INFORMATICA, 1999, Vol. 10, No. 3, 275–288

A Dynamic Growth Model for Focused Broadcasting over the Internet

James K. HO
Information and Decision Sciences, University of Illinois at Chicago
m/c 294, 601 South Morgan, Chicago, IL 60607, USA
e-mail: jimho@uic.edu

Received: March 1999

Abstract. As a significant segment of the Information Industries, classified advertising can be a prime example of how conventional businesses, rather than being simply transplanted to the New (digital) Media, may indeed be transformed for future growth. To be successful, such transformations must be able to take full advantage of the defining features of the emerging information infrastructure for innovative creation of economic value. Focused Broadcasting, a class of service for matching classified and want ads using the World Wide Web, is an approach that balances the push-pull dynamics of information over the Internet. Applying the concept of product introduction with complementary network externalities, a dynamic model is formulated to simulate the potential growth of such business in cyberspace. Robustness of the model is demonstrated.

Key words: information dynamics, economics of information, network externalities, dynamic growth model, classified advertising, World Wide Web, diffusion of innovation.

1. Introduction

Classified advertising is a significant segment of the Information Industries. Annual expenditure on newspapers is $15 billion in the US alone (NAA, 1997). Efforts are already emerging to transplant this business to the New Media, a terminology used by newspaper professionals for Internet-based cyberspace. For example, AdOne Classified Network charges newspapers a fee to post their classified ads on its Web site (Tartar, 1996). Web users can then browse such ads just as they read newspapers. This leads to the general question of whether putting businesses online will be mostly a shift of media, or more fundamental transformations that can create innovative economic value and hence growth. Obviously, for the latter to happen, the transformations must be able to take full advantage of the defining features of the New Media, which brings us to the center of the current debate on the relative merits of various information dynamics over the Internet.

Through its explosive growth in recent years, the Internet has long been regarded as the antithesis of conventional broadcasting media such as newspaper, radio, and television. Instead of pushing generic content designed for mass consumption to the user, it lets the latter control the process of communication by pulling in only items of personal interest. The liberating effects of this approach appeared to culminate with the proliferation of the World Wide Web as the increasingly popular medium to publish and browse

information. The potential for business applications in electronic commerce (Kalakota, 1996) was quite obvious. Indeed, as enterprises large and small scurried to stake their presence on the Web, hopes were high that once that is done, the whole world will come knocking. To date, this has rarely been the case (Essick, 1997). In the haste of jumping on the band wagon, many commercial Web projects suffered from murky definition of business purposes and dubious value-added for the customers. See (Ho, 1997) for a global study of commercial web sites using a purpose-value framework from the perspective of consumers. In any case, with millions of sites vying for attention, advertisers were losing patience with the "pull" format. In came "push" technology to the rescue by delivering more or less customized content to a browser's desktop along with unsolicited advertising (Cortese, 1997; Kelly, 1997). To the critical observer (Caruso, 1997; Levy, 1997), this approach is tantamount to retrofitting the Internet with cable television. While convergence of the two media may indeed facilitate penetration of the mainstream market, real progress is unlikely with the simple blending of one into the other. It now appears that such progress may not be totally reliant on the invention of more techno-gizmos. Rather, it can depend more on the creation of value (Ho, 1994) through truly compelling uses with a suitable balance of push and pull.

This work addresses one potential example of a compelling use that may transform conventional classified advertising. Focused Broadcasting is a class of service for matching classified and want ads in the New Media. After explaining the mechanics of this approach and where it fits in the push-pull framework of information dynamics, a market growth model for such service is presented. The formulation is based on the observation that two of the key components in Focused Broadcasting – viewers and advertisers – are actually complementary products in a market with network externalities. A strategic option to jump-start the market by offering a free-trial period is explicitly considered. A number of plausible scenarios are simulated to demonstrate the robustness of the model. Results from such analysis can be used to evaluate specific design options in actual planning and implementation of focused broadcasting on the World Wide Web.

2. Information Dynamics

To capsulize the ongoing debate over the relative merits and potentials of push versus pull technologies for the Internet, it is helpful to position various conventional and emerging media as shown in Fig. 1.

A two-dimensional framework is used. Horizontally, the relative characterization of how information is disseminated and acquired is displayed. Note that to the extent that information is being made available for public consumption, there is always an element of push in the sense of broadcasting, whether it is in print, air waves, or electronic signals. Without any attempt at formal definitions, it is important to have some guiding principle to distinguish push from pull. We propose a simple one in the form of a question: "Can you look it up at your own leisure?" If so, then it is pull. This is certainly the case with books in a library or newspapers on a coffee table, but not so with the real-time broadcast

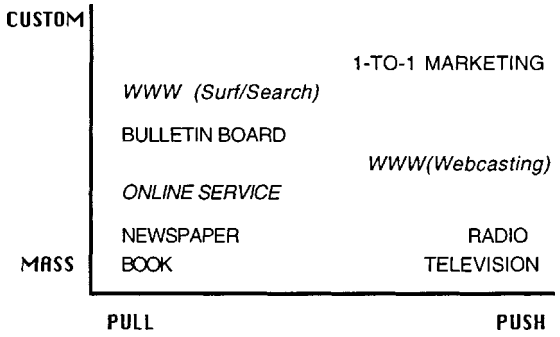

Fig. 1. Schematic of information dynamics.

of radio or television programs. The vertical axis indicates whether the content of the medium is primarily designed for mass consumption, or customizable to individual interests. The question to ask here is: "To what extent do you see only what you are looking for?" In this sense, the distinguishing emphasis is put on how an individual is guided to information of interest, rather than the selectiveness of the overall material. For example, a typical book is a line by line presentation (linear text) designed by the author. Much as any reader can skip around the pages, the layout is the same for everyone and primarily meant to be followed cover to cover. By contrast, a dictionary, while providing the same overall content to every user, is specifically designed to help find only what one is looking for.

Within this framework, both conventional and emerging media can be characterized. Book and newspaper are highly mass-pull while radio and television are highly mass-push. Bulletin boards, especially those with classified and want ads, sit higher on the custom scale. (The same goes for special sections of newspapers for this purpose.) So-called 1-to-1 marketing (Peppers, 1996), in which individual purchasing behavior is culled from massive customer databases and used to target advertising campaigns can be considered highly custom-push. Three Internet-based media are shown in italics. Online services, in the role as content providers, are somewhat more custom-pull then newspapers. The World Wide Web, as a repository of hyperlinked multimedia, is much higher in the same column. Webcasting (Cortese, 1997), which has gained much attention recently, is push and not much higher than online services on the custom scale.

The purpose of our framework for information dynamics is to provide a perspective for future development of Internet applications. Observe that mass-pull and mass-push are already saturated by conventional media, and those emerging to-date tend to fall into the same push-pull divide (Zinkhan, 1996). This suggests various unexplored territories and the prospect of truly compelling applications bearing the corresponding characteristics. In the following, we introduce one such example which is a highly custom balance of pull and push.

3. Focused Broadcasting

Much as the Internet is undergoing explosive growth, penetration of the mass market is still far from reality (Coates, 1997). It is quite conceivable that significant breakthrough may not depend solely on further advances in the technology, but rather on truly compelling applications of what is already available. Take senior citizens for example. Most of them have no interest in high technology in its own sake. Judging from demographic data (see, e.g., GVU, 1997) efforts to pitch computers to them as gadgets of pastime or tools to keep an active mind have only very limited success to date. However, grandparents are likely to find "videoconference" over the Internet with their out-of-town grandchildren compelling (Meyerhoff, 1996). Others may be similarly impressed by healthcare resources on the Web. In our context, any feature that is attractive enough to lure people into gaining access to the Internet is considered truly compelling.

We now introduce a class of service that has a promising niche in our framework of information dynamics. The term Focasting stands for "focused broadcasting", an advertising system that takes full advantage of both the culture and the technology of the Internet in general, and the World Wide Web in particular. Three parties are involved: Viewer, Focaster, Advertiser. The Viewer registers with the Focaster (who may be an ISP, E-Mall, Directory, Web-Host, etc.) free of charge, indicating specific items, categories, or sources of interest. Provided with an ID and Password for subsequent visits, the Viewer sees Web pages at the Focaster's site showing only timely information furnished by Advertisers of interest. The Advertiser pays the Focaster at rates that can be meaningfully established and negotiated based on Viewer demands.

Focasting is essentially an automated matching service for classified and want ads over the Internet. However, it is not information brokering, purchase agency, or any traditional role of go-betweens and middlemen. As the trend in cyber-culture is toward disintermediation, even automation of such models is not promising. Instead, the Focaster strives to be an efficient conduit of valuable information. Apart from helping to classify and match the supply and demand, no value judgment is exercised. Hence, no value-based commission is charged. The Viewer sees only what is of interest, for free. The Advertiser reaches only those who are interested (a focused audience), and more cost-effectively than with conventional advertising. The Focaster earns a fee by providing the service, leveraging Web technology for economies of scale. Why not charge the Viewer a fee? Obviously, the Viewer derives value from the service and may indeed be willing to pay for it. However, competition among Focasters will eventually drive this fee to zero. As long as Focasting generates sales for the Advertisers, they have an incentive to pay.

There are many precursors to the building blocks of the Focasting system. Customized reports and newspapers embody the same technology, but not the economics. Existing E-Malls and Industry Networks serve the same purpose, but lack the dynamics to balance the pushing and pulling of information. Ultimately, it is the recognition that by catering fully to the Viewer, the Focaster ends up with a product that is perfectly marketable to the Advertiser. With the new focused channels, the Advertiser can concentrate on timely and customized announcements, rather than the relatively static and mass appeal approach in conventional media.

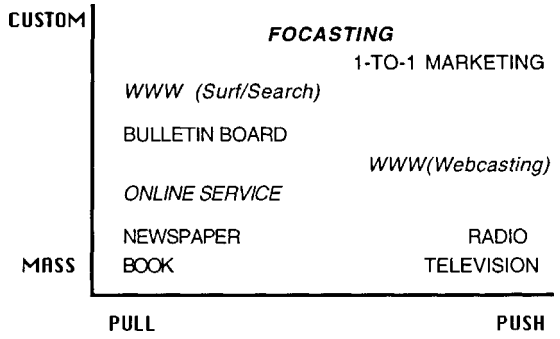

Fig. 2. Information dynamics of Focasting.

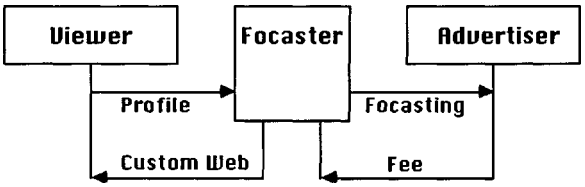

Fig. 3. Mechanism of Focasting.

The relative positioning of Focasting in the schema of information dynamics is illustrated in Fig. 2, while its mechanism is illustrated in Fig. 3. Note that it can be regarded as a balanced act of pull and push since contents of interest are linked in real time and pushed to the Viewer. However, the latter takes the initiative and control of the timing of communication. The only basic technical requirement to implement Focasting is the ability to generate data-based Web pages on the fly, which is already widely available with most server systems. There is no drawback in terms of high bandwidth demands as with existing push technology.

As obvious applications abound in trade, real estate, collectibles, automobile, travel and leisure, and recruiting, commercial Web sites having features that fit the Focasting model are indeed appearing. The prime examples include the Personal Retriever^{TM} offered by Coldwell Banker's (www.coldwellbanker.com) for the real estate market. Here, the Viewer may set up a portfolio specifying the type and size of houses, the neighborhood or township, and the price range of interest to create customized real estate listings. Similarly, Asian Sources Online (www.asiansources.com), a provider of trade information for volume buyers of products from Asian suppliers features its Product Alert service. The Viewer chooses to monitor product categories from extensive lists of options, in order to be on constant look out for timely offerings from wholesalers and manufacturers. An example using E-mail notices without customized Web pages is the CareerBuilder (www.careerbuilder.com), a job search/recruiting network. Here, using its Personal Search Agent^{SM}, the registered Viewer may maintain up to five profiles, each indicating a choice of job type and geographical location. Subsequently, E-mail notification of new job postings by Advertisers that fit the Viewer's profiles are sent daily. Another

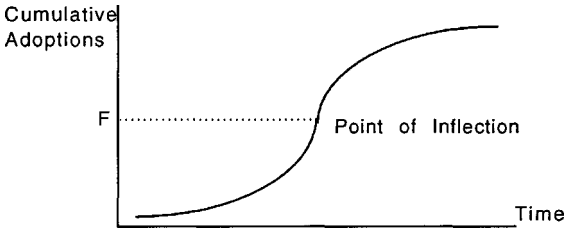

Fig. 4. The Bass new product diffusion model.

example is Cyber-Merchant Exchange (www.c-me.com,) an electronic trade-show site for wholesalers and volume buyers, that has formally adopted the Focasting model (Balu, 1997).

4. Diffusion of Innovation

If we consider the transformation of conventional classified advertising into Focasting as a technological innovation, we may be able to draw upon substantial previous work on the adoption and diffusion of new products (see Mahajan and Muller, 1979; Mahajan *et al.*, 1990; Everett, 1995 for comprehensive surveys.) The basic models (Bass, 1969) address the growth of the first-time buyers of a product (i.e., adoption) by considering the flow of customers from a constant potential market to the current market, by way of two communication mechanisms converting potential customers to adopters – mass media and word of mouth. These have been applied to the study of retail services, industrial technology, agriculture, grocery products, and consumer durables. They are based on the assumption that the message about the product reaches first a few innovators who then pass the word to so-called imitators.

Extensions of the basic models consider a potential market that may expand from the untapped population, as when people learn about and begin to find technological innovations such as computers affordable. Also, the two-step communication mechanism is generalized to one with external (e.g., the marketing efforts of promoters of the product) and internal (e.g., peer) influences. Most of the models result in the formulation of some generalized logistic (S-shaped) curve for the diffusion process as illustrated in Fig. 4.

Typically, the process takes some time to gain momentum, undergoes rapid growth, slows down and stagnates eventually. In most diffusion of innovation models proposed to date, there is no explicit provision for incorporating marketing strategies. Also, the value of the product is assumed to be independent of market size. We address such shortcomings and approaches to overcome them next.

5. Markets with Network Externalities

The value of many goods and services increases with the size of their market. A classic example is the telephone which is of little value with few users. A more contemporary

analogy is electronic mail. Consumers of such products and services constitute network markets whose economics have proven to be problematic in traditional theory (Katz and Shapiro, 1985). They are referred to as markets with network externalities, and are subjects of a growing body of primarily theoretical literature especially in the context of the adoption of technological innovations (Katz and Shapiro, 1982, 1986; Cabral, 1990; Church and Gandal, 1990; Brynjolfsson and Kemerer, 1996; Economides, 1996).

Market externalities can be either direct or indirect. Direct market externality means that a consumer's utility depends directly on the total number of users of the same (or compatible) product. For example, the value to any user of an e-mail network increases with the number of subscribers with access to the same network. As value is increasing with the number of users, such network externality is considered positive. Negative network externalities (Westland, 1992) are also possible, as with traffic congestions that often degrade information services provided over the Internet. Indirect market externality means that a consumer's utility for one product depends on the total number of users of a different product. If the dependence is positive, the products are considered complementary. An example is computer hardware and software. The utility of, say, a particular PC platform depends on the variety of software that runs on it. In turn, the utility of any software depends on the popularity of the platform on which it runs (Gandal, 1995).

In Focasting, the value of the custom Web pages shown to the Viewers increases with the total number of advertisers using the service. With more classified ads, it is more likely for the Viewer to find what he or she is looking for as specified in the search profile maintained by the Focaster. Likewise, the value of the Focasting service to the advertisers depends on the user base of Viewers: the larger the base, the more exposure for the ads. Therefore we can consider the custom Web pages and the classified ads as complementary products in a market with network externalities. This point of view provides another justification of our basic assumption of offering Focasting free to the Viewers. In the context of markets with externalities, they are actually the primary product that the Focaster is pitching to the Advertisers who are the paying customers.

6. A Dynamic Growth Model for Focasting

Based on the above discussions, we propose a simple market growth model for Focasting with the following properties:

i) modeling the interdependence of the Viewers and Advertisers as complementary network externalities;
ii) incorporating a marketing strategy to gain critical mass for the diffusion process;
iii) retaining the basic S-shaped characteristics of a diffusion of innovation process.

To do so, we assume:

i) the Viewers to be the adopters of innovation in the sense that those in the potential market have not yet used Focasting while those in the current market will remain users;

ii) network market effects of the Advertisers are represented by the number of ads so that repeated and multiple uses of Focasting by individual Advertisers can be accounted for;
iii) the flow rate of new Viewers from the potential to the current market is directly proportional to the current number of Advertisers up to a point of inflection, after which it attenuates as in the basic diffusion process;
iv) the flow rate of ads in any period is directly proportional to the flow rate of Viewers in the previous period;
v) to spur initial growth, a free-trial period is offered, at the end of which a portion of current Advertisers are expected to drop out.

Letting
t – time period;
$V(t)$ – number of viewers in time period t;
$A(t)$ – number of ads in time period t;
Q – potential market of viewers;
F – inflection ratio;
v – duration of free trial;
r – retention factor at end of free trial;
α_0 – growth factor for $A(t)$ under free trial;
α_1 – growth factor for $A(t)$ with fees;
β – growth factor for $V(t)$ before point of inflection;
μ – damping factor in attenuation of $V(t)$;
k – periods after point of inflection;
we have,

$$V(t) = V(t-1) + \beta A(t-1) \quad \text{if } < FQ \text{ else} \tag{1a}$$
$$= V(t-1) + [Q - V(t-1)]\,(1 - e^{-\mu k}), \tag{1b}$$

$$A(t) = A(t-1) + \alpha_0\,[V(t-1) - V(t-2)] \quad \text{if } t < v \tag{2a}$$
$$= rA(t-1) \quad \text{if } t = v \tag{2b}$$
$$= A(t-1) + \alpha_1\,[V(t-1) - V(t-2)] \quad \text{if } t > v. \tag{2c}$$

Noting that $V(t) - V(t-1)$ is the flow rate of Viewers from the potential to the current market in period t, Eq. (1a) expresses the complementary network externality effect of its dependence on the number of ads $A(t-1)$ up to the point of inflection FQ. Eq. (1b) models the attenuation of this flow thereafter. Equations (2a) and (2c) say that the flow rate of ads, $A(t) - A(t-1)$, in period t is proportional to the flow rate of Viewers in the previous period $t-1$, again reflecting complementary externality. The factors of proportionality before and after the free trial, α_0 and α_1 respectively, may differ. Eq. (2b) indicates that a portion $(1-r)$ of current ads are dropped when the Focaster begins to charge fees at the end of the free trial period.

We should emphasize that the essence of our model is in the distinction between Eqns. (1a) and (2a/c). It reflects the argument that new adopters are driven by the actual

availability of ads, while true increases in ads that are not just replacements and repeated purchases by current Advertisers are induced only by an increase in new adopting Viewers. The linearity of dependence assumed in both cases is a first approximation. Apart from this minimal but plausible theoretical foundation based on complementary network externalities, the rest of the model is empirical with parameters to accommodate a full range of applications. Also, while the nonsmooth transitions from (1a) to (1b), (2a) to (2b), and (2b) to (2c) may pose difficulty for purely mathematical analysis, they are no obstacles to discrete event simulation using spreadsheets.

The model can be used to investigate questions such as:

i) For given values of the parameters, is the market for Focasting viable?

ii) For given market conditions, what is the optimal strategy for the free-trial offer?

iii) How does the fee rate affect market growth?

Actual validation and application of the model require empirical data on or good estimates of the various parameters. For our present purpose, it suffices to demonstrate the robustness of the model with a series of scenarios. In each case, we present the values used for the parameters, their interpretation, and a graph of the market growth for viewers and ads. By varying the parameter v, the effect of the free trial offer can be tested. For simplicity, we use the steady state for ads as a measure of performance, and report the corresponding value of v for optimal growth. In practice, a trade-off between the area under the growth curve for ads before (cost) and after (benefits) the free trial will have to be considered.

The model is implemented on a spreadsheet with the following set of parameters: $(\alpha_0, \alpha_1, \beta, r, A(0), V(0), Q, F, \mu)$. The numerical values chosen to illustrate various scenarios are primarily relative in significance. However, to help fix ideas, the time periods $t = 1, 2, \ldots, 12$ can be interpreted as months, and the potential market $Q = 100$ as 100% of some target. $A(0)$ and $V(0)$ are initial conditions to get the process started. F and μ are adjusted mainly to obtain presentable scaling of the graphs. Also, while plotted on the same graph, the variables $A(t)$ and $V(t)$, for ads and Viewers respectively, do not have to share the same scale and units.

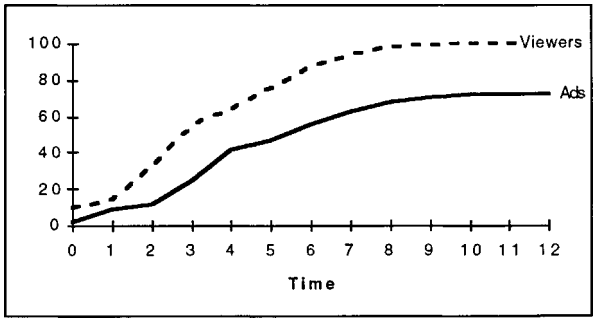

Fig. 5. *Case 1*. Self-propelled Market.

Parameters: $\alpha_0 = 0.8, \alpha_1 = 0.7, \beta = 2.0, r = 0.5, A(0) = 2, V(0) = 10, Q = 100, F = 0.9, \mu = 0.2$. Healthy growth rates even with fees make a free trial strategy unnecessary. Optimal growth is with $v = 0$.

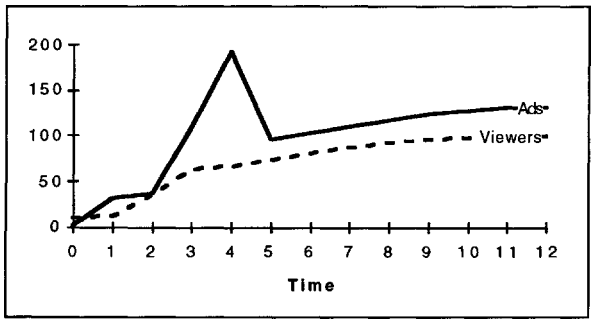

Fig. 6. *Case 2*. Market requiring jump-start.
Parameters: $\alpha_0 = 3.0, \alpha_1 = 1.1, \beta = 0.75, r = 0.5, A(0) = 2, V(0) = 10, Q = 100, F = 0.95, \mu = 0.1$.
Lower growth rate with fees takes substantial free trial to build critical mass. Optimal growth is with $v = 5$.

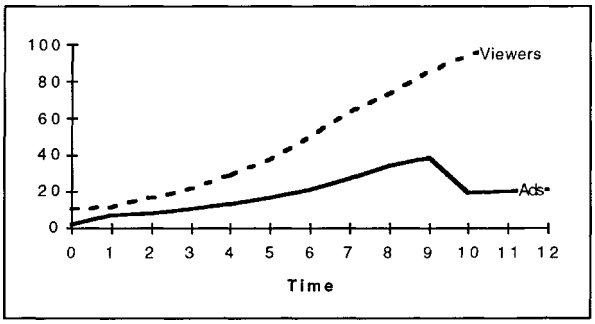

Fig. 7. *Case 3*. Market that never took off.
Parameters: $\alpha_0 = 0.5, \alpha_1 = 0.1, \beta = 0.7, r = 0.5, A(0) = 2, V(0) = 10, Q = 100, F = 0.7, \mu = 0.3$.
Growth rates are too low for even long period of free trial (optimal at $v = 10$) to result in a viable market.

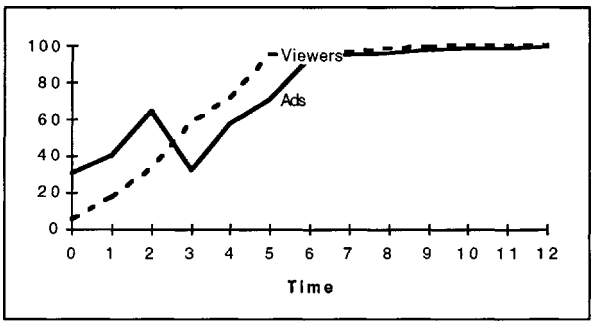

Fig. 8. *Case 4*. Market with large initial Advertiser base and low Viewer adoption rate.
Parameters: $\alpha_0 = 2.0, \alpha_1 = 1.0, \beta = 0.4, r = 0.5, A(0) = 30, V(0) = 5, Q = 100, F = 0.95, \mu = 0.2$.
Low Viewer adoption rate calls for a free trial even with substantial Advertiser base at the start. Optimal growth is with $v = 3$.

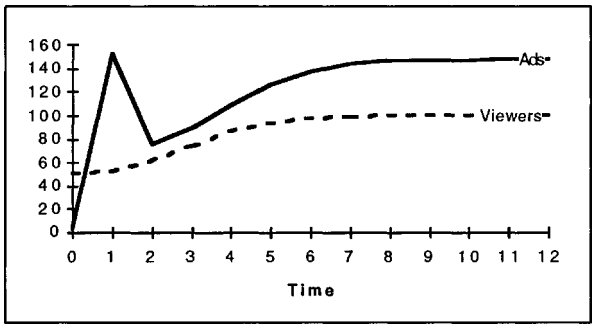

Fig. 9. *Case 5*. Market with large initial Viewer base.

Parameters: $\alpha_0 = 3.0, \alpha_1 = 1.5, \beta = 1.2, r = 0.5, A(0) = 2, V(0) = 50, Q = 100, F = 0.95, \mu = 0.2$. A ready market of viewers with only modest growth in new adoptions can support healthy growth in ads.

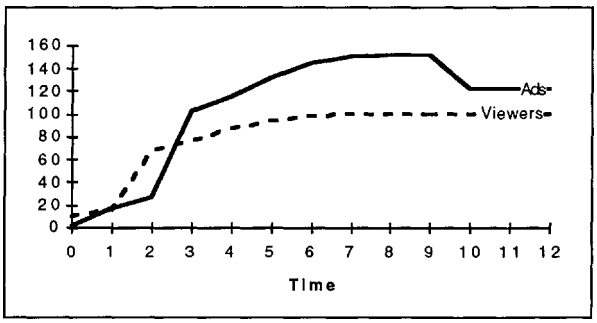

Fig. 10. *Case 6*. Market requiring deep pocket and patience.

Parameters: $\alpha_0 = 1.5, \alpha_1 = 0.7, \beta = 1.2, r = 0.8, A(0) = 2, V(0) = 10, Q = 100, F = 0.95, \mu = 0.3$. Modest but steady growth takes patience to build up Viewer base which entices a high retention rate of Advertisers at the end of free trial. Optimal growth is with $v = 10$.

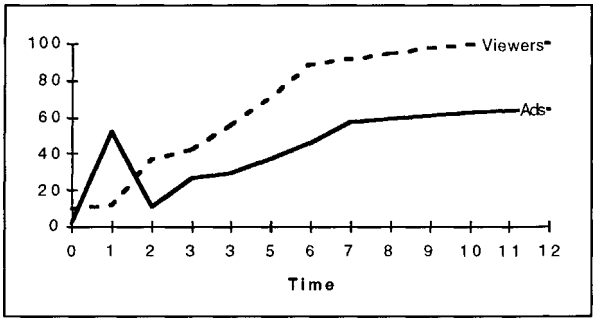

Fig. 11. *Case 7*. Market with low retention after free trial.

Parameters: $\alpha_0 = 5.0, \alpha_1 = 0.6, \beta = 0.5, r = 0.2, A(0) = 2, V(0) = 10, Q = 100, F = 0.99, \mu = 0.25$. Low retention after free trial makes recovery difficult and a prolonged offer ineffectual. Optimal growth is with $v = 2$.

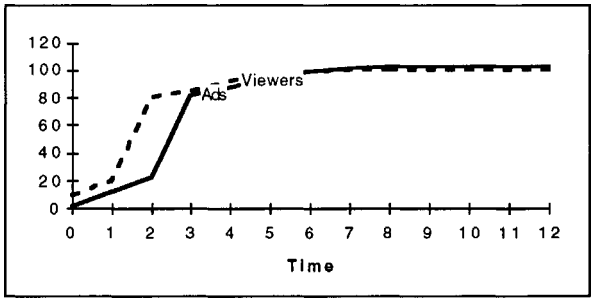

Fig. 12. *Case 8*. Market with Advertisers ready to pay for results.

Parameters: $\alpha_0 = 1.0$, $\alpha_1 = 1.0$, $\beta = 5.0$, $r = 1.0$, $A(0) = 2$, $V(0) = 10$, $Q = 100$, $F = 0.95$, $\mu = 0.3$. With the growth rate for ads unaffected by a free trial, and full retention at the end of such, the offer of incentive has only marginal effect on the steady state.

7. Discussion

We have argued that simply transplanting conventional businesses to the digital New Media – particularly Internet-based cyberspace – may not lead to real progress in terms of innovative creation of economic value. Instead, opportunities that can transform businesses for future growth should be developed. To be successful, such transformations must be able to take full advantage of the defining features of the emerging information infrastructure such as the push versus pull of information dynamics over the Internet. Classified advertising, as a significant segment of the Information Industries, is shown to be a prime example in the form of Focused Broadcasting: a class of service for matching classified and want ads using the World Wide Web. Applying the concepts of product introduction and diffusion of innovation with complementary network externalities, a market model is formulated to simulate the potential growth of such business in cyberspace. Robustness of the model is demonstrated with a series of eight scenarios illustrating its potential use for market research and analysis in practice. Future work should include case studies of early ventures in Focasting that provide empirical data for more systematic validation and improvement of the formulation.

References

Balu, R. (1997). Buying and selling in cyberspace: a biz model. *Crain's Chicago Business*, 5/12/97.

Bass, F. (1969). A new product growth model for consumer durables. *Management Science*, **15**, 215–227.

Bresnahan, J. (1997). Up close and personal. *CIO*, 5/15/97.

Brynjolfsson, E., and C. Kemerer (1996). Network externalities in microcomputer software: An econometric analysis of the spreadsheet market. *Management Science*, **42**, December.

Cabral, L. (1990). On the adoption of innovations with "network" externalities. *Mathematical Social Sciences*, **19**, 229–308.

Caruso, D. (1997). When push comes to shove. *The New York Times*, 3/24/97.

Church, J., and N. Gandal (1990). Complementary network externalities and technological adoption. *International Journal of Industrial Organization*, **11**, 239–260.

Cortese, A. (1997). A way out of the Web maze. *Business Week*, 2/24/97.
Coates, J. (1997). E-commerce eludes on-line retailers. *Chicago Tribune*, 4/17/97.
Economides, N. (1996). Network externalities, complementarities, and invitations to enter. *European Journal of Political Economy*, **12**, 211–232.
Essick, K. (1997). Internet users slow to adopt electronic commerce. *Computerworld*, 4/14/97.
Everett, R. (1995). *Diffusion of Innovation.* 4th ed. New York, Free Press.
Gandal, N. (1995). Compatibility, standards and complementary network externalities in the PC software market. *Review of Economics and Statistics*, **77**, 599–608.
GVU (1997). WWW User Surveys, Graphics, Visualization and Usability Laboratory, Georgia Institute of Technology, `http://www.cc.gatech.edu/gvu/user_surveys/`.
Ho, J. (1994). Prosperity in the Information Age: Creating value with technology – from mailrooms to boardrooms. *Infotomics*, `http://www.uic.edu/~jimho/pia.html`.
Ho, J. (1997). Evaluating the World Wide Web: a global study of commercial sites. *Journal of Computer Mediated Communication*, **3**(1), `http://www.ascusc.org/jcmc/vol3/issue1/ho.html`.
Kalakota, R., and A. Whinston (1996). *Frontier of Electronic Commerce.* Addision-Wesley.
Katz, M., and C. Shapiro (1982). Product introduction and network externalities. *Journal of Industrial Economics*, **40**, 55–83.
Katz, M., and C. Shapiro (1985). Network externalities, competition, and compatibility. *American Economic Review*, **75**, 424–440.
Katz, M., and C. Shapiro (1986). Technology adoption in the presence of network externalities. *Journal of Political Economy*, **94**, 822–841.
Kelly, K., and G. Wolf (1997). Push! The radical future of media beyond the Web. *Wired*, March.
Levy, S. (1997). The Internet gets pushy. *Newsweek*, 5/12/97.
Mahajan, V., and E. Muller (1979). Innovation diffusion and new product growth models in marketing. *Journal of Marketing*, **43**, 55–68.
Mahajan, V., E. Muller and F. Bass (1990). New product diffusion models in marketing: A review and direction for research. *Journal of Marketing*, **54**, 1–26.
McDonald, W. (1996). Internet customer segments: an international perspective. In C. Droge and R. Calantone (Eds.), *Enhancing Knowledge Development in Marketing*. American Marketing Association. pp. 338–344.
Meyerhoff, M. (1996). The methods of a modern-day grandpa. *Hemisphere*, March.
NAA (1997). Annual newspaper classified advertising expenditures. *Market and Business Analysis*, Newspaper Association of America. `http://www.naa.org/marketscope/databank/annclass.htm`.
Peppers, D., and M. Rogers (1996). One-to-one media in the interactive future. In E. Forrest and R. Mizerski (Eds.), *Interactive Marketing: The Future Present*, NTC Business Books.
Tartar, M. (1996). Internet classifieds present revenue opportunity. *Newspaper & Technology*, 6/10/96.
Westland, J.(1992). Congestion and network externalities in the short run pricing of information systems services, *Management Science*, **38**, 992–1009.
Williamson, D. (1996). Smart agents build brains into Net ads. *Advertising Age*, 4/8/96.
Zinkhan, G., and R. Watson (1996). Advertising trends: innovation and the process of creative destruction. *Journal of Business Research*, **37**, 163–171.

J.K. Ho is a professor of Information and Decision Sciences at the University of Illinois at Chicago. He did his undergraduate work at Columbia University and obtained his Ph. D from Stanford University. His research interest is in the integration of information management and systems optimization. He is the author of *Prosperity in the Information Age: Creating Value with Technology – from Mailrooms to Boardrooms* (Infotomics, Wilmette, IL: 1994).

Fokusuoto transliavimo internete dinaminio augimo modelis

James K.HO

Klasifikuoa reklama – svarbus informacinės industrijos segmentas – gali būti geru pavyzdžiu to, kaip bendrai priimta komercinė veikla gali būti iš tikrųjų transformuota tolesniam augimui. Tam, kad būtų sėkmingos, šios transformacijos turi galėti priimti visus ekonominių vertybių inovacinio kūrimo informacinės infrastruktūros privalumus. Fokusuotas transliavimas (serviso klasė klasifikuotam lenktyniavimui naudojantis WWW) yra požiūris, kuris balansuoja informacijos dinamiką internete. Remiantis produkto pristatymo naudojant papildomas tinklo galimybes idėja, yra suformuluotas dinaminis modelis skirtas potencialiam šios komercinės veiklos augimui modeliuoti kibererdvėje. Parodytas šio modelio robastiškumas.