



# **The Newton Ball Multi-National Diffusion Acceleration Effect: an Apple iPhone Case Study**

**Acceleration of the rate of diffusion of  
innovations in lag markets due to the  
Learning Effect**

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## 1. Executive Summary

Rogers' classic theory on the Diffusion of Innovations was first published in 1962, with the fifth edition published as recently as 2003. Of most relevance to marketers is Rogers' definition of diffusion of innovations, the rate of adoption, perceived attributes of innovations, adopter categories, and communication channels.

However, the world has changed dramatically in the forty years since Rogers first published his theories, with the notable rise of globalisation and the internet. Several researchers have attempted to extend Rogers' Diffusion of Innovation theory so it is relevant in this global context, covering topics such as diffusion rates across countries, country characteristics and cultural context's impact on rates of diffusion, and most importantly for this paper, the lead-lag learning effect.

Ganesh and Kumar (1996), Ganesh et al. (1997), Dekimpe et al. (2000), and Kumar and Krishnan (2002) have all discussed the impact the learning effect experienced in lead markets can have on the rate of diffusion in lag markets. This paper extends these researchers' findings through the development of a working framework titled the 'Newton Ball Diffusion Acceleration Effect'

The 'Newton Ball Diffusion Acceleration Effect' framework works just like the famous 'Newton Ball' executive desktop accessory, in that it first relies on some adoption of the innovation in the lead market (aka swinging the ball back), from which subsequent markets experience the learning effect as they interact with the lead market (balls colliding), then the lag market experiences the greatest learning effect and acceleration of adoption rate compared to the lead market (last ball accelerates faster than the other balls).

The working framework is applied to the most recent worldwide innovation phenomenon, the Apple iPhone. The paper discusses the potential accelerated rate of diffusion in Australia (lag market) versus the United States (lead market), using Rogers Perceived Attributes of Innovations, and Ganesh et al (1997) Factors Influencing the Learning Process framework.

The strengths of the framework are that it provides marketers with a visual representation of the acceleration effect in lag markets, and may assist in decision making as to whether to launch an innovation in many markets at once using a sprinkler strategy, or in a phased approach to capitalise on the learning effect using a waterfall strategy (Ohmae 1985).

The framework does have weaknesses and issues, with factors other than the learning effect, such as price, competition, and government policies, having significant impacts on the rate of diffusion in the lag market. There is also further research required to determine whether the framework is generalisable when using developing markets as the lag market.

## 1. Introduction

The world has changed significantly in the forty plus years since Rogers (1962) published his classic theory on the *Diffusion of Innovations*, which outlined the study of how and at what rate new innovations spread across markets.

Firstly, the rise of the global economy has meant that new innovations are no longer just launched and diffused in one market in isolation, but in many countries across the world at the same time. This has a significant impact on Rogers' theories which were developed with only one market in mind.

Secondly, the development of the Internet has meant that communications are no longer restricted to one market, as consumers see advertising and discuss innovations that are happening abroad even before they reach their own market.

Many researchers have attempted address these issues and further develop Rogers' Diffusion of Innovations theory in the new global context. For example, Dwyer et al (2005) researched the influence of national culture on cross-national product diffusion, and Tellefsen and Takada (1999) have looked at mass media availability and its relationship to multi country diffusion of consumer products.

Of particular interest for this paper however is the work of several researchers into the *learning effect* and its impact on the diffusion of innovation in lag markets, or markets which have followed the innovation launch in a lead market (Ganesh & Kumar 1996, Ganesh et al 1997, Dekimpe et al 2000, Kumar & Krishnan 2002).

This paper will build on this topic of research to propose a working framework of the learning effect's impact on lag markets, titled the 'Newton Ball Diffusion Acceleration Effect'. This framework will then be applied to the recent launch of the Apple iPhone in Australia, and an argument will be made as to why the diffusion of the iPhone in Australia will proceed at a greater rate than that of the lead market, the United States of America.

Limitations of the 'Newton Ball Diffusion Acceleration Effect' model will then be discussed with suggestions for future research to further test and develop the framework.

## 2. Overview of Rogers' Diffusion of Innovation Theory

Before we look at how researchers have developed Roger's (1962) Diffusion of Innovation theory in a global context, it is important to summarise the theories that Rogers' initially proposed. Rogers' book titled the 'Diffusion of Innovations' was first published in 1962, with the fifth edition published as recently as 2003. This summary will cover the theory as outlined in the most recent edition.

### a. Definition

Rogers (2003) defined Diffusion of Innovation as *'the process by which an innovation is communicated through certain channels over time among the members of a social system. Diffusion is a special type of communication concerned with the spread of messages that are perceived as new ideas.'*

It is interesting to note that Rogers' definition focuses on 'communication' rather than 'adoption' of new innovations, and this is perhaps due to the fact that Rogers was a communications academic. It has required other researchers, such as the ones mentioned in subsequent sections, to apply his theory to marketing.

Also, by definition 'members of a social system', while useful at the time of writing, may restrict the theory to one home market.

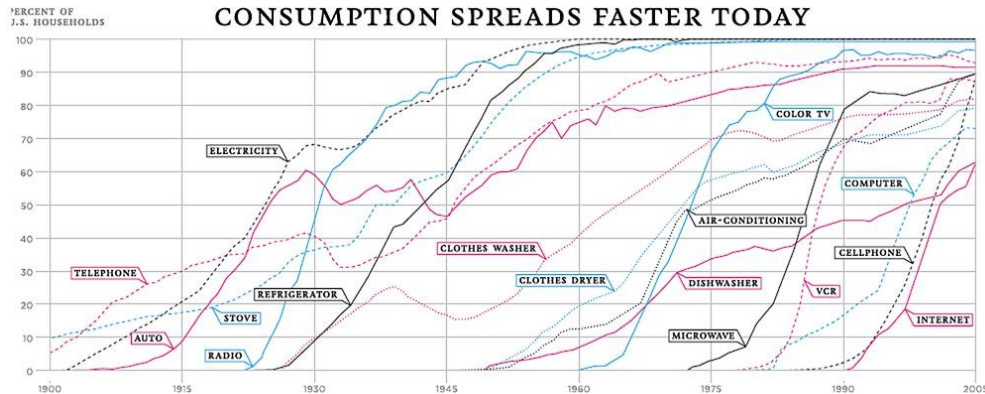
### b. Rate of Adoption

Arguably the most important component of Rogers' theory from a marketing perspective is that of the rate of adoption, which he defines as *'the relative speed with which an innovation is adopted by members of a social system.'*

When plotted on a graph, most new innovation rate of adoptions follow an S-shaped curve over time. At first adoption is slow, however as more people discover and adopt the innovation the curve becomes steeper, before adoption slows as the innovation is adopted by the majority of the market. Bass (1969) introduced a mathematical model since widely used to help predict adoption rates of innovations.

The rate of adoption (and the resulting S-shaped curves), vary widely across different innovations (Figure 1). For example, the automobile has had a relatively slow rate of adoption taking over 100 years to fully diffuse in the United States, whereas colour television was fully diffused within 30 years.

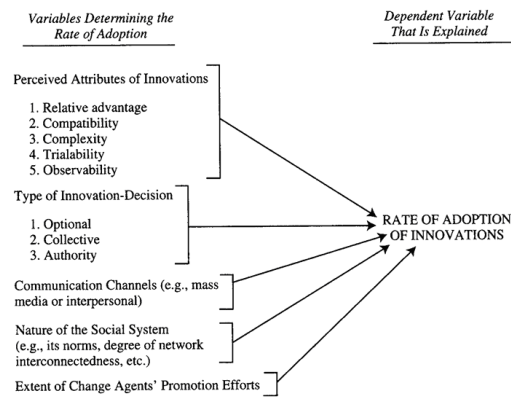
Figure 1. Adoption rates of different innovations over time in the US.



Source: New York Times (2008)

It is important to note that the rate of adoption of innovations launched in the last few decades is in most cases much faster than those launched prior to the 1950's. This may be due to advancements to a number of variables that Rogers' proposed determine the rate of adoption of an innovation, but most probably is due to the development of mass media communication channels. (Figure 2)

Figure 2. Variables Determining the Rate of Adoption of Innovations



Source: Rogers 2003 (p222)

### c. Perceived Attributes of Innovations

Rogers proposed five perceived attributes that affect the rate of adoption of innovations being: relative advantage; compatibility; complexity; trialability; and observability. Hsu et al (2006) found that 49 to 87% of the variance in the rate of adoption across innovations can be attributed to these five attributes.

Relative advantage is defined as *'the degree to which an innovation is perceived as being better than the idea it supersedes'*. This attribute is most likely to explain the relatively rapid rate of adoption of the colour television, due to its clear advantage over black and white television.

Compatibility is defined as *'the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters'*. It is intrinsically linked to the theory of continuous versus discontinuous innovations outlined by Moore (2002). Continuous innovations are simple upgrades from current products where we do not need to change our behaviour, and therefore have high compatibility. An example of a continuous innovation is the colour television, which did not require any behaviour change to experience the innovation once you turned the television on.

Discontinuous innovations on the other hand need us to change our current behaviour, and therefore have low compatibility (Moore 2002). An example of a discontinuous innovation is the telephone, which required behavioural change from sending letters. It is for this reason that continuous innovations in most cases have faster adoption rates than discontinuous innovations.

Complexity is defined as *'the degree to which an innovation is perceived as relatively difficult to understand and use'*. This is likely to explain part of the slow rate of adoption of the computer as seen in Figure 1. Early computers were very complex pieces of machinery that required a lot of training to understand. It was not until the launch of the graphical user interface by Apple and Microsoft in the early 1980's that the complexity was significantly reduced (Toastytech.com 2008)

Trialability is defined as *'the degree to which an innovation may be experimented with on a limited basis'*. Marketers trying to influence the rate of adoption will often provide free trials of their innovations, with the idea that consumers will want to purchase the product after they have trialled it. This is very often the strategy for software products (anti virus), and new car launches.

Observability is defined as *'the degree to which the results of an innovation are visible to others'*. The mobile (cell) phone has one of the steepest adoption curves in Figure 1. Potentially one of the reasons for this is the high observability of the innovation, with adopters carrying and visibly using them anywhere they go. Once considered a fashion accessory, the belt clip on early mobile phones helped to increase observability.

In their study of the adoption of online games in Taiwan, Lin et al (2007) found that the relative advantage and compatibility of the game positively affected its adoption, while the complexity of the game had a negative affect on adoption. However, the perceived attributes of trialability and observability had no significant affect on the adoption rate of the online game.

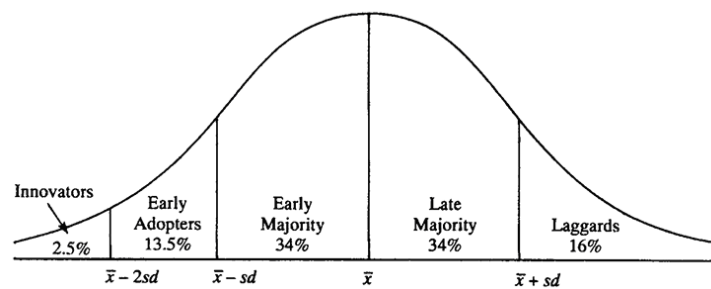
This study suggests that in some cases not all of the attributes proposed by Rogers' will have a significant affect on the adoption rate of a new innovation.

#### d. Adopter Categories

Following the 'Rate of Adoption' component of Rogers' theory, the next most valuable insight for marketers would have to be his categorisation of adopters. The development of these categories has enabled marketers to target adopters based on their psychographic profiles of innovativeness.

Rogers' identified five adopter categories being; innovators; early adopters; early majority; late majority; and laggards. The category populations form a bell shaped curve (Figure 3), with the theory that each group acts as a reference base for the next group, from innovators through to laggards (Moore 2002)

Figure 3. Adopter Categorisation on the Basis of Innovativeness



Source: Rogers 2003 (p281)

Given the theory that each group acts as a reference group for the next in influencing take up of the new innovation, some researchers such as Clark and Goldsmith (2006) have focused on how marketers should promote their innovations to innovators and early adopters, thinking that they will then communicate the benefits of the innovation through word of mouth to influence the rest of the population. They suggest that marketers should focus their promotions on innovators by appealing to their superior knowledge needs through featuring detailed product information in their advertising.

However, there are some researchers that have challenged the adoption lifecycle as proposed by Rogers (2003). Geoffrey Moore in his best selling book 'Crossing the Chasm' (2002) identified an issue for high tech innovations in moving from early adopters to the early majority, i.e. 'the chasm'. He argues that given the vastly different psychographics of the two groups, early adopters (visionaries) and early majority (pragmatists), mean that the latter will not use the former as a reference group. Therefore the early majority will only take other early majority members as their reference group, creating a catch 22 situation for marketers.

Malcolm Gladwell in his book 'The Tipping Point' (2000) also touches on this critical part in a product's lifecycle which he defines as '*the moment of critical mass, the threshold, the boiling point*', where an idea will either take off (see inflection of curve between early adopters and early majority in Figure 3) or fall into Moore's chasm.



### e. Communication Channels

Rogers defines communication channels as *'the means by which messages get from one individual to another.'* He argues that mass media and interpersonal channels (word of mouth) are more effective in communicating ideas to different adopter categories. Specifically *'mass media channels are more effective in creating knowledge of innovations, where interpersonal channels are more effective in changing attitudes towards a new idea, and thus influencing the decision to adopt or reject a new idea'*.

Tellefsen and Takada (1999) in their study on mass media availability and diffusion across countries found evidence supporting Rogers' theory above. Those countries that had higher availability of mass media channels had faster rates of adoption amongst innovators and early adopters (who crave knowledge of new innovations). However, they also found that the same countries experienced slower rates of adoption in subsequent adopter categories (the majority) due to the decreased reliance on word of mouth communication, which is critical to convince these later groups to adopt.

In the 2003 edition of the Diffusion of Innovations, Rogers briefly discusses the Internet as an emerging communication channel that can achieve both mass media and interpersonal communication objectives. However, Rogers does not go into any depth on the topic and has left that to future researchers. He does however acknowledge the effect of the Internet on the rate of adoption highlighting that *'the rate at which the Internet speeds up the diffusion process in some cases is illustrated by internet viruses, which can travel world wide in a day or two.'* The Internet plays a key role in the working framework that is proposed in Section 5 of this paper.

### 3. Assessment of Rogers Diffusion of Innovation Theory in an International Context

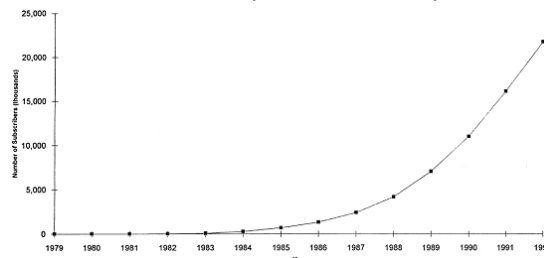
Rogers (2003) himself said that *'clearly, the world in which we live today is different one than that of sixty years ago when the study of the diffusion process began'*. Indeed, Roger's theories on Diffusion of Innovations were developed prior to the period of mass globalisation that has occurred in the last few decades.

Rogers raised several questions in the latest edition of his theory in respect to the differences in diffusion rates across countries. For example *'why was the rate of adoption of mobile phones much more rapid in Finland and Scandinavian nations than in Japan?'* Several marketing academics have looked at this issue and more to build on Rogers' theories so they take into account the global marketplace that we now preside in. Some of the key research will be explored in this section.

#### a. Diffusion Rates Across Countries

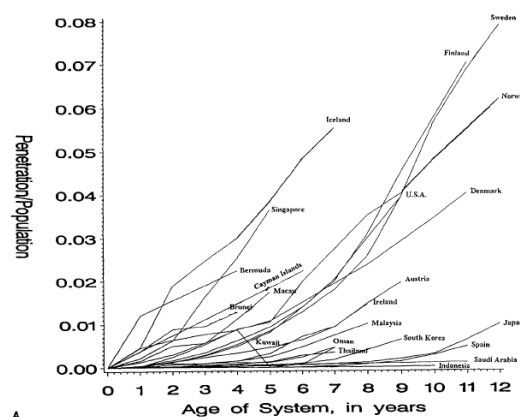
The global diffusion rate of a new innovation such as the mobile phone generally follows the typical S-shaped curve, as seen in Figure 4. However, the diffusion rates are likely to vary widely between countries, as seen in Figure 5.

Figure 4. World wide adoption of mobile phone services



Source: Dekimpe et al. 2000

Figure 5. Penetration of mobile phone services across countries



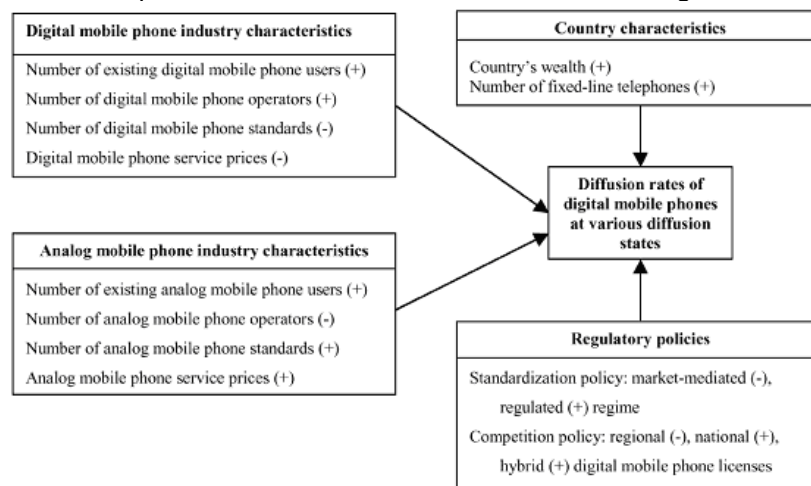
Source: Dekimpe et al. 1998

The differences in diffusion rates across countries may be due to a variety of reasons such as country characteristics, cultural context, and the lead-lag learning effect. Each of these will be discussed in turn.

## b. Country characteristics

Kauffman (2005) researched international diffusion patterns of digital mobile phones and found that specific country characteristics have a significant impact on adoption rates. For example, wealthier countries with a higher GNP per capita were found to promote faster adoption in the early phases of diffusion. Dekimpe et al (2000) also found support for the wealth of a country and adoption rates. Kauffman (2005) also identified several other country/industry specific factors that influence the diffusion rates of digital mobile phones as per Figure 6.

Figure 6. A conceptual model for the international diffusion of digital mobile phones



Source: Kauffman and Techatassanasoontorn (2005)

Gruber and Verboven (2001) found support that regulatory policies drive adoption of digital mobile phones, showing that Scandinavian countries were among the first to grant licences for the technology, likely influencing their strong rate of adoption in Figure 5.

## c. Cultural Context

Takada and Jain (1991) studied the diffusion of consumer durables in the Pacific Rim countries of the United States, Taiwan, South Korea and Japan. They used Hall's model (1976), to classify the United States as a low context culture, and the Asian countries of Taiwan, South Korea and Japan as high context cultures.

They proved that countries with high context cultures experience a faster rate of adoption for new innovations, than low context cultures and this is due to the homophilous nature of communication in high context cultures. Homophilous refers to where the population has *'similar cultural and socioeconomic*

*backgrounds*', and is prevalent in high context cultures such as Japan. The United States on the other hand, has much more heterophilous communication due to the *'heterogeneity of the population and its diversified background'*.

Gatignon et al (1989) also looked at culture's impact on multinational diffusion patterns, basing their study on three key variables being: cosmopolitanism; mobility, and women in the workforce. They found support that *'cosmopolitanism'* or *'individuals oriented beyond their own social system'* and *'mobility'* are key drivers in cross national diffusion, as they help share ideas across borders.

However, their study was based only on European nations that share borders and therefore it could be argued that *'cosmopolitanism'* and *'mobility'* are not as important drivers in more isolated countries such as Australia.

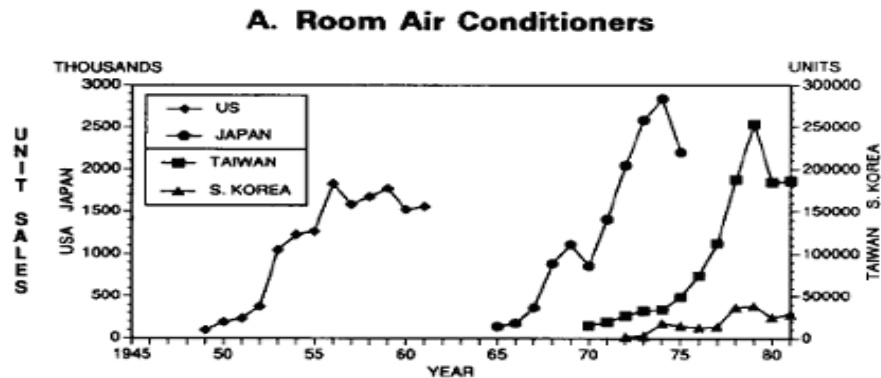
Using Hofstede's (1980) dimensions of culture framework, Everdingen et al. (2005) found that consumers in countries with high individualism and low uncertainty avoidance such as the Scandinavian countries of Sweden, Denmark and the Netherlands, have faster rates of adoption. Dwyer et al. (2005) also used Hofstede's model to determine cultures influence on multinational diffusion, and found that four out of the five dimensions of culture have an impact on cross national innovation diffusion.

Specifically, Dwyer et al. (2005) found that the dimensions of power distance and masculinity were positively linked to a country's adoption rate. On the other hand, individualism and long term orientation provided a negative effect on the adoption rate. Hofstede (1991) described that *'low context'* is similar to *'individualism'*, and therefore the results from Dwyer et al. (2005) correlate with the findings of Takada and Jain (1991) above.

#### **d. The Lead-Lag Learning Effect**

Takada and Jain (1991) in addition to looking at cultural impacts on rate of adoption also looked at the lead-lag relationship. They found that countries with a lagged introduction experience accelerated diffusion rates due to improvements in design and quality of the innovations and the availability of mass media vehicles over time (see Figure 7).

Figure 7. Lead and Lag Time Relationships of Diffusion Processes Among Four Countries



Source: Takada and Jain (1991)

Based on Takada and Jain's findings Helsen et al. (1993) suggested that marketers should segment countries into clusters based on their diffusion patterns to determine which markets should be lead and lag markets in a new innovation roll out. However, their research showed that there was no consistency of diffusion patterns across innovations or across countries.

Canepa and Stoneman (2004) supported this claim when they found that *'diffusion paths are technologically specific and no country in Europe or North America can be said to exhibit faster, earlier or more extensive diffusion for all technologies than other countries'*.

Dwyer et al. (2005) has been the only researcher to suggest what countries a company should launch its innovation and in what order to obtain the greatest lead – lag effects and adoption rates across countries. They hypothesise that innovations should initially be launched in countries such as: Taiwan and South Korea which are high in collectivism; the United States and Great Britain which have a short term orientation; Japan and Italy which are masculine cultures; or Mexico and France who have high power distance.

Countries which are *'individualist, long-term oriented, feminine, and low power distance'* such as the Scandinavian countries should be selected as lag markets. Van Everdingen et al (2005) noted that it is not only the lead-lag effect but also the simultaneous effect that has influenced the diffusion of the Internet and mobile phone services across 15 countries in the European Union. Importantly, they found that the *'influence of adoptors on potential adopters in another country is equal to the influence on potential adopters in their own country'*. This study provides support for Gatignon et al (1989) cultural elements of *'cosmopolitanism'* and *'mobility'* within the European Union.

They found that cross population mixing drives diffusion processes across the European Union and that marketers should not treat countries in isolation, but the EU should also not be considered one big market, due to diffusion rates varying greatly between countries. The cross population mixing effects may be in part

due to the nature of the European Union sharing borders. It may be difficult for isolated countries, such as Australia, to experience the same effect.

Van Everdingen et al (2005) also noted that cross population mixing may effect some innovations more than others. They found that the Internet is more positively impacted than the mobile phone, as the usefulness of the Internet/email increases as more users adopt it, whereas mobile phones can reach and be reached by landline phones so the network externalities are minimal.

Ganesh and Kumar (1996) also studied the phenomenon that lag markets often have faster diffusion rates than the lead markets that the innovation was initially launched in. They found that a *'learning effect'* exists across national borders, preparing the lag market by communicating the benefits of the innovation found in the lead market.

They also explain how the learning effect ties to Rogers (2003) perceived attributes of innovation. The communication between the lead and lag markets, helps consumers in the lag markets understand the relative advantage of the innovation, compatibility with their needs, and to observe the usage of the innovation.

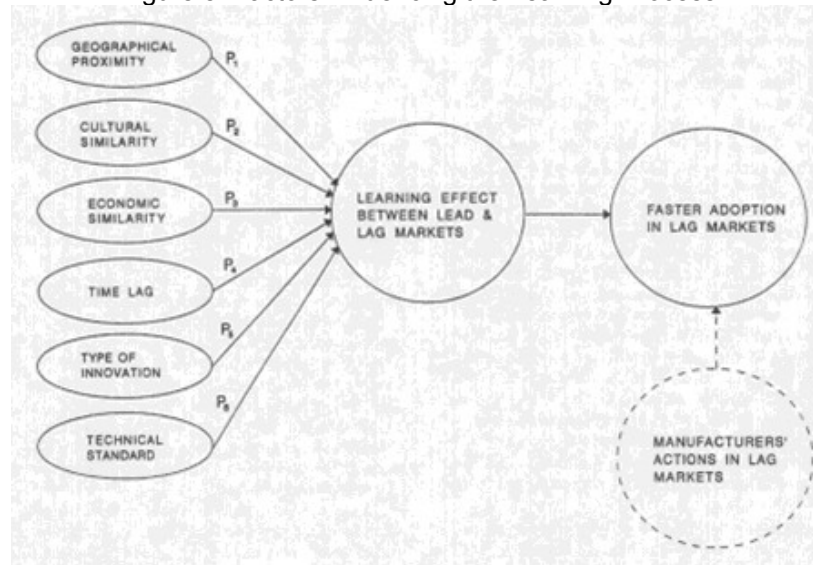
Dekimpe et al. (2000) support these findings however they instead term the *'learning effect'* the *'demonstration or snowball effect'*, and argue that *'as more countries have adopted the technology, the uncertainty surrounding its value diminishes since potential adopters can benefit from the experience of earlier adopters'*.

It is important to note that it is not just consumers that experience the learning effect. Ganesh and Kumar (1996) state that manufacturers and marketers improve their innovation and strategies over time, by learning in lead markets. This learning results in *'better product positioning'* in the lag markets.

The presence of a learning effect impacts on marketers decisions as to whether to use a sprinkler strategy, launching in multiple markets at the same time, or use a waterfall strategy, using a phased approach to launch in order to benefit from the learning effect (Ohmae 1985).

Ganesh et al. (1997) then extended the learning effect theory when they identified six factors that are likely to influence the effect between lead and lag markets (see Figure 8).

Figure 8. Factors Influencing the Learning Process

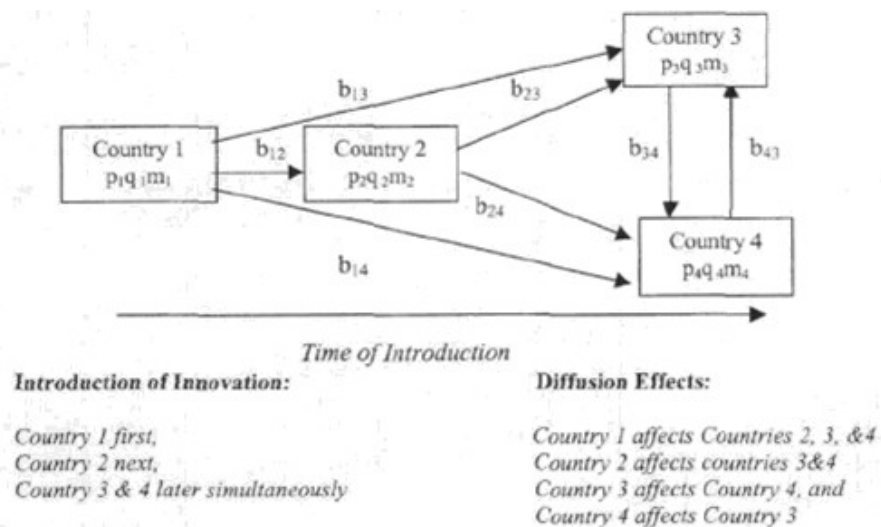


Source: Ganesh et al. 1997

Kumar and Krishnan (2002) then studied the lead-lag, simultaneous, and lag-lead effects of multinational product launches. While these results generally support the findings of Ganesh et al (1997), they add the insight into what type of countries will influence others. For example, in the case of microwave ovens, Germany demonstrates a higher influence on Belgium, as Germany is widely perceived as the most 'technologically advanced country in Europe'.

Kumar and Krishnan (2002) also visualised the learning effect phenomenon as seen in Figure 9 which shows both the lead-lag and simultaneous effects.

Figure 9. Lead-lag and simultaneous learning effects



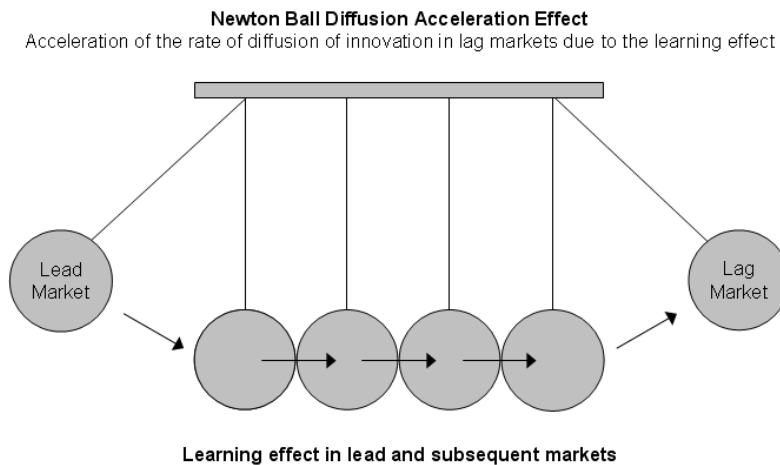
Source: Kumar and Krishnan 2002

#### 4. Development of the 'Newton Ball Diffusion Acceleration Effect' Working Framework

Although the learning effect that occurs between lead and lag markets has been researched by several academics as outlined above, there is no clear framework that has been developed to explain the process and assist marketers in forecasting adoption rates within lag markets when they use a waterfall innovation launch strategy.

In Figure 10, building on the work of Ganesh and Kumar (1996) and Kumar and Krishnan (2002), I have developed a working framework to explain the learning effect's impact on the rate of adoption in lag markets. I have called this the '*Newton Ball Diffusion Acceleration Effect*' working framework.

Figure 10. The Newton Ball Diffusion Acceleration Effect Working Framework



Just like the famous '*Newton Ball*' executive desktop accessory, the '*Newton Ball Diffusion Acceleration Effect*' working framework first relies on some adoption of the innovation in the lead market (aka swinging the ball back), from which subsequent markets experience the learning effect as they interact with the lead market (balls colliding), then the lag market experiences the greatest learning effect and acceleration of diffusion of all the markets (from a standing start).

Using the waterfall strategy, new innovations are often launched in a lead market, and then subsequently rolled out to other markets globally, so the framework will be applicable across a variety of innovations.

The working framework demonstrates in a visual way my hypothesis that the learning effect will result in a rate of diffusion in lag markets greater than that of the lead market.



## **5. Applying the Newton Ball Diffusion Acceleration Effect Working Framework to the launch of the iPhone.**

The best way to discuss the working framework is by applying it to a practical situation. Researchers such as Ganesh and Kumar (1996), and Kumar and Krishnan (2002), have already proven that the learning effect exists and has had an impact on lag markets for consumer products such as microwave ovens, personal computers, CD players, and mobile phones.

It is important to note that all the previous research has focused on products that have previously been launched in markets globally, and studied the effects after they happened. It is arguable whether this post analysis is useful for marketers who have to make decisions before any data is available. For this reason I have decided to apply the working framework to the world's most recent innovation phenomenon, the Apple iPhone.

In particular, using the framework I will discuss why Australia (the lag market) is likely to have a faster rate of adoption of the iPhone than has been experienced in the United States (the lead market). This section will be broken up to look at the iPhone learning effect through the lenses of Rogers (2003) '*Perceived Attributes of Innovations*', and Ganesh et al. (1997) '*Factors Influencing the Learning Process*'.

### **a. Rogers Perceived Attributes of Innovations**

In Section 3c, we discussed Rogers (2003) five perceived attributes that affect the rate of adoption of innovations. Each attribute will be discussed now in turn in respect of the iPhone in Australia.

#### *Relative Advantage*

The relative advantage of the iPhone when compared to current phones on the market is that it combines an iPod with a touch screen, a mobile phone and an Internet device, without the compromise that is typically seen in 'smart' phones. Potential Australian innovators have learnt about these relative advantages through the many blogs by United States adoptors, which has helped communicate the benefits of the innovation, and will persuade them to take it up quickly when it launches in Australia.

As noted above in Section 4d, it is not just consumers who experience the learning effect. Apple has increased the relative advantage of its product by launching the iPhone 3G. When the product was initially launched in the United States it was not 3G and this may have slowed initial diffusion rates, whereas Australia will not have this issue.

### *Compatibility*

It is arguable whether the iPhone is a continuous or discontinuous innovation. We have already discussed that continuous innovations have greater compatibility (Moore 2002), and given that the iPhone is simply an improvement of a smart phone and doesn't involve any major behaviour change it would be considered a continuous innovation and will diffuse at a greater speed throughout the population.

Compared to the United States where the iPhone is only sold by one carrier, AT&T, in Australia it is sold by all three major phone networks and this is likely to increase compatibility as most consumers won't need to change providers.

However given the relatively low penetration of smart phones compared to standard mobile phones, and the use of a touch screen, the iPhone may in fact be considered a discontinuous innovation for much of the population, and this may affect take up further into the adoption lifecycle in Australia.

### *Complexity*

Apple products have a reputation for being very easy to use. Apple was the first to commercialise the graphical user interface and the mouse with personal computers, and devices that work 'out of the box' with minimal instructions (Moore 2002).

As Australian's have extensive experience with iPods, the complexity of the iPhone is reduced. Apple has also recently launched a television commercial demonstrating the iPhone in use, perhaps to overcome the perceived complexity of the product (Apple.com.au 2008).

### *Trialability*

The iPhone is an interesting case, as when it was only available in the United States, innovators from other countries managed to 'unlock' the phone for use in their home countries before it was made legally available. Some analysts have estimated that over 1 million iPhones were illegally unlocked from the AT&T network (CNET 2008).

With this many unlocked iPhones in circulation it is highly likely that innovators and early adopters in Australia were at least able to trial the iPhone before its launch in Australia. This would help these consumers understand the relative advantage and lack of complexity, and therefore increase initial demand.

## Observability

Kumar and Krishnan (2002) highlighted that people travel, and view media and sports from other countries, exposing these consumers to mass media spill over. As the leading media nation in the world, the spill over outside the borders of the United States is so great it educates consumers in other countries about innovations before they are available. Let's call this *'the MTV effect'*. For example iPhones may have appeared in American music videos and movies, providing observability to Australian consumers before the product was available.

In summary, it can be argued that the iPhone has ticked all the attribute boxes for a faster adoption rate in the lag market of Australia than the lead market of the United States.

## b. Factors Influencing the Learning Process

### Geographical Proximity

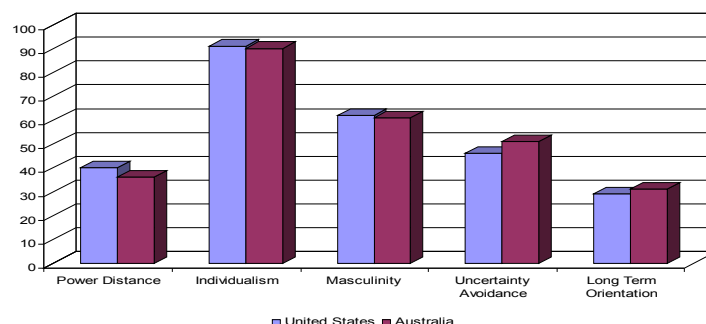
The United States and Australia are a long distance from each other and do not share any common borders. It is therefore hypothesised that the learning effect regarding the iPhone will be reduced in Australia.

However, Ganesh et al. (1997) found that in three out of four innovations studied, geographic proximity did not have a significant effect on rate of adoption in lag markets. It is assumed that this is due to the rise of the Internet making the flow of communications easy across long distances to countries that do not share borders.

### Cultural Similarity

Figure 11 shows the United States compared to Australia based on Hofstede's cultural dimensions (1980). The cultures appear extremely similar and this indicates that there is likely to be a high level of learning that will take place between the two markets, meaning that Australia has a good chance of achieving a faster rate of adoption due to the learning effect.

Figure 11. Hofstede's cultural dimensions for United States and Australia



Source: Adapted from ClearlyCultural 2008

### *Economic Similarity*

While the United States may be the most powerful economy in the world, Australia also has a strong economy with, according to the CIA (2008), '*a per capita GDP on par with the four dominant West European economies*'.

The per capita GDP of the United States is \$46,000 and Australia is \$36,300 (CIA 2008). Given the relative economic similarities, there is unlikely to be a negative impact on the learning effect, as sometimes seen when there are large dissimilarities between economies (Ganesh et al 1997).

### *Time Lag*

The iPhone was initially launched to the public in the United States on 29 June 2007. iPhone 3G was launched in Australia (and globally) on 11 July 2008. This means that there has been just over a full year time lag for the learning effect to occur. Takada and Jain (1991) found that where there is a time lag the adoption rate is positively accelerated in the lag market

### *Type of Innovation*

As mentioned in the section above regarding compatibility, the iPhone is more likely to be considered evolution of the smart phone rather than revolution, and therefore a continuous rather than discontinuous innovation. Continuous innovations generally experience faster rates of adoption.

### *Technical Standard*

Unlike the case of VCRs, where the Beta and VHS systems battled to become the dominant standard, all mobile devices tend to work on all networks with a healthy dose of competition from other handset providers. So it is not assumed that the Apple iPhone's diffusion rate will suffer as a result of not being the technical standard in Australia.

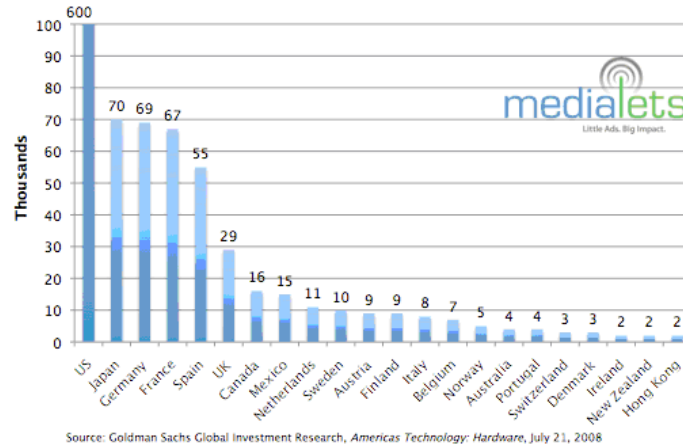
## **c. Diffusion rates in the United States and Australia to date**

Apple tends to keep their sales numbers close to their chest so it is difficult to estimate the diffusion rates across countries. However we can make estimates at least on the very first part of the adoption curve based on the first weekend sales volumes for the original iPhone (US only) and the iPhone 3G in Australia.

Analysts estimated that approximately 500,000 iPhones were sold in the first weekend on sale in the United States (Bloomberg 2007). Based on a population of approximately 300,000,000 this indicates a penetration rate of 0.16%.

Goldman Sachs Global Investment Research (Medialets 2008) published a breakdown of the first 1 million iPhone 3G sales showing that 4,000 iPhones had been sold in Australia (Figure 12). Based on a population of approximately 20,000,000 this indicates a penetration rate of 0.02%

Figure 12. Breakdown of the First 1 Million 3G iPhone Sold by country

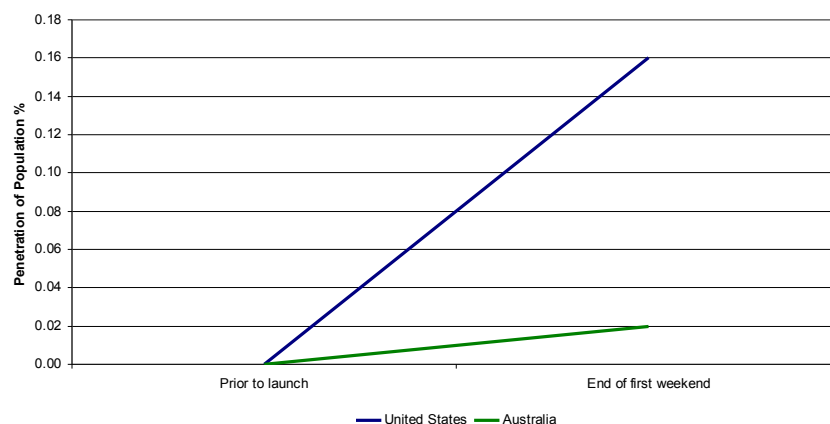


Source: Medialets 2008

Figure 13 shows the adoption rates in the first weekend of iPhone sales in the United States and Australia. The United States clearly has experienced a faster adoption rate in this period. However this is very early days, and the sales penetration disparity is likely to be heavily affected by supply issues in Australia rather than the lack of a learning effect.

One blogger (TechCrunch 2008) noted that 'If Australia had more stock they would have had more sales - I'm still waiting for mine!' Indeed Austria who has a population of less than half of Australia, sold more than double in the first weekend (Figure 12). These weaknesses of the model and more will be discussed in the next section.

Figure 13. iPhone Sales Penetration in first weekend in United States and Australia



Sources: Bloomberg 2007 and Medialets 2008

## **6. Strengths, Weaknesses and Issues relating to the 'Newton Ball Diffusion Acceleration Effect' Working Framework**

### **a. Strengths**

There are two key strengths of the working framework. Firstly, it provides a visual tool that marketers can use to demonstrate the acceleration of diffusion in lag markets due to the learning effect, when the waterfall strategy of global innovation is used instead of the sprinkler strategy.

Secondly, the working framework can be validated prior to launch on a case by case basis as we have done in Section 6, by using a combination of Rogers (2003) Perceived Attributes of Innovations, and Ganesh et al. (1997) Factors Influencing the Learning Process.

### **b. Weaknesses**

The major weakness evident in the framework is the problem of determining causality. *Ceteris paribus*, or all else being equal, the working framework would be a good predictor of the rate of adoption in lag markets. However, all else is not equal and factors such as product availability (as we have seen in the case of the iPhone in Australia) can significantly impact the adoption rate.

Kauffman (2005) found that demand for a technological innovation is due to a variety of factors other than the learning effect. These include the *'price of products and services, government policies, adopter wealth and willingness to pay, size of the installed base of adopters of complementary products, extent of the homogeneity of social environment in which technology adoption ensues, and intensity of competition in the market place.'*

We could also add in the case of the Apple iPhone brand awareness in the country to this list. Established brands such as Apple usually have a greater awareness and likeability in their home country, so the rate of adoption may be higher in the home market than in the lag market.

### **c. Issues**

The significant issue relating to the framework is the answer to the question *'is it generalisable?'* Particularly in respect to developing countries, the answer is not always.

Dekimpe et al (1999) stated that diffusion research to date has focused on industrialised countries and ignored the key developing BRIC economies (Brazil, Russia, India and China), which represent over 40% of the worlds population.

In their study of 6 innovations across 31 developed and developing countries, Talukdar et al (2001) found that despite the learning effect being evident in lag markets, developing countries still demonstrated slower adoption rates than develop countries. On average, developing countries took 17.9% longer than developing countries to achieve peak sales.

In contrast, Perkins and Neumayer (2004) found that developing countries that adopt a new technology later and have less existing installed capacity, experience faster diffusion rates. This is due to a combination of the lag market learning effect, and the fact that they do not have sunk costs in existing technology. They highlight success stories such as *'Japan, South Korea and Taiwan, whose rapid post-war growth was rooted in the successful acquisition, imitation and copying of technologies originally developed in industrialised economies.'*

However it is important to note that even if lag market developing economies do have faster adoption rates than the lead market, they may never catch up to the develop economies, who may have already moved onto the next technology (Perkins and Neumayer 2004).

## **7. Further Development of the 'Newton Ball Diffusion Acceleration Effect' Working Framework and Suggestions for Future Research**

Further development and research on the working framework should focus on addressing the weaknesses and issues as discussed in Section 7.

Firstly, factors that impact on the diffusion rates in individual countries outside of the learning effect, such as price, competition, and government policies need to be included in the framework. Secondly, the framework needs to be validated in the case of developing countries as lag markets.

The suggestion for future researchers is to continue with the Apple iPhone case study, using mathematical models such as those developed by Kumar and Krishnan (2002) to measure the learning effects (and other variables) impact on the rollout of the iPhone. This research should include developing countries as they launch the technology, in particular the emerging BRIC economies.



## **8. Conclusions**

In conclusion, the 'Newton Ball Diffusion Acceleration Effect' working framework is a step in the right direction in understanding the learning effect's impact on the diffusion rate in lag markets. It provides marketers with a visual representation of the acceleration effect, and could assist in their decision making as to whether to launch an innovation in many markets at once (sprinkler strategy), or in a phased approach to capitalise on the learning effect (waterfall strategy).

The working framework does have its weaknesses and issues, as demonstrated in the case of the Apple iPhone even though the learning affect should accelerate the diffusion rate in Australia, other factors are holding it back. And it is questionable whether the framework can be generalised to include developing countries as the lag market. Further research is required to address these weakness and issues, to increase the usefulness of the framework.

## 10. Reference List

- Alkemade, F., Castaldi, C. 2005, 'Strategies for the Diffusion of Innovations on Social Networks', *Computational Economics*, Vol 25, pp3-23
- Apple.com.au 2008, 'Cro Mag TV ad',  
<http://www.apple.com/au/iphone/gallery/ads/> , viewed 16 September 2008
- Beise, M. 2005, 'Lead markets, innovation differentials and growth', *International Economics and Economic Policy*, Vol. 1, No 4, pp305-328
- Bloomberg 2007, 'Apple May Have Sold 700,000 iPhones, Beating Estimate (Update7)', <http://www.bloomberg.com/apps/news?pid=20601087&sid=a6YRRDri.RfE&refer=home> , viewed 16 September 2008
- Canepa, A., Stoneman, P. 2004, 'Comparative International Diffusion: Patterns, Determinants and Policies', *Econ. Innov. New Techn.*, Vol. 13(3), April, pp. 279–298
- Clark, R.A., Goldsmith, R.E. 2006, 'Interpersonal influence and consumer innovativeness', *International Journal of Consumer Studies*, Vol.30, No.1, pp34–43
- ClearlyCultural 2008, 'Geert Hofstede cultural dimensions',  
<http://www.clearlycultural.com/geert-hofstede-cultural-dimensions/> , viewed 16 September 2008
- CIA 2008, 'The World Factbook', <https://www.cia.gov/library/publications/the-world-factbook/index.html> , viewed 16 September 2008
- CNET 2008, 'iPhone unlocking explodes despite Apple's countermeasures',  
[http://news.cnet.com/8301-13579\\_3-9860766-37.html](http://news.cnet.com/8301-13579_3-9860766-37.html), viewed 16 September 2008
- Dwyer, S., Mesak, H., Hsu, M. 2005, 'An Exploratory Examination of the Influence of National Culture on Cross-National Product Diffusion', *Journal of International Marketing*, Vol. 13, No. 2, pp. 1–28
- Ganesh, J., Kumar, V. 1996, 'Capturing the Cross-National Learning Effect: An Analysis of an Industrial Technology Diffusion', *Journal of the Academy of Marketing Science*, Vol. 24, No. 4, pp328-337
- Ganesh J., Kumar, V., Subramaniam, V. 1997, 'Learning Effect in Multinational Diffusion of Consumer Durables: An Exploratory Investigation', *Journal of the Academy of Marketing Science*, Vol. 25, No.3, pp 214-228

- Gatignon, H., Eliashberg, J., Robertson, T.S. 1989, 'Modelling Multinational Diffusion Patterns: An Efficient Methodology', *Marketing Science*, Vol. 8, No. 3, pp231-249
- Gladwell, M. 2000, *The Tipping Point: How Little Things Can Make a Big Difference*, Little, Brown and Company, USA
- Hall, E.T. 1976, *Beyond Culture*, Double bay, New York
- Helsen, K., Jedidi, K., DeSarbo, W. 1993, 'A New Approach to Country Segmentation Utilizing Multinational Diffusion Patterns', *Journal of Marketing*, Vol. 57 pp60-71
- Hofstede, G. 1980, *Culture's Consequences: International Differences in Work-Related Values*, Sage Publications, Beverly Hills CA
- Hofstede, G 1991, *Cultures and Organisations: Software of the Mind*, McGraw-Hill, London
- Hsu, P.F, Kraemer, K.L., Dunkle, D. 2006, 'Determinants of E-Business Use in U.S. Firms', *International Journal of Electronic Commerce*, Vol. 10, No. 4, pp. 9–45.
- Kauffman, R., Techatassanasoontorn, A 2005, 'International Diffusion of Digital Mobile Technology: A Coupled-Hazard State-Based Approach', *Information Technology and Management* 6, pp253–292
- Kumar, V., Krishnan, T.V. 2002, 'Multinational Diffusion Models: An Alternative Framework', *Marketing Science*, Vol. 21, No. 3, pp318-330
- Lin, J.Y.C, Wang, E.S.T, Cheng, J.M.S, Kao, L.L.Y. 2007, 'A Study of the Perceived Recognition Affecting the Adoption of Innovation with Respect to the Online Game in Taiwan' *CyberPsychology & Behaviour*, Vol. 10, No. 6, P813-815
- Medialets 2008, 'The first 1 million iPhones: where did they go?', <http://www.medialets.com/blog/2008/08/04/the-first-1-million-iphones-where-did-they-go/>, viewed 16 September 2008
- Moore, G.A. 2002, *Crossing the chasm*, 3<sup>rd</sup> edition, Harper Collins, New York
- New York Times 2008, 'Consumption spreads faster today', <http://graphics8.nytimes.com/images/2008/02/10/opinion/10chart.large.gif>
- Ohmae, K. 1985, *The Triad Power*, Free Press, New York

Packer, C., Simpson, S., Stevens, A. 2006, 'International diffusion of new health technologies: A ten-country analysis of six health technologies', *International Journal of Technology Assessment in Health Care*, Vol. 22, No.4, pp419-428

Perkins, R., Neumayer, E. 2004, 'The international diffusion of new technologies: a multi-technology analysis of latecomer advantage and global economic integration', *School of Geography, University of Plymouth*

Rogers, E.M. 2003, *Diffusion of Innovations*, 5<sup>th</sup> edition, Free Press, New York

Takada, H., Jain, D. 1991, 'Cross-National Analysis of Diffusion of Consumer Durable Goods in Pacific Rim Countries', *Journal of Marketing*, Vol. 55, No. 2, pp48-54

Talukdar, D., Suhir, K. 2001, 'Investigating New Product Diffusion across Products and Countries' *SSRN Working Paper Series*. Oct 2001.

TechCrunch 2008, 'The global reach of the first million 3G iPhones', <http://www.techcrunch.com/2008/08/05/the-global-reach-of-the-first-million-3g-iphones/> , viewed 16 September 2008.

Tellefsen, T., Takada, H. 1999, 'The Relationship Between Mass Media Availability and the Multicountry Diffusion of Consumer Products', *Journal of International Marketing*, Vol. 7, No.1, pp77-96

Toastytech.com 2008, 'Graphical User Interface Timeline' <http://toastytech.com/guis/guitimeline.html> , viewed 15 September 2008

Whelan, S. 2003, 'Uneven Diffusion of Innovation within the International Cellular Telecommunications Market: Lessons for Irish Firms' *Irish Marketing Review*, Vol. 16, No. 1, pp25-30

Van Everdingen, Y. M., Aghina, W.B, Fok, D. 2005, 'Forecasting cross-population innovation diffusion: A Bayesian approach', *International Journal of Research in Marketing*, Vol. 22, pp293-308