

Diffusion Models for B2B, B2C, and P2P Exchanges and E-Speak

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Consulting groups are predicting that the future of business-to-business (B2B) and business-to-consumer (B2C) exchanges will generate exponentially increasing revenues. However, the economic uncertainties in the market and technological innovations, such as peer-to-peer (P2P) networks and e-Speak from Hewlett Packard, may significantly alter the outlook for the current exchanges. In this study, we adopted a diffusion model for B2B, B2C, and P2P exchanges and e-Speak to capture the future revenue potentials of these electronic exchanges. We simulated the proposed model to incorporate possible market uncertainties. We initially analyzed the case where B2B and B2C increased exponentially. Then, we considered the case of migration from B2B and B2C to P2P and e-Speak. We tested the rate of diffusion with respect to certain parameters, such as imitation, innovation, market potential, and switching rate. With the set of parameters we used, we found out that the effect of imitation was stronger than innovation. The switching rate played an important role in how easy it was for agents to move to later technologies. The inertia factor determined the winner in the marketplace, based on the values, making it more expensive or less expensive to switch to later technologies.

diffusion models, B2B, B2C, P2P, e-Speak

1. INTRODUCTION

Market potential and overall industry forecasts help managers to define their strategies and goals. However, defining market potential in the presence of market uncertainties and the impact of introducing new generations create a challenge for researchers. In this study, we propose a model to investigate the impact of different environments and strategies on the development of e-commerce.

Global and U.S. Internet commerce is expected to grow exponentially over the next couple of years. High estimates are around \$3,000 billion whereas low estimates are \$1,500 billion.

If we perform a microanalysis, we can separate e-commerce into business-to-business (B2B) and business-to-consumer (B2C) exchanges. According to the 2000 industry estimates, B2B revenue is going to grow exponentially to be more than \$800 billion in 2003.

On the other hand, B2C revenue is expected to be more than \$100 billion in 2003. B2B covers B2B transactions and supply-chain management. For example, in the automobile industry, Covisint (<http://www.covisint.com>) consists of GM, Ford, DaimlerChrysler, and Renault/Nissan. In a similar effort, the airline industry is also trying to form its own exchange.

There are many firms providing B2B services to the businesses for building their B2B exchanges. For example, mySAP.com provides customer relationship management, supply-chain management, and e-commerce applications for B2B exchanges. On the other hand, Ariba consists of an operating resource management system and an operating resource management exchange and provides a procurement system, connecting industrial customers and suppliers. By using the B2B procurement technology offered by Ariba, firms can get preapproved vendors from which an employee could order, given the employee's spending limit and the instructions for supervisor approval for the account against which purchases should be charged. There are also restrictions and procedures for suppliers to join the system and be an approved vendor. CommerceOne is another service provider on the buy side, offering an online procurement system that uses an intranet. Using these exchanges may cost \$0.25 to \$2.00 per transaction for the suppliers.

Current innovations in the marketplace place peer-to-peer (P2P) networking and e-Speak (from Hewlett Packard [HP]) as alternative technologies that are likely to compete against B2B and B2C. P2P networking is basically a file-sharing environment that utilizes the Internet infrastructure for communication. The characteristic of P2P is that proprietary software is written to communicate between the involved parties such that each party can act as servers and clients simultaneously. The early examples of P2P networking are Napster.com (<http://www.napster.com>), Scour.com (<http://www.scour.com>), Imesh.com (<http://imesh.com>), and Gnutella.com (<http://www.gnutella.com>). Although, Napster.com provided the most prominent P2P application, due to copyright infringement issues with the music industry, it is under legal scrutiny. Currently Napster and Bertelsmann are trying to agree on a fee system that will affect Napster users. Early information is such that they are focusing on a fixed monthly fee. In general, the advantages of P2P networking can be summarized as follows:

- No central exchange. There are significant efficiency gains because all the participants can act as servers and clients. Instead of building complex and expensive networking infrastructures, information systems can be integrated with a P2P program, or peering portal.
- Start-up and maintenance costs are very low. The primary start-up cost is the creation of a P2P software. Because each computer can act as a client and a

server, the network always functions as long as there are computers connected to the network.

- There are no bounds on the membership and the network capacity. A P2P environment can grow and use all the existing computers connected with a peer-ing portal.
- Ease of expansion and set up.

There are also some disadvantages. Some of them are:

- Security structures.
- Redistribution (encryption to prevent redistribution)
- Legal issues.

It is expected that the growth of P2P networking will be significant in the future, especially after the availability of software technologies that will enable merging complex businesses [1].

Firms like HP, Microsoft, IBM, and Ariba have been working on more efficient and newer versions of networking and exchange technologies to introduce into the market. E-Speak is the dominant and most promising alternative for the B2B, B2C, and P2P networks as of today [2].¹ E-Speak provides an open-source system that allows easy communication [3]. It facilitates the creation of customized relationships between businesses, people, and businesses and people through ad hoc discovery of Web-based services. It enables a relationship to adapt automatically to changing conditions. It offers collaborative commerce and gives away source code. Volunteers can also contribute to its code. It is expected that this technology will also solve the problem of sharing complicated product specifications and tasks. These cannot be shared within the current P2P technology because of their complexity.

There are many reasons why HP may benefit by offering an open-source technology free of charge while engaging in significant investments on e-Speak technology [4]:

- HP gains expertise.
- The category as a whole benefits because of the increased opportunities.
- Like SABRE and American Airlines (AA) yield management and airline seat management, AA does consulting to other airline companies and then beats them in the market place.
- Halo effect: The customer later buys hardware from HP.
- No one company has the creative bandwidth to match the larger community of software developers.
- HP benefits from the positive externality because the number of customers using the offered technology increases rapidly.

In the next section, we review the related literature. In Section 3, we present the model. We simulate the model and discuss the managerial implications in Section

¹Although Hewlett Packard developed e-Speak originally, we use e-Speak to represent this new generation networking. However, there are also other competing alternatives. For example, UDDI by Microsoft, IBM, and Ariba stands as an alternative to HP's e-Speak.

4. The summary and conclusions, model limitations, and possible future research avenues are in the last section.

2. LITERATURE REVIEW

Diffusion models have been used and successfully tested in the marketing and information systems literature [5, 6]. Diffusion models capture the process of the adoption of new technologies over a period of time. The early models date back to 1960s.

Fourt and Woodlock [7] suggested that there is always a set of consumers who use a new technology as soon as the technology is available in the market. As soon as these customers, called *innovators*, learn the availability of a new technology from the mass media, they try it. Let $N(t)$ capture the total number of adopters at time t . Let M be the potential number of adopters for a given new technology. Then, a pure innovation model can be formulated as:

$$n(t) = \frac{dN(t)}{dt} = p(M - N(t)), \quad (1)$$

where $n(t)$ captures the number of adopters at time t and p is the coefficient of innovation. According to Equation 1, the number of people who are trying the new offering for the first time is proportional to the number of customers who did not adopt the product yet at time t , that is, $M - N(t)$, by a constant p .

However, Fisher and Pry [8] proposed that there is a significant group of customers who will only try a new technology based on positive advice or word of mouth from the early adopters. These customers will be imitating the success based on the positive experience of the others. According to the model, the number of people trying for the first time is given by

$$n(t) = \frac{dN(t)}{dt} = q \frac{N(t)}{M} (M - N(t)), \quad (2)$$

where q is the coefficient of imitation. In Equation 2, the term $\frac{N(t)}{M}$ captures the percentage of current adopters. Hence, the current period adopters are proportional to the positive word of mouth, captured by the coefficient of imitation, q , created by the customers who already adopted the new technology.

In an effort to combine both of these influences, Bass [9] suggested a model that captures the impact of innovators and imitators within a general framework. Accordingly, he suggested combining the effect of innovators and imitators as follows:

$$n(t) = \frac{dN(t)}{dt} = \left(p + q \frac{N(t)}{M} \right) (M - N(t)). \quad (3)$$

In Equation 3, p and q capture the coefficients of innovation and imitation respectively. Note that it is possible to formulate the previous problem with a hazard function. If we assume that the probability of adoption at period t is represented by $f(t)$, then, $F(t)$ represents the cumulative probability of people who have already adopted the technology. Hence, $MF(t)$ gives the cumulative number of adoptions, or $N(t)$. If both sides of Equation 3 are divided by M , Equation 3 can be written as

$$\frac{f(t)}{1-F(t)} = (p+qF(t)). \quad (4)$$

One criticism for the previous formulation is that the effect of pricing is not included in the diffusion patterns. Ram and Bass [10] suggested that the effect of price is the same for coefficient of innovation and imitation and proportional to $e^{-\varepsilon}$ price, where ε represents the price elasticity. Then, by integrating both sides and solving for $F(t)$, we find:

$$F(t) = \frac{1 - e^{-(p+q)te^{-\varepsilon}\text{price}}}{1 + \frac{q}{p}e^{-(p+q)te^{-\varepsilon}\text{price}}}. \quad (5)$$

This model captures the diffusion of only one innovation. However, when there are multiple generations and many innovations in the market, there is a need to account for the impact of each generation. Building on work by Bass [9], Norton and Bass [11] suggested a model that captures the substitution and cannibalization effects for introducing multiple generations. They assumed that consumers use the new technology at a constant consumption rate once an adoption occurs, although they may switch to newer generations later on. They tested their model and found good fit in explaining the diffusion of new technologies on many industries, such as consumer and industrial goods, pharmaceuticals, computer products, and recording media. Using empirical evidence, Norton and Bass [12] argued that their model could be used to accurately forecast the future demand for multiple generations.

Their model does not allow for the switching to older generations, although switching to newer generations is permitted. A customer may try a new technology for the first time; however, the customer may still switch to older technologies even after the trial.

Next, we present the model. We extend the Norton and Bass [11] model and incorporate the impact of switching in the adoption process while accounting for multiple generations during the diffusion process.

3. MODEL

Customers can adopt a new technology without using any earlier generations or switch from an older generation to a newer one. However, when customers switch from an older technology to a newer generation, customers have the option of switching back to the old way of doing the business when they are not fully satisfied. After the trial and initial adoption process, organizations may realize the full cost and benefits of the new offering. In some cases, organizational learning and the cost of full implementation may outweigh the benefits of the new generation.

We assume that when organizations adopt a newer generation after using an older generation, they go through a trial and organizational learning phase. As a result, depending on their experience and learning with time, the willingness to completely switch and stay with the newer generation changes. Organizations stay with the new technology as long as

$$ct + e < bt, \tag{6}$$

where t represents the elapsed time since the first trial of the new technology and e represents the error term, capturing the randomness in the decision-making process and microlevel idiosyncrasies. The terms c and b are the respective costs and benefits to the companies. We further assume that the error term, e , follows an extreme value distribution. Then, the willingness to stay with the newer generation can be formulated as

$$S_i(t) = \frac{1}{1 + e^{(c_i - b_i)t}}, \tag{7}$$

where $i = 11$ for B2B, 12 for B2C, 2 for P2P, 3 for e-Speak, t is the time spent trying the newer generation, and c_i and b_i are the respective costs and benefits as a function of time. The term $S_i(t)$ captures the percentage of customers who are willing to stay with the newer generation after the first trial with the new technology occurs. As time from launch increases, it may increase, decrease, or stay constant, depending on the costs and benefits.

When c_i is greater than b_i , the organizations realize that they incur a significant switching cost as time passes, and some organizations may revert back to an older technology; that is, $S_i(t)$ decreases with time. In this case, there is a positive inertia in the market because the older technologies become more salient in the market and the older habits prevail in the long run. However, when c_i is smaller than b_i , the organizations realize the benefit of the new generation, and the benefits outweigh the costs. Then, the organizations are more likely to stay with the newer generation, and eventually, all the organizations that switch to newer generation stay, given a sufficient learning period; that is, $S_i(t)$ approaches 1. This is the negative inertia case because agents leave their older habits easily and adopt the newer offerings in time. If the costs and benefits are the same ($c_i - b_i = 0$), organizations have a 50% chance of staying with the newer generations.

We assume that the market potential for a given technology approaches a constant. The market potential of a given technology is the maximum possible rate of revenue generated per time period (i.e., in dollars per quarter) when used by all the potential customers. Let m_{11} represent the market potential for B2B, and let m_{12} represent the market potential for B2C exchanges. Although a newer technology can serve an older generation's market potential effectively, it can also generate additional opportunities in the market and create an incremental market potential. This incremental market potential cannot be served by any earlier generations. Let m_2 represent the incremental market potential generated by P2P, and let m_3 represent the incremental market potential generated by e-Speak.

We assume that the percentage of customers trying generation i is given by $F_i(t)$. These are the solutions of the Bass model [9]. Similar to Equation 5

$$F_i(t) = \frac{1 - e^{-(p_i + q_i)t_i e^{-\epsilon_i \text{ price}_i}}}{1 + \frac{q_i}{p_i} e^{-(p_i + q_i)t_i e^{-\epsilon_i \text{ price}_i}}}, \tag{8}$$

where $i = 11, 12, 2, 3$; t_i is the time spent from the launch of the network i ; p_i and q_i are the coefficients of innovation and imitation, respectively; $price_i$ is the price of using the network, and ϵ_i is the price coefficient representing the price elasticity of adoption for generation i . In this formulation, it is assumed that the price policies impact the coefficient of innovation and imitation similar to Ram and Bass [10].

The cannibalization effect of P2P from B2B and B2C are modeled similar to Norton and Bass [11]:

$$m_{11}F_{11}(t)F_2(t)S_{11}(t) + m_{12}F_{12}(t)F_2(t)S_{12}(t). \tag{9}$$

In Equation 9, the first term captures the cannibalization of B2B, and the second term captures the cannibalization of B2C due to P2P. Similarly, the cannibalization due to e-Speak can be captured by

$$m_{11}F_{11}(t)F_2(t)S_{11}(t)F_3(t)S_2(t) + m_{12}F_{12}(t)F_2(t)S_{12}(t)F_3(t)S_2(t) + m_2F_2(t)F_3(t)S_2(t). \tag{10}$$

Then, the revenue for each generation is formulated as

$$R_{11} = m_{11}F_{11}(t)[1 - F_2(t)S_{11}(t)]. \tag{11}$$

$$R_{12} = m_{12}F_{12}(t)[1 - F_2(t)S_{12}(t)]. \tag{12}$$

$$R_2 = F_2(t)[m_2 + m_{11}F_{11}(t)S_{11}(t) + m_{12}F_{12}(t)S_{12}(t)][1 - F_3(t)S_2(t)]. \tag{13}$$

$$R_3 = F_3(t)\{m_3 + F_2(t)[m_2 + m_{11}F_{11}(t)S_{11}(t) + m_{12}F_{12}(t)S_{12}(t)]S_2(t)\}. \tag{14}$$

Sales may decrease when the rate of increase in the adoption process is outweighed by the rate of decrease due to increasing switching cost. In this case, although more organizations may be experimenting with the network and considering adopting, because of the increased switching and organizational learning costs, some organizations may revert back to old networks. The previous model collapses to the Norton and Bass [11] model when $S_i(t)$ is taken as 1 for $i = 11, 12, 2$.

This model can capture a wide variety of scenarios compared to the model in Norton and Bass [11]. According to the proposed model, newer generations can coexist with the older generations. For example, in Equation 11, if all the customers switch to the newer technology, B2B revenue goes to zero, whereas P2P revenue increases. (This is the case in the Norton and Bass [11] model.) However, if not all the customers switch to the newer technology, B2B does not go to zero, and both generations can coexist. This is not possible in the Norton and Bass [11] model.

Our model also has a different perspective and employs a cost and benefit approach. We can capture positive and negative switching externalities between generations. If the costs increase due to a negative externality, customers do not switch and stay with the older technologies. If the benefits increase at a rapid pace due to a positive externality, customers switch faster.

4. SIMULATION RESULTS

In running different scenarios, we fixed the parameters of B2B and B2C and changed the parameters of P2P and e-Speak. We used the data mentioned previously to identify the parameters of B2B (\$800 billion in 2003) and B2C (\$100 billion in 2003). We assumed that B2B and B2C were introduced in the market at the beginning of 1997. Using the least squares method and quarterly data for the years 1997, 1998, and 1999, we found the best fitting curves for B2B and B2C. These values were also similar to the values found in Norton and Bass [11].

If the newer generation technologies did not impact the market potentials for B2B and B2C exchanges, these exchanges would follow the diffusion patterns as suggested by the fit of the model. The diffusion patterns for these two exchanges under this scenario are presented in Figure 1. (In the figure, Quarter 12 represents the beginning of the year 2000, Quarter 20 represents the beginning of the year 2002, and Quarter 40 represents the beginning of the year 2007). Accordingly, the penetration of these exchanges would increase at an increasing rate until the beginning of the year 2006 (Quarter 36). Then, the penetration rate would increase at a decreasing rate and achieve a maximum penetration rate for B2B and B2C in the year 2012. At this point, the market revenue generated with B2B and B2C exchanges would reach a maximum of \$4,000 billion and \$100 billion per quarter, respectively.

However, it is highly likely that the advent of new technologies such as P2P and e-Speak would distort this pattern. These technologies may offer new opportunities and increase the overall market potential served by B2B and B2C while cannibalizing traditional B2B and B2C exchanges. Next, we analyzed the possible diffusion scenarios in the presence of new technologies.

We fixed the diffusion parameters for B2B and B2C as presented in Table 1. We arbitrarily set a base case scenario and changed the parameters for P2P and e-Speak. We analyzed the impact of these changes on the overall diffusion patterns. The base case scenario is given in Table 2.

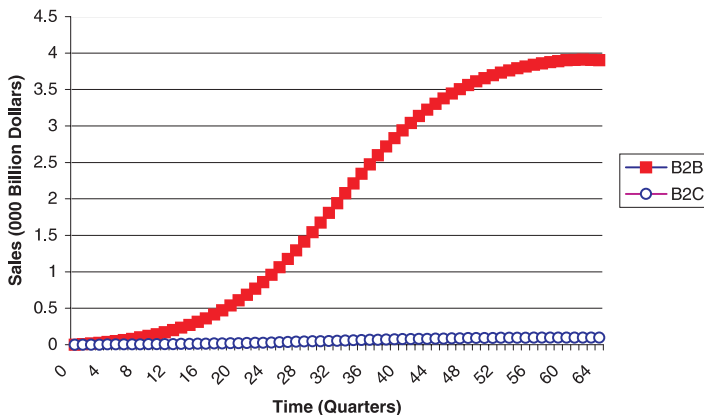


Figure 1. Diffusion of business-to-business (B2B) and business-to-consumer (B2C) exchanges.

Table 1
Estimated Parameters for B2B and B2C

<i>Parameter</i>	<i>B2B</i>	<i>B2C</i>
Coefficient of innovation	0.002	0.003
Coefficient of imitation	0.135	0.116
Per quarter market potential	4.0	0.1

Note. We assumed that the price is fixed at \$2 per transaction and price elasticity was low and fixed at 0.01. B2B = business to business; B2C = business to consumer.

Table 2
Base Case Scenario

<i>Parameter</i>	<i>P2P</i>	<i>E-Speak</i>
Coefficient of innovation	0.004	0.004
Coefficient of imitation	0.15	0.15
Per quarter market potential	2.0	2.0

Note. P2P = peer to peer.

We assumed P2P impact as of the year 2000 (Quarter 12) and e-Speak impact as of the year 2002 (Quarter 20). We tried different years as starting points and determined that the results were not sensitive to this parameter. Also, because organizations may be more receptive toward these types of innovations, we assumed higher levels of innovation and imitation for these new generations, compared to the parameters for B2B and B2C. Although price could be low per transaction, the price elasticity could be high for these new technologies. We assumed a per-transaction price of \$0.01 and an elasticity of 2. Also, we assumed the switching probability was fixed at .5 and that it did not change with time.²

According to the base case scenario, the later technologies would attract transactions from the earlier technologies as shown in Figure 2. Initially, P2P would attract from B2B and then e-Speak would steal from P2P. In addition to the business generated by the early adopters of previous generations, adopters for P2P and e-Speak may also come from brand new innovators who adopt P2P or e-Speak for the first time and from the imitators who adopt the new generation due to the positive word of mouth without having used any previous generations.

We used the case as presented in Figure 2 as a benchmark case to evaluate the diffusion impact of different parameters. According to this scenario, the latest technology, e-Speak, would dominate in the market and cannibalize earlier technologies.

However, if the agents were not receptive to the newer generations and they do not want to take risks and try newer technologies, the number of innovators for the

²This is the case when *c* and *b* in Equation 7 are equal.

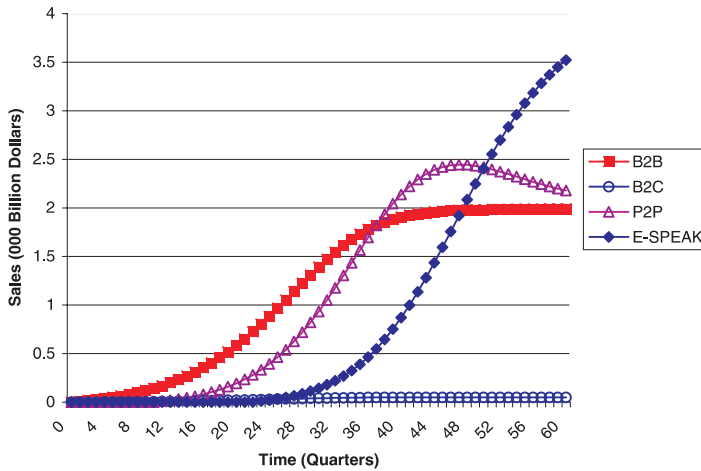


Figure 2. The base case. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

new technologies would be lower in the market. In this case, the availability of the positive word of mouth and the positive publicity would be also limited and delayed. However, most of the customers would still adopt the new technology after its success was proven in the market. Figure 3 presents such a case.³ In the figure, there is a significantly slower adoption for P2P and e-Speak (compared to the base case). B2B, B2C, P2P, and e-Speak converge more or less to the same figure, given a sufficient time horizon. B2B and B2C first increase and then decrease due to the cannibalization and the positive word of mouth for the new generations after they are available.

In generating Figure 3, we assumed that the technology generates a strong positive word of mouth and publicity once the customers adopt it. It may be the case that the offered technology would not meet expectations, and it would not create strong positive comments among the customers. Figure 4 presents such a case where the lower impact of word of mouth was captured by decreasing the coefficient of imitation compared to the base case.⁴ The majority of agents would imitate and adopt at a slower rate. The effects can be seen as increasing market share of B2B and B2C. Because of the positive word of mouth and publicity behind B2B and B2C, the newer generations would not pick up the momentum, and older technologies would dominate in the market.

When the market is not perceptive to new technologies, later technologies gain market share later on. When there is no strong publicity and word of mouth for the new exchanges, the first mover captures the market.

In Figures 5 and 6, we present the impact of higher innovation and imitation, respectively. In Figure 5, the agents are receptive to the newer offerings. A higher in-

³The value of the coefficient of innovation (p) was assumed to be 0.0005 for both P2P and e-Speak.

⁴There was still a positive but not very significant publicity and the coefficient of imitation (q) was set at 0.01.

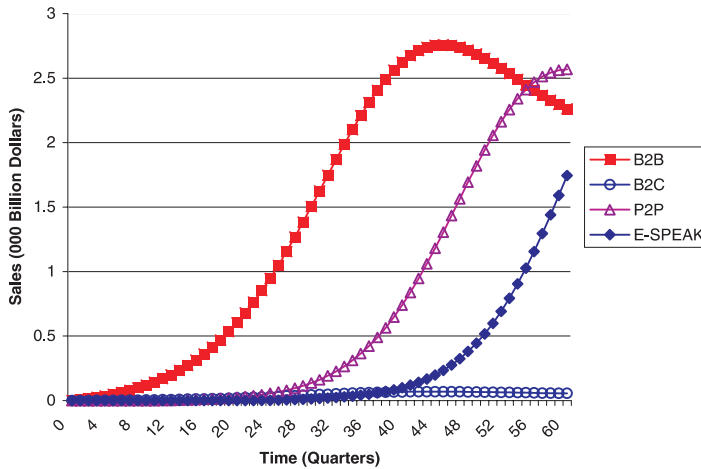


Figure 3. Low innovation. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

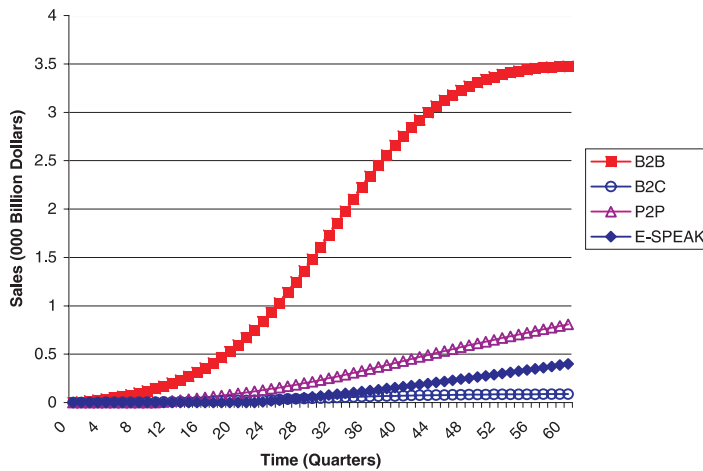


Figure 4. Low imitation. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

novation coefficient captures this motivation toward trying newer technologies.⁵ In this case, the later technologies such as P2P and e-Speak take off very rapidly. P2P attracts business from B2B and B2C and e-Speak start dominating the market after introduction. It especially hurts the latest technology, P2P because most of the agents start using the latest technology. P2P, B2B, and B2C increase slightly later on and settle on a lower market potential.

⁵ p was increased to 0.15 for P2P and e-Speak.

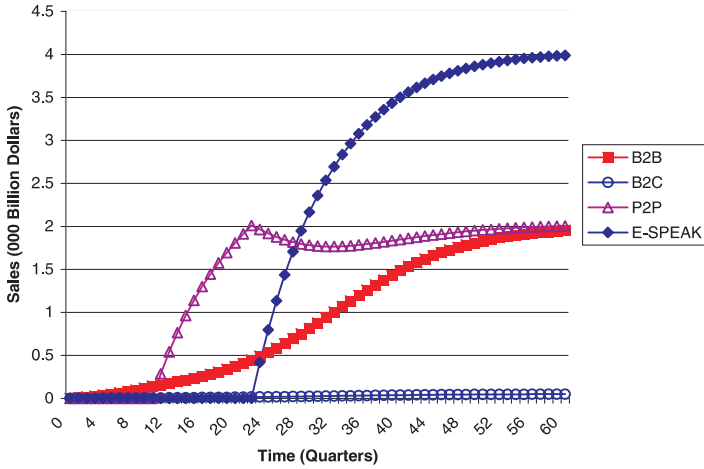


Figure 5. High innovation. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

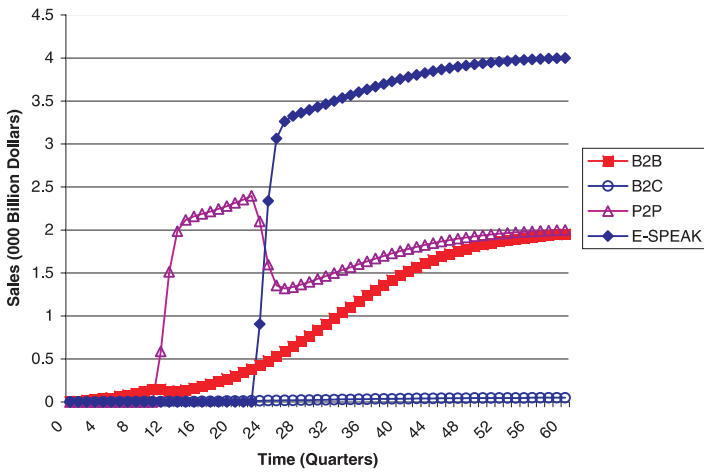


Figure 6. High imitation. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

In Figure 6, the imitation effects for both P2P and e-Speak are very strong.⁶ This is depicted in the figure by the sharp increase in P2P and, then, later on the sharp increase in e-Speak.

We noticed that the effect of the imitation was stronger than the innovation for the later technologies. However, they settled on more or less the same values in both cases. In another experiment, both imitation and innovation parameters were

⁶The parameters for the imitation were set to 1.6 both for P2P and e-Speak.

set to high values. The effect was the same as the one in high imitation. Hence, the imitation effect dominated the attraction to higher technologies based on these parameter values. The market share was more sensitive to a decreasing willingness to try new technologies. A manager of B2B exchanges should emphasize positive publicity to limit the successes of newer technologies. A manager of e-Speak should give incentives to increase the willingness to adopt later technologies and should make sure of the current customers are satisfied.

So far, we have assumed that the newer technologies create significant market potential that cannot be served by the earlier technologies. However, the impact of increasing market potential over earlier technologies may be limited. Newer introductions obtain revenue mainly due to switching customers from older technologies, cannibalizing older technologies. This limits the market potential of P2P and e-Speak, resulting in the market domination of B2B and B2C as presented in Figure 7.⁷ P2P stabilizes below B2B, whereas e-Speak increases.

In Figure 8, we simulated the incremental high market potential for P2P and e-Speak.⁸ The latest technology, e-Speak, benefits the most and captures the market.

Market shares are very sensitive to the new opportunities generated by the new technologies. Hence, a manager of P2P exchanges should include more technological advances to increase the market share.

Figure 9 shows the negative inertia where the corresponding c values of B2B, B2C, and P2P are greater than the b values. This case favors the latest technology, and e-Speak captures the market share, whereas B2B and B2C decline and almost disappear. P2P initially increases then dies down.

In Figure 10, we have the positive inertia toward newer technologies. This means that adopting a better technology is more costly, and as time passes, these costs increase. In this situation, B2B captures the market share. The latecomer e-Speak also increases; however, it is at the half of market share of B2B.

A manager of B2B should try to lock in customers by using long-term contracts to increase the market share because favorable switching costs to newer technologies may destroy the B2B market share and increase the penetration of newer technologies.

In Figure 11, we have high imitation and positive inertia. Because of high imitation, P2P and e-Speak increase initially; however, due to positive inertia, B2B captures most of the market share. It becomes more expensive to switch from B2B and B2C as time passes ($c > b$); therefore, B2B and B2C capture significant markets. The latest technology, e-Speak, decreases after a peak because most agents revert to older technologies. When the new generations cannot provide sufficiently high value, most prefer to stay with older versions, although the positive publicity around the new innovations may encourage them to try the newer technologies.

⁷This case was simulated by setting the m value at 0.5 (from 2 in the base case).

⁸This was obtained by setting the m value at 0.6 (vs. 0.4 in the base case).

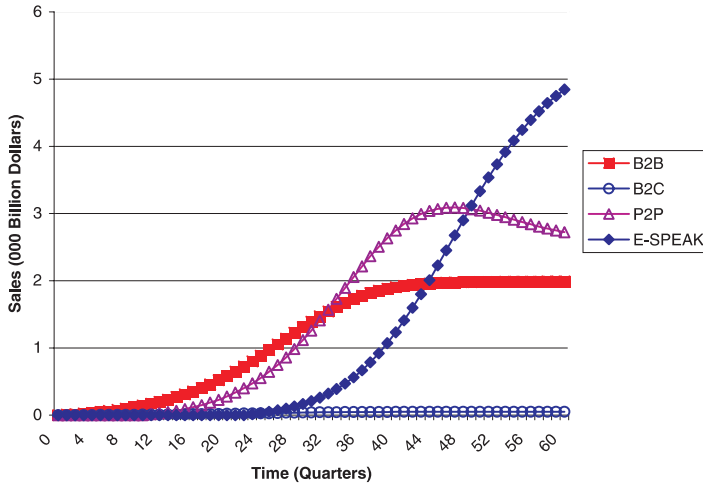


Figure 7. Limited incremental market potential with the newer technologies. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

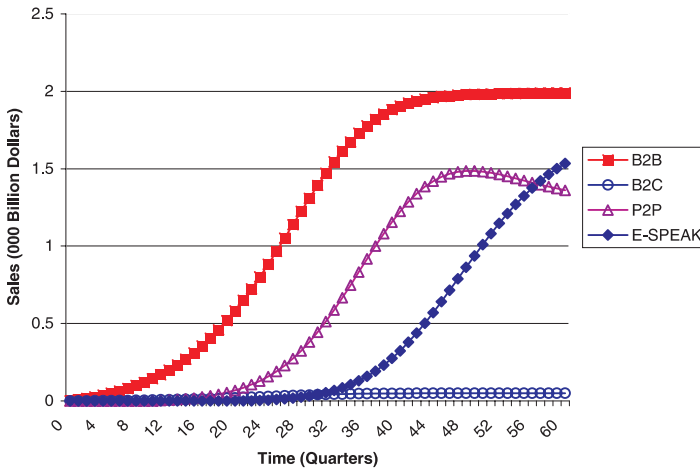


Figure 8. Higher incremental market potential with the newer technologies (B2B = business to business; B2C = business to consumer; P2P = peer to peer).

By comparing Figures 6 and 11, a B2B manager can successfully defend his/her market share by customer lock in the presence of strong publicity toward newer generations.

Figure 12 depicts high innovation and imitation for e-Speak and involves a positive inertia toward e-Speak. In this scenario, e-Speak initially increases then slowly decreases. Because of the increasing preference to stay with P2P, P2P increases and captures the most of the market. This case is another testimony that habits may play a stronger role in capturing market share and override high innovation and imitation.

P2P managers can also benefit by customer lock-ins and long-term contracts while defending against strong publicity and willingness to adopt newer technologies.

Figure 13 shows high imitation and positive inertia toward P2P and e-Speak. This scenario allows for a rapid increase on P2P and e-Speak because of strong and positive publicity. However, the high lock-in costs prevent organizations from trying newer technologies, and the new networks can only capture the incremental markets that they create. Accordingly, B2B, B2C, and P2P increase, whereas e-Speak quickly stabilizes and captures its incremental market share only. The elapsed time and incurred lock-in costs while using older technologies make it difficult for e-Speak to cannibalize older technologies. When there are high locking costs, introducing P2P gains significant market opportunity, whereas e-Speak is limited by its incremental market.

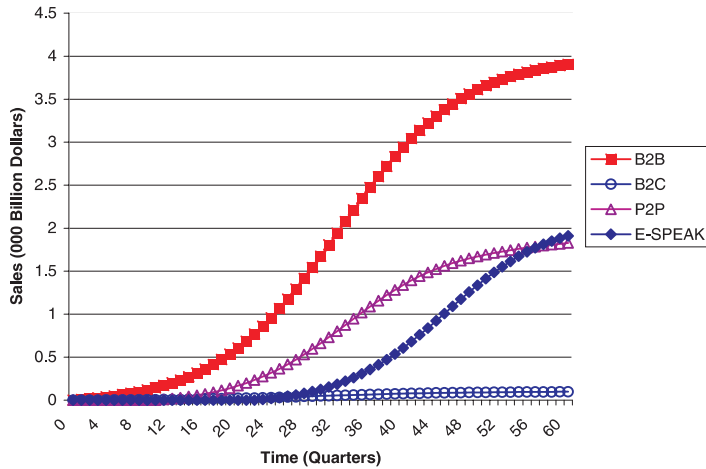


Figure 9. Negative inertia. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

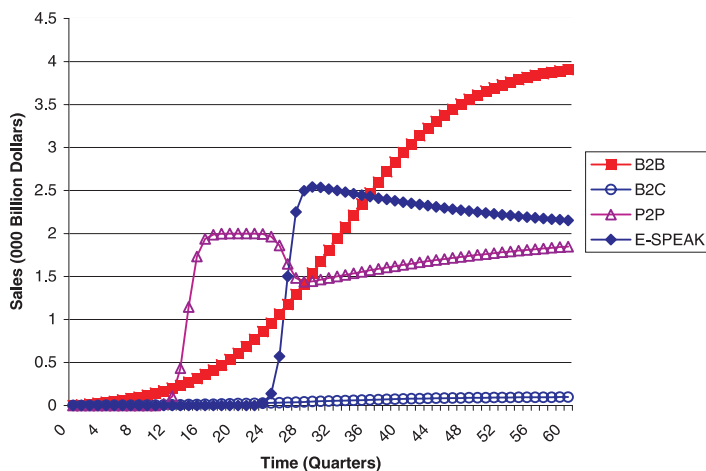


Figure 10. Positive inertia. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

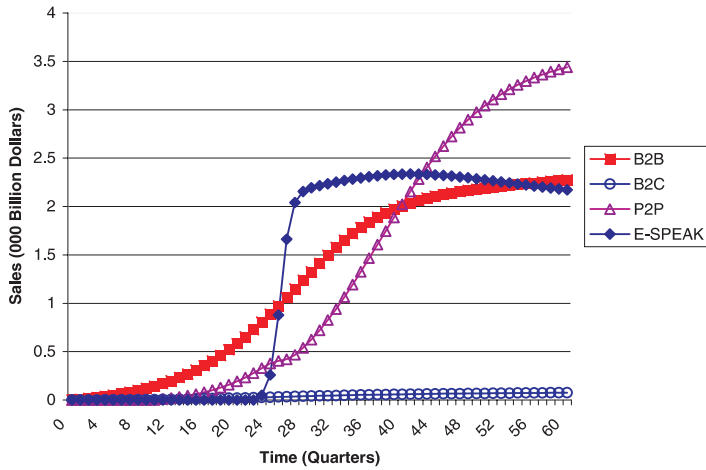


Figure 11. High imitation with positive inertia. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

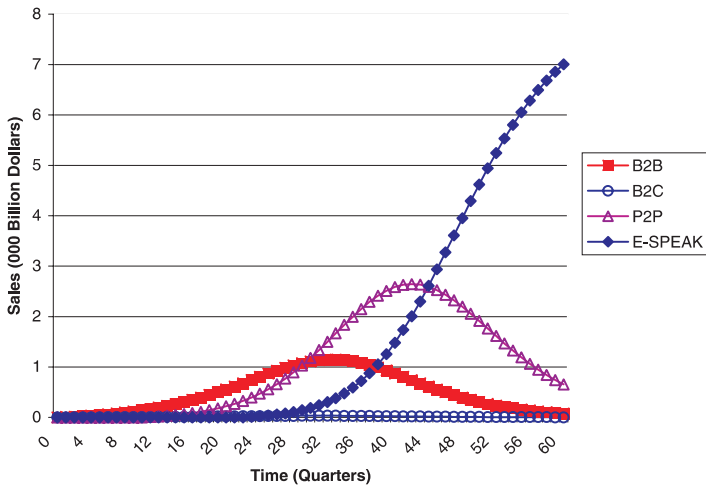


Figure 12. High innovation and imitation for e-Speak with positive inertia. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

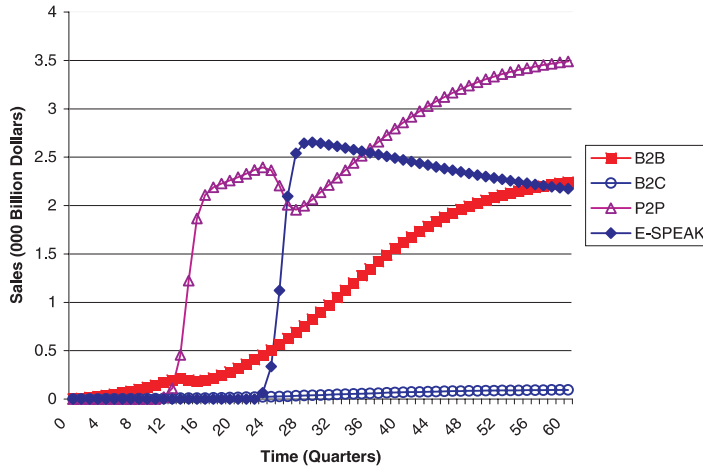


Figure 13. High imitation and positive inertia. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

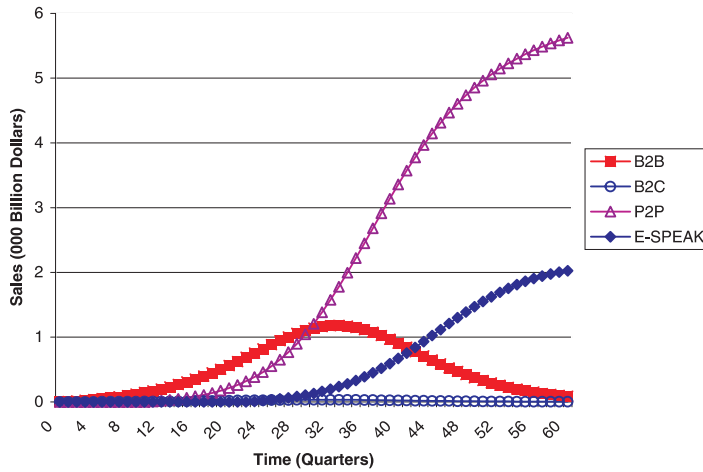


Figure 14. Negative and positive inertia. B2B = business to business; B2C = business to consumer; P2P = peer to peer.

In Figure 14, the inertia toward P2P is negative, and inertia toward e-Speak is positive. This structure allows B2B and B2C to die down because agents are willing to adopt the new technology offered by P2P. However, the positive inertia toward e-Speak makes it difficult to capture additional market share.

P2P managers should try to lure customers away from B2B while locking with long-term contracts.

5. CONCLUSIONS AND FUTURE RESEARCH

Managers may rely on forecasts like the ones provided by Jupiter Communications and Forrester Research. These firms poll the executives and consumers and come

up with their estimates. However, their forecasts are context free. That is, they do not evaluate possible different scenarios and account for their impact separately. Furthermore, their forecasts do not let the managers evaluate different strategies and decide on the best course of action. Also, polling for new technologies may not produce correct results because most of the time, executives are overly optimistic and consumers cannot really know how much they will spend on a given new technology without actually experiencing it [13].

On the other hand, waiting an extensive period of time to gather historical data and then fitting a model may prove to be a useless exercise for managers because the innovations in the market place may have already created a different outlook for the future and managers are more interested in new initiatives and their possible impacts. We suggest using a simulation approach.

The cases where B2B and B2C increase exponentially were studied first. Then, the case of switching from B2B to P2P and e-Speak were considered. We noticed the imitation effect was stronger than the innovation effect for the later technologies. However, in both experiments, they approached more or less the same values. The high imitation and innovation parameters yielded the same results as the one in high imitation. Hence, the imitation effect dominated the attraction to higher technologies based on these parameter values.

When new technologies do not increase the overall potential, the revenue mainly comes from the switching customers from older technologies. Because of the friction of switching, B2B and B2C may dominate the market.

If there are significant switching costs toward e-Speak in the presence of high imitation and innovation, the revenue of e-Speak may increase at first. However, due to increasing switching costs in time, e-Speak revenue may decrease. When new generations cannot provide sufficiently high value, most agents may prefer to stay with older versions, although the positive publicity around the new innovations may encourage them to try the newer technologies.

When there is negative inertia toward P2P and positive inertia toward e-Speak, the revenues of B2B and B2C may decrease. Agents may be willing to adopt the new technology offered by P2P. However, the positive inertia toward e-Speak would make it difficult to capture additional market shares.

Given significant data points, one can estimate the parameter values of the diffusion model, providing the best fit to real life. However, many years have to elapse to statistically estimate these values. The lack of data limited us to doing a simulation study instead.

We suggested a practical macrolevel model that can be used by practitioners for category-wide assessments. Firm-level strategies can be further studied with game theory concepts within a dynamic setting.

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