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A Critical Review of Innovation Diffusion of a Product and its Growth Models

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ABSTRACT

Over the past few years, the way new products and services are communicated has become more complex. Nowadays, people are influenced by many things such as word of mouth, online communication, and social media. In business research, the study of how innovation develops (called the diffusion model) to understand these effects. We discuss how researchers model this across industries and brands. We will examine issues such as relationships, network effects, separations and technology generations in business life. We explore the impact of different countries, differences in growth and competition affecting growth, in the context of different businesses and brands. After reviewing the research, we think that in order to stay current, different models should be changed instead of looking at how people communicate. Our general recommendation: innovation diffusion refers to the way new products and their services enter the market, ambitious by social impact and all the ways in which people Consumers influence different business people. This includes things we may not be aware of that impact the business. Although much research has been done on the diffusion model, we believe there is much more to be discovered, especially to explain and understand the current market. These trends include globalization, the growth of online services, social disruption, and the complexity of everyday products and services.

Keywords: Innovation Diffusion, Growth Model, Consumers.

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1. INTRODUCTION

As of the end of 2008, approximately 4 billion people worldwide use mobile phones, making the mobile phone a global phenomenon (ITU, 2008; The Economist, 2009). Mobile phone services emerged in Scandinavia in 1981 and are now part of daily life for more than half of the world's peoples in 211 countries. In many developed countries, more than 100% of the population uses a mobile phone, and people have many phones, notebooks, phones, and sometimes different service providers. The widespread adoption of the technology is similar to the proliferation of other products such as DVDs, computers, cameras, flash drives, online commerce, and the Internet over the past few years. We hope to introduce many new products and services in the future as the company continues to innovate. The process of expanding market expansion is called "expansion".

Diffusion research attempts to understand how innovation spreads by developing a model that explains the entire life cycle of the innovation through communication and interaction with customers. Traditionally, the diffusion model is based on the model developed by Bass in 1969. The Bass model looks at all the beginnings of growth of fixed products introduced to the market, including the target audience, which can be represented by "m". He wants to say that through innovation the social network has turned out to be completely connected and homogeneous. In the Bass model, as more people join the market, their decisions will be influenced by other factors (p) such as advertising and social media. Relationship (q) of the interaction between them.

The Buss model suggests that when people are not yet open to an innovation, their purchases will increase linearly with previous customers. To make the bass model work, we use three parameters - p, q and m. These measurements can be determined by examining real-world data. Various publications, including Jiang, Bass, and Bass (2006); Borthwick and Francis (2005); Vandenbult and Stremersch (2004); Venkatesan, Krishnan and Kumar (2000); Li Lian et al. (2000); Sultan, Farley and Lehmann (1990); and Van den Bulte and Lilien (1997) discuss the problems and considerations in estimating these indicators. With the globalization of the economy and increased competition, easier access to information, entertainment and communication products has changed the way new products are produced. It is expressed beyond the nature of a monopolistic market for fixed goods in the social whole.

Since the 1990s, research on diffusion models has focused on developing the Bass framework to better understand the complexity of the growth of new products. Table 1 shows significant changes in research focus over the past two decades. One of the interesting aspects discussed in Table 1 involves examining various internal influences on the diffusion process. While Bass's original work and subsequent studies found an internal measure of q to represent the impact of verbal communication, more recent contributions have revisited the concept and translated it to describe and discuss other relationships. Based on these developments, we propose to reconsider the definition of diffusion theory.

The traditional view of diffusion theory, which generally focuses on personal communication, should be expanded to include different types of relationships, as noted by Mahajan, Muller, and Bass (1990) and Mahajan, Muller, and Wind (2000).), as noted by Goldenberg et al. (2010) and Van den Bulte and Lilien (2001). We examine in more depth two social influences that have attracted recent attention: external communication and social interaction beyond verbal communication. Network externalities occur when a product aimed at consumers increases as more people adopt it (Rohlfs, 2001). This can be direct (such as phone calls or e-mail) in terms of the number of users of the same product, or indirectly in terms of the number of connected users, for example, DVD players being nicer than DVDs, DVDs being more powerful (Stremersch and Binken, 2009; Stremersch, Tellis).

Actually, personal contact is not always necessary for networking. Potential customers can learn about the popularity of new products through advertising or by looking at items for sale. For example, during the transition from video tapes to DVDs, customers entering a video store can understand that DVDs have become a new model by scanning the address of VHS and DVDs. Turn into social issues that deal with the social information people collect from others who embrace innovation. As Bourdieu (1984) points out, purchasing decisions may reflect different social or group identities. These signals influence others to adopt the consumption behavior of their target group (Simmel, 1957; Van den Bulte and Joshi, 2009; Van den Bulte and Wuyts, 2007).

Social signals can work both vertically, directing the user to the right, and horizontally, affecting the transmission rate, especially when adverse changes occur in the community (Van den Bulte and Stremersch, 2004). In addition to our search, social symbols also work horizontally, signaling the identity of the group. When a group adopts an innovation, it signals its members to adopt it, and members of other groups differentiate themselves by avoiding adoption (Berger and Heath, 2007; 2008). It's important to remember that social signals don't have to be word-of-mouth or broadcast; consumers may overlook these issues and impact the social impact of adoption.

It is important to distinguish relationship signals from other things, such as performance signals. Performance signals provide information about the market's understanding of a product's performance characteristics, such as its performance or the risk associated with adoption. In contrast, relationship signals provide information about the relationship between adoptions, including innovation risk. An important question arises: Is the orientation of social and external communication as an internal influence related to the founding of Bass? Traditionally, Bass's framework has focused mainly on verbal communication and interpersonal communication, considering intrapersonal influences (Mahajan et al., 1990).

However, it is significant to note that the model itself does not specify the driving force of the relationship. Therefore, external communication and interaction with social thinking are based on the Bass framework and other growth factors to the extent that they show that the purchase will increase with the customer first.

Table 1: Shifts in focus of research interests.

S. No.	Prior attention	Supplemented with existing attention
1	Word of mouth as driver	Buyer interdependencies as drivers
2	Monotonically growing penetration curve	Turning points and irregularities in the penetration curve
3	Progressive	Spatial
4	Industry-level investigation	Brand-level investigation
5	Segment-based models	Individual-level models
6	Fully connected systems	Moderately connected and small-world systems
7	Products	Services
8	Predicting	Managerial analytics

Contrary to popular evidence about the role of individual communication in merchandise adoption, another theory is gaining traction. This view considers that the most significant factor in the development of new products is not customer interaction, but customer differentiation. Heterogeneity approaches suggest that social systems vary in terms of innovation, price sensitivity, and demand, leading to differences in adoption. In this context, while innovators show the most patience in terms of adoption, laggards show the most patience. Factors such as product affordability and willingness to pay appear to be associated with permanence (Bemmaor, 1994; Golder and Tellis, 1998; Russell, 1980; Song and Chintagunta, 2003). The strength of the market can act as a "patient" distribution in the face of falling prices, leading to an S-shaped trend, especially if income follows a distribution (Golder and Tellis, 1997).

This research line suggests that the traditional diffusion-based approach may have exaggerated the role of word-of-mouth communication (Van den Bulte & Lilien, 2001; Van den Bulte & Stremersch, 2004). It underscores various drivers of new product diffusion, organized by the degree of direct interpersonal communication involved. The paper's aim is to review the diffusion literature on interactions from the past decade, examining how it has broadened its focus to encompass a more comprehensive range of consumers' internal influences. The objective is not to cover the entire diffusion literature, given recent overviews, but rather to integrate different modeling efforts of interpersonal influences into a unified framework.

2. DIFFUSION WITHIN MARKETS AND TECHNOLOGIES

Here we take an in-depth look at four of the seven most important communication trends in science over the past decade. These areas (Conferencing, Networking Outside, Challenges and Saddles, and Technology Generations) focus on disruption in a particular industry or technology.

2.1. DIFFUSION IN SOCIAL NETWORKS

Social media, often referred to as social networks, is a platform for publishing innovations. In response to the decline in the effectiveness of offline advertising and the growth of online social networks such as Facebook, companies are increasingly interacting directly with their customers' websites. They invest in marketing to strengthen the internal strength of these networks. In order to improve these results, it is necessary to better understand how the structure and the relationship between them affect the diffusion process.

The central quest for expansion in social networks is based on how the structure of relationships affects the development of products. Although not yet fully resolved, psychology research has explored this issue to some extent (see Van den Bulte and Wuyts, 2007 for a review). Considerable research has focused on the role played by central institutions throughout development, often referred to as influencers or social hubs (e.g. Goldenberg, Han, Lehmann, & Hong, 2009; Iyengar, 2009). Mainly due to data limitations, research on the role of network structures in expansion is still evolving. The emergence of new methods to support large samples and analysis of online networks should stimulate further research (see, for example, Dorogovtsev and Mendes, 2003; Jackson, 2008).

From the model's perspective, an important question arises: How can we participate in the discussion in different ways? The implicit assumption of the Bass model and its many extensions is that social systems are homogeneous and fully connected, allowing adoption to be represented at all levels. Although aggregate models are simple and require minimal data for insight and prediction, they lack a deep understanding of how individual interactions affect international business performance. Recent findings indicating that social networks are neither homogeneous nor fully connected (Kossinets & Watts, 2006) are prompting a gradual shift in diffusion research from the aggregate to an individual-level perspective.

One effective way to understand individual adoption decisions and their impact on overall outcomes is through agent-based modeling. This approach views the market as a collection of individual entities (units, agents, or nodes) interacting through connections. Each individual element, representing a consumer, follows a decision rule. Agent-based modeling encompasses various techniques like neural networks, cellular automata, and small-world models.

A notable example is the cellular automata model by Goldenberg, Libai, and Muller (2001a; 2001b), where each unit stands for an individual consumer with a value of "0" if not yet adopting the product and "1" if already adopted. The receiver will be able to make decisions based on the combination of external noise (p parameter) and internal noise (q parameter), similar to the Bass frame. This model is useful in overcoming many of the shortcomings of ensemble models. First, it establishes a link between individual-level influence and integration, leading to a better understanding of how individual economic factors affect the overall performance of the company.

Response to commercial advertising can be factored into an agent's policy changes, and performance is the sum of network-wide decisions. Second, this modeling allows covariance to be taken into account. The model (Goldenberg et al. (2010)) can be customized to encompass various aspects of heterogeneity, such as individual responsiveness to price and advertising (Libai, Muller & Peres, 2005), the presence of negative word of mouth (Goldenberg, Libai, Muller & Moldovan, 2007), intrinsic consumer innovativeness (Goldenberg, Libai & Muller, 2002), the presence of heavy users and connectors (Kumar, Petersen & Leone, 2007), and individual roles in the social network—such as hubs, connectors, and experts (Goldenberg et al., 2009).

Agent-based models offer an additional advantage in considering the spatial aspect of diffusion. In a variation known as small-world models, Goldenberg et al. (2001a) investigated spatial dynamics in the market by examining the relative influences of strong and weak ties. Their findings, consistent with studies by Wuyts, Stremersch, Van den Bulte, and Franses (2004) and Rindfleisch and Moorman (2001), demonstrated the significant impact of the cumulative influence of weak ties on the growth process. Garber, Goldenberg, Libai, and Muller (2004) proposed a method to measure spatial adoption rate to predict product success or failure. Conceptually, the collective diffusion model describes the overall impact of the individual process. Therefore, in order to create the same business representatives, it is necessary to balance the individual level and all business representatives.

However, it is not easy to achieve balance between the two models. Previous studies have proposed methods that incorporate individual behaviors based on different consumer perceptions and time taken into account (Chatterjee 2000; Van den Bulte and Stremersch, 2004). Particularly in terms of cellular automata, Goldenberg et al. (2001a) introduced the equation by relating the parameters p and q to the risk function of adoption and presented simulations showing what would happen at the individual level. Adoption will lead to diffusion curves with p and q. The relationship between the Bass model and the representational model has also been investigated by Rahmandad and Stremers (2008) and Fibich et al. (2009).

Sheikh et al. (2006) showed how to assemble small-world material to create a Bass model using simple assumptions. However, the interaction between the individual and the global level still lacks a closed representation and needs to be further investigated.

2.2. DIFFUSION AND NETWORK EXTERNALITIES

Over the past two years, researchers have delved into the complexity of network externalities to understand their impact on growth. But a clear consensus on how the reality of external communication affects business development remains elusive. Information shows that communication often leads to faster business growth due to returns (Nair, Chintagunta, and Dubé, 2004; Tellis, Yin, and Niraj, 2009). However, networks can also inhibit growth due to what is called "excessive inertia" (Srinivasan, Lilien, & Rangaswamy, 2004). Customers may accept the product in the early stage of the product life cycle when the number of customers is low.

This initial reluctance can lead to a slow start, with early growth from a few customers who see electricity usage despite the restrictions of others. The general pattern of development involves a combination of excess inertia and excess energy; this is fast growth after slow growth (Van den Bulte and Stremersch, 2006). Different ways of external networking help create this development model. In direct network interaction, electronic devices interact directly with consumers, as seen in communication products such as fax and e-mail. For example, the more people use a fax machine, the more useful it becomes. In contrast, indirect effects on hardware and software in the network include increased electricity use by business intermediaries, such as the presence of middleware.

The effects of external networks on development depend on whether they are global or local. While the outside world considers the entire relationship when evaluating the benefit based on the number of customers, the external customer takes into account the adoption of the customer in their close relationships. Research is moving away from thinking primarily about the outside world towards local research outside (Binken and Stremersch, 2009). Customers were previously expected to grow through word of mouth and personal influences such as referrals; this often-reduced risk and search costs. At the same time, adoption from previous customers can increase influence in the network and drive further growth. Researchers have overcome this challenge by propagating these effects and linking network effects to the initial level of consumer use (Goldenberg et al., 2010). The results show that external communication initially has a "medicinal" effect on growth, followed by an expansion-enhancing increase. Further discussion of these findings can be found in Gatignon (2010), Rust (2010), and Tellis (2010).

3. DIFFUSION ACROSS MARKETS AND BRANDS

In this section, we examine the last of the seven research areas that, from our perspective, have been important for innovation research in the last decade. These three areas focus on different aspects of the market and different products, including the impact within the country, the growth gap across the country, and the impact of the growth challenge.

3.1. CROSS-COUNTRY INFLUENCES

Since the 1990s, many research papers have followed this global perspective, shifting their focus to explore cross-border product recognition and expanding the scope of work to always be there. This extension was developed to address problems and issues related to international communication (for a comprehensive review, see Dekimpe, Parker, and Sarvary (2000a).

An important issue in the field of transnational expansion, especially in terms of entry sequences, is the mutual influence of the expansion process in different countries. In the context of cross-border interventions, studies with some exceptions such as Desiraju, Nair and Chintagunta (2004) and Elberse and Eliashberg (2003) have highlighted an important finding: the effect of access time delays in the diffusion process of good alcohol.

Simply put, an innovation An importer country tends to expand rapidly (Tellis et al., 2003 ; Dekimpe, Parker, & Sarvary, 2000b ; 2000c ; Ganesh, Kumar, & Subramaniam, 1997 ; Jain, 1991) and has a shorter exit period (Van Everdingen, Fok, & Stremersch, 2009 In this country, the phenomenon of influence is called the lead-lag effect, recognizing that power can work in many directions.

4. DIRECTIONS FOR FURTHER RESEARCH

The main purpose of diffusion modeling from the beginning is to provide a better understanding of the new product life cycle. In this article we show how technological progress and changes in the nature of innovation are expanding the scope of traditional diffusion research. Looking ahead, we expect future innovations to expand even further, resulting in never-before-seen growth patterns. Watch the mobile phone industry as an example. As mentioned earlier, we expect to observe trends such as long-term integration of several generations of technologies, multiple services from different (sometimes competing) providers on the same device, and international decisions increasingly influencing the adoption process.

The penetration of communications and other technological advances into emerging markets marked by specific constraints and needs provides the opportunity for good models like this to emerge. Research on diffusion models must continue to stay current and keep up with business trends. In this section we present possible directions for these extensions.

4.1. DIFFUSION, SOCIAL NETWORKS, AND NETWORK EXTERNALITIES: FUTURE DIRECTIONS

The impact of the deployment process on the entire business is often measured at an aggregate level, but the company's marketing strategy works on an individual basis. The industry has recently turned to influencing the internal marketing of the business through initiatives such as influencer programs and gossip campaigns. The shift from a holistic perspective to an individual perspective holds promise for future extension research. Although modeling self-determination began in the 1970s, examining these decisions in economic growth through the lens of self-level diffusion is still in its early stages. Simultaneously building a network, collecting personal data, and tracking growth can present challenges. However, the need for such research is increasing.

Online advertising, which includes platforms such as blogs, CRM systems, and social networking sites such as LinkedIn and Facebook, provides a great opportunity for this research by creating surveys. Personal information. To better understand self-determination, researchers need to develop models of self-determination by breaking down the adoption process into sub processes, including knowledge, emotions, preferences, choices, purchases, and vice versa. Each level in this hierarchy should be informed by behavioral research. For example, although the selection phase has been investigated through preliminary experiments such as the integration experiment, fewer studies integrate the selection phase into diffusion models, such as Landsman and Givon (2010). This will help highlight the impact of fundamental factors on long-term growth and profitability.

4.2. LIFE CYCLE ISSUES: FUTURE DIRECTIONS

The two main phases of a new product's life cycle include the first phase until the product is discontinued and finally its replacement with next-generation technology. The cancellation schedule does not depend on the customer relationship; instead, withdrawal occurs due to changes in price sensitivity and risk aversion. As the cost of innovation drops and becomes less risky, things will improve. This illustrates the intersection of heterogeneity and communication, where heterogeneity dominates before takeoff and user relationships become important immediately after takeoff. Understanding this debate has important implications for management. If take-up time is truly affected by risk and perceived cost, companies will find it more profitable to invest in these areas than to improve internal communications.

However, existing studies are descriptive and do not examine the underlying mechanisms in depth. Despite technological change, the way technology is transferred has been around for some time, there are still important questions that have not been answered. The first of these concerns the process of change; because

the traditional belief is that the new generation will eventually replace the old ones. Many objects testified to the long association between the old and the new generation. Dealing with multiple generations of technology simultaneously is a challenge for companies, especially in emerging markets. Most models of technological change are limited in their ability to address diversity and lack an understanding of issues such as leapfrogging behavior and differences between adoption groups. Additionally, generational change at the species level needs to be investigated.

A combination of behavioral and modeling studies is needed to understand consumer behavior in response to technological change and integrate findings into model integration. The second question in the context of technological change concerns the timing of the introduction of new generations. The ideal for healthcare providers is to create products as soon as they get started, but factors such as cannibalization and brand competition will affect these results. Scientific research should be conducted on the optimal timing of access to production. The third question concerns the estimation of adopted children. Multigenerational cohorting allows researchers to use data from previous generations to predict the distribution of future generations, which requires the use of semiparametric and nonparametric models.

4.3. COMPETITION AND GROWTH: FUTURE DIRECTIONS

In the world of managerial decision-making, the company's own label is often included as the competitive model becomes more complex. Decision-making levels are important for optimizing management options. Many competitive research questions can benefit from the use of diffusion models. First, the real decision is competition: Is there a business that every business can use, or is it reasonable to think that every business can do business? It is crucial to answer this question by comparing models for two cases, supported by empirical reference to general data. The answers help determine the true level of competitive intensity in marketing deployment and improve decisions regarding marketing mix, product development, and location. For example, if the potential of the market does not match, a firm may adjust its efforts, adopt a lower price, and consider a cooperative distribution method with its competitors. The second question explores the impact of competition on the supply chain.

CONCLUSION

In businesses such as mobile telephony, service providers compete to share the same phone model, third parties offer automatic network selection at the best price, and customers work with multiple service providers. In addition to differences between companies, this also benefits the consumer's business idea and therefore the development of business strategies that improve growth. Developing the simple diffusion model to include

more layers and competition would improve the description and analysis of this problem. As in other fields, the dissemination of research is driven by a dedicated community of curious researchers who use cutting-edge technology and encourage each other to push the boundaries of knowledge and discovery. This retrospective aims to provide an overview of community integration in the last decade and provide insight into future prospects.

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