote or inhibit the adoption process at national or regional level. Adoption performance throughout the Nordic region was clearly significantly enhanced by the agreement of the Nordic countries to utilise the common NMT standard. Similarly, American-Anglo-Irish consensus on the use of AMPS/TACS technology produced a comparable outcome. Countries such as Germany, Japan and France which opted for the use of national proprietary systems, failed to attain similar levels of demand. The choice of network standard clearly impacts on relative adoption performance. The international use of globally standardized technologies should lead to more homogenous levels of adoption since all countries could similarly benefit from the advantages of sharing a common underlying technology[213].

[213] To investigate this hypothesis it is useful to consider the experience of fixed-line telephony as an example of the use of a globally standardize technology.

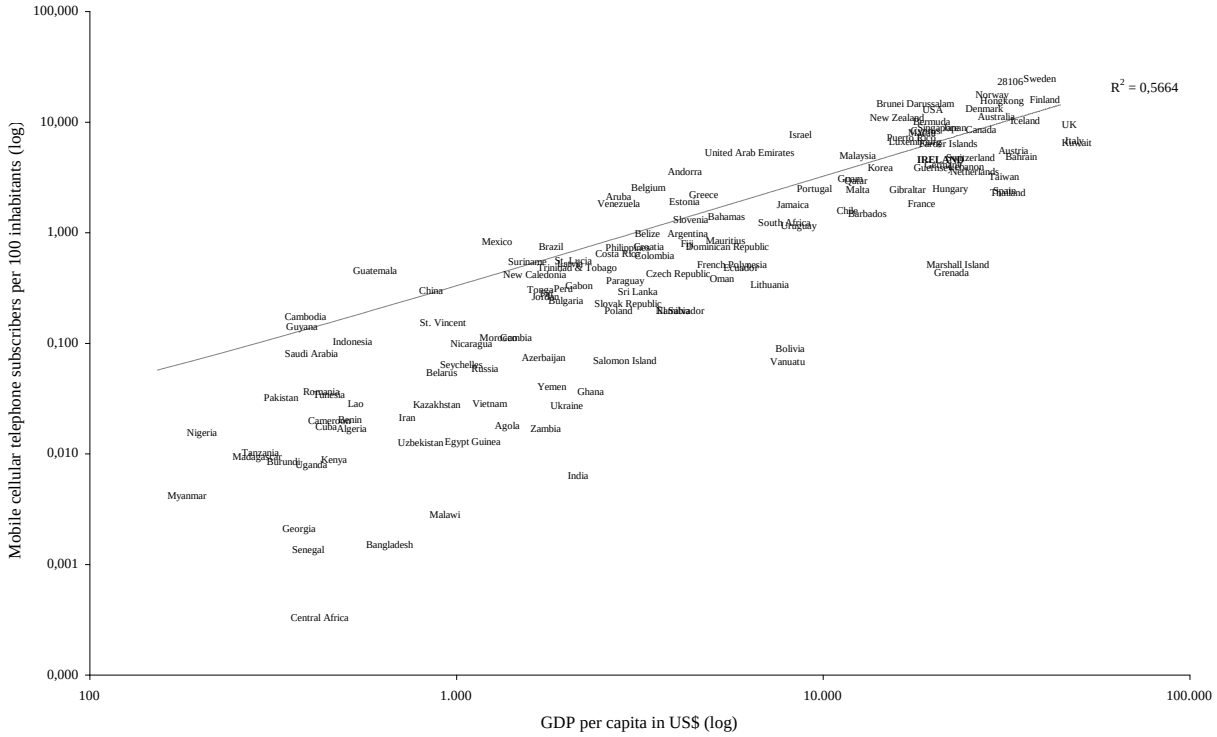


Figure 9-14: Cellular telephone subscribers vs. GDP, 1995 [ITU2005].

Another five years later the decrease in the value of the coefficient of correlation ($R^2 = 0.57$) as depict in the graph above, illustrates that the correlation between cellular density and a country's wealth was weakened. Significantly, while the number of countries above the trend line equals that of those below the trend line in 1990 this balance has changed towards a scenario where the numbers of countries that perform weaker than expected overshadows the benchmark. This trend is a clear indication of the impact that the launch of tariffs aimed at low-spending and low-usage consumer had on the market. Moreover, mobile telephony has become indispensable in the developing world where it is used as an alternative – or even solely available – access path to the mostly absent traditional fixed-line network. Indeed, cellular technology emerges as an even more useful tool in an environment where the availability of other forms of communications and related infrastructure such as roads, petrol stations, postal system, electricity or main lines are limited. Foremost, developing countries still suffer a lack in basic education, health and social services. Contrary, the relatively low cellular density in affluent economies of North America or Europe may point to the traditional role the fixed-telephony has gained in either societies as being regarded as a broadly available, efficient and reliant means of communication. Coincidentally, the high density of fixed telephony may also be mirror by the older demography in developed economies compared to the younger populations in Africa or Asia.

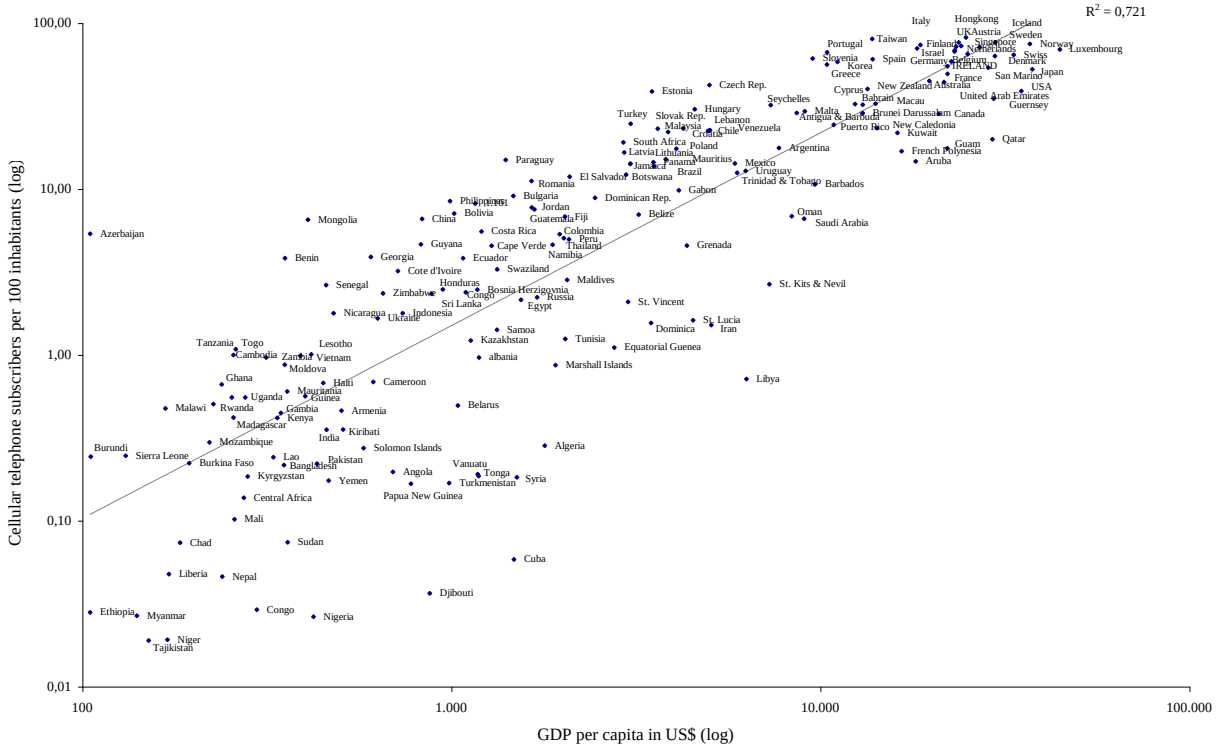


Figure 9-15: Cellular telephone subscribers vs. GDP, 2000 [ITU2005].

Following the launch of prepaid card services during the late-1990s it comes as no surprise that more and more developing countries jumped on the mobile phone bandwagon. Indeed, while the market for more sophisticated or higher-priced products such as main line telephones or PCs is restricted by social, economic or traditional types of ICT infrastructure limitations the 'just enough' functionality of an affordable prepaid cellular phone is more than embraced. Therefore, underpinning the correlation between cellular telephone subscription and GDP even more with a coefficient of correlation of $R^2 = 0.70$. Most importantly, the rapid and broad diffusion of cellular telephony presents an opportunity for these regions to leapfrog ahead. Furthermore, cellular operators in emerging markets increased their subscriber base by launching advanced phones with the latest features[214]. Hence, people turn towards mobile telephone services and related equipment with extensive features that increase the functionality. Moreover, with a weak fixed electrical and telecommunications infrastructure in place, wireless alternatives are being adopted at a faster rate.

[214] This trend towards cellular phone ownership in these regions is further helped by the fact that people cannot afford multiple devices to satisfy both their communications and entertainment needs such as PSTN telephones, mp3-players, PCs for internet access or game consoles. Surprisingly, the preference for one device could also be witnessed in the US where the fastest growth for apple's iPhone was from low income households "*partly due to the benefit of saving costs of a separate broadband connection and other music devices and gadgets*"[Silv2008].

Ironically, although it is widely accepted that the prepaid card scheme, launched in 1995 enabled less affluent people to adopt the sophisticated and expensive cellular technology a gap still remains between developed and developing countries. It can savly be postulated that one key obstacle to the broader diffusion of the mobile telephone is the limited access to electricity in rural regions (which also lack other more vital infrastructure such as water supply), illustrating a form of regional digital divide within a nation.

Another feature that contributes to the low level of mobile telephone penetration is the community use of mobile telephones as illustrated by the example of 'wireless women' in Bangladesh[215]. Interestingly, one of the operators, Grameen Telecom, a joint venture including the Bangladeshi Grameen Bank[216] and Norwegian operators Telenor, launched its Village Pay Phone (VPP) program. Under this scheme women who were recommended by their fellow villagers, were loaned around US$ 350 to purchase a mobile phone. They then purchase airtime from Grameen and reselling it to their customers [ITU1999a].

Altogether, to be fair it must be stated that in the most impoverished regions even prepaid cards or subsidized mobile telephony services are still priced at extra-ordinary high levels making any means of communication a privilege of the rich elite.

The cellular telephone's rapid adoption stands in stark contrast to the one of the PC in poor countries although both technologies emerged within the same decade and were marketed virtually back on back. Ironically, while the PC was seen as the main tool to access the internet in poorer countries[217] until the mid 2000s this may not be true anymore. Reasons are that the policy makers recognized the important role that mobile telephony plays in providing the vital access path to the internet as well as educational (in particular literacy) deficits. On one hand, the weak or even non-existent telecommunication infrastructure represents a barrier towards the

[215] In the country, with on of the lowest fixed telephone densities in the world, around 80 per cent of the telephone lines are in the four largest cities while 80 per cent of the population lives in some 68,000 rural villages. Not surprisingly, just two years after its introduction cellular telephony had attracted some 75,000 subscribers, representing 15 per cent of all telephone connections in 1998 [ITU1999].

[216] The bank became famous for its micro-lending scheme, whereby it lends small amounts to people who would not qualify for credit from traditional financial institutes [ITU1999].

[217] Program such as 'One Laptop per Child' (OLPC), initiated by MIT Labs' Nick Negroponte in 2005, which mission was "*to create educational opportunities for the world's poorest children by providing each child with a rugged. Low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning*" [OLPC2011].

establishment of more advanced technologies such as wireline internet access. In particular, not only is the telecommunications carrier required to have an fixed-network installed (which may have been a target of criminal attacks) with extensive coverage in mostly densely populated areas at high costs but also the potential customer was required to pay dearly for hardware equipment[218]. On the other hand, PC users were required to have some level of literacy, not only but also in the English language. Therewith, people had to be educated in both, basic ICT as well as language skills, which in turn increases the total costs of wireline internet access even more. In contrast, the set-up of a mobile phone is rather intuitive whereas prepaid schemes offered the chance to obtain such a device for the general public.

Table 9-5 shows the coefficient of correlation (R^2) between GDP and main line/cellular density, respectively, number of countries with a cellular network in the period of 1960 to 2000.

[218] Bauer et al. asserts that GDP is a strong determinant of internet access: "*Income constraints the ability of people to invest in PCs and acquired the necessary computing training.*" [Baue2000]. ISP charges and the availability of adequate financial resources for infrastructural investment to provide access to communication services are also influencing factors. Further, effective use of the internet was also found to depend on the educational level, which itself is income dependent. Although PC diffusion and consequently internet use is linked to GDP, suppliers and manufacturers have erected significant financial and knowledge-based barriers to entry which restricts competition and impacts on diffusion patterns. Similar financial obstacles associated with premium pricing of equipment may have impeded the promotion of mobile telephone services and forced operators to find ways to stimulate diffusion by countering the negative impact of high equipment charges on potential customers (e.g. by means of subsidies).

Table 9-5: Correlation between both main lines and cellular telephone subscribers vs. GDP (R^2), numbers of countries/territories with a cellular/main line network, 1985-2000 [ITU2002].

	1960	1970	1980	1985	1988	1990	1992	1993	1994	1995	1996	1998	2000
GDP/main lines -> R^2	0.83	0.77	0.42	0.74		0.85	0.82	0.79	0.78	0.78	0.68	0.78	0.74
Countries+ with PSTN	117	148	166	205		208	213	213	213	213	213	213	213
GDP/cellular subs. -> R^2	n/a	n/a	n/a	0.36	0.73	0.72	0.75	0.77	0.79	0.77	0.76	0.8	0.72
Countries with cellular	-	-	1	9	39	66	102	120	133	153	173	193	199

+ According to ITU (2005) data which covers 214 territories/nations Palau remained the only country which did not report any figures in the particular period. However, the CIA (2008) World Factbook the country had 7,800 main lines in use in the year 2008 with a population of 20,796 (July 2010 est.).

Surprisingly, the two R^2 values reconcile over time which gives rise to the assertion that wealth is similar important for cellular telephone adoption as for main lines. With regards to main lines the correlation has become weaker since the 1960s and the beginning of the 1990s[219] only to increase in the subsequent years again. In contrast, the scenario for cellular telephony is quite different since the correlation between wealth and mobile penetration gets stronger as the industry matures. Indeed, this result appears rather contradictive when considering the launch of tariffs options that suite low-spending customers such as prepaid card service (mostly with a subsidized handset) in the mid-1990s, an event that is claimed to be the dominant driver behind the 'cellular revolution'. In particular, the prepaid concept is most beneficial for low-spending users and individuals that cannot afford a long-term subscription with monthly billing.

However, certain historical aspects have to be considered which put the contradiction into perspective. Foremost, there is a substantial lack in reliable data for the period before 1960 with regards to main line density compared to the launch of cellular telephone services in the 1980s

[219] To obtain an even more accurate view it is recommended to examine a larger sample of years in the period 1960-1990 (i.e. annually or bi-annual) which is not possible given the lack of reliable data. A similar lack of information is similarly observable for the era of the introduction of the fixed-line telephone at the beginning of the 20th century.

which was covered intensively by the media, shareholders, regulators, academics and the network operators themselves. Foremost, all parties involved in the cellular industry were particular focused on the innovation's success or failure which could easily be measured by the number of its subscribers which allowed for further benchmarking among cellular network operators both domestic and abroad. Hence, it is nearly impossible to construct a similar detailed timeline of fixed-line telephony since its initial launch.

Nevertheless, given that cellular telephony managed to achieve a comparable rate of global network deployment than its fixed-line counterpart in just two decades may tempt observers to argue that the cellular telephone is or was a democratic technology which seems affordable to the broader public given the emergence of prepaid card packages that featured a reasonable priced mobile handset. Most surprisingly, what really caused cellular telephony to gain such a prominent role in even the poorest regions of the world was the paradigm change involved with the prepaid scheme. In contrast to a fixed-line connection that required the payment of a monthly service charge mobile phone subscribers were free from any credibility issues since they could pay up-front for airtime if their financial situation allowed for.

Hence, fixed-line diffusion still reports a strong correlation with GDP decades after its first deployment, which may be particular irritating since related customer equipment dropped in prices[220].

Given this finding it appears that wealth and the costs of cellular telephony had to be put into perspective. Similarly, the [OECD2000] rightly argues that the growth rates in mobile subscribers also reflect a trend in the pricing of services related to market structure. Consequently, it can be concluded that the adoption of cellular telephony depends on its perceived affordability in the particular market rather than on general economic factors therewith, differentiating it from the experience gained on the fixed network. Similarly, Bakalis *et al.* (1986) argue that, while income may explain some adoption performance, the impact is neither uniform nor universal. The data points to the presence of other significant influencing factors and the need to refine the macroscopic variable approach typified by the GDP.

[220] This was due to the invention of the transistor which laid the foundations for the semi-conductor/micro-processor industry with ever-faster life-cycles alongside a downward spiral for costs.