Internet Diffusion in China: Economic and Social Implications

Linda S.L. Lai and Wai-Ming To, Macao Polytechnic Institute

This article explores the economic and social implications of Internet diffusion in China. With the penetration rate and application of e-commerce technologies expected to surge in the next three years, IT professionals will have ample opportunities to engage customers.

Internet technologies were almost non-existent in China 20 years ago. In 1994, there were approximately 1,600 Internet users.\(^1\) In contrast, in 2011, there were approximately 513 million users (38.4 percent of the Chinese population),\(^2\) and 356 million of those were mobile Internet users. This represents an exponential growth rate in Internet users over the past decade—from 1.78 percent of the Chinese population in 2001, to 10.52 percent in 2006, to 38.4 percent in 2011. Chinese Internet users currently represent 23 percent of the world’s population of Internet users.\(^2\)

Here, we view this rapid adoption of Internet technologies in China from an innovation diffusion perspective, using the diffusion model to characterize the growth of Internet users, IP addresses, and webpages in China. We also consider the use of Internet applications in China, discussing the economic and social implications and highlighting business opportunities for IT professionals, security experts, and mobile marketers.

Innovation Diffusion

Researchers have been studying the diffusion of innovations for decades.\(^4\) In particular, Everett Rogers has meticulously collected relevant information as part of his rural sociological, medical, communications, and marketing research.\(^4\) He showed that the adoption of innovations exhibits a logistic curve. When an innovation—defined by Rogers as “an idea, practice, or object perceived as new”—is communicated among members of a social group, and nonusers start adopting it, then the diffusion process takes place spontaneously. Internet adoption in China has followed a similar logistic curve and is experiencing such spontaneous diffusion.

In the past, such spontaneous diffusion typically involved interpersonal communication channels or mass media, such as television, radio,
newspapers, and magazines. Now, information technologies such as the Internet and mobile phones are formidable tools of diffusion. Yet the tools themselves—the Internet and mobile phone technologies—are innovations.

Paul DiMaggio and his colleagues, in their work on the growth of Internet users in the US, argued in 2001 that the adoption of the Internet is innovation diffusion. However, they didn’t provide any empirical evidence of such growth in Internet adoption, probably due to the lack of data at that time for the US and other countries.

**Diffusion of Internet Technologies in China**

To provide open information to the public, the China Internet Information Center (CNNIC) publishes a report on the use of Internet technologies in China twice a year. The biannual reports present the demographical details of Internet users. Figure 1 shows the number of Internet users in China from 1998 to 2010 and also in the US between 1990 and 2010. The growth of Internet users in the US indeed follows a logistic curve, nearly reaching the saturation level in the last two years. The fitted logistic function for the US is

$$IU_{Year}^{US} = \frac{249}{1 + e^{-0.38(Year-2000)}}$$

where $IU_{Year}^{US}$ is the number of Internet users (in millions) in the US in a specific year. The correlation between the regenerated data using this equation and the actual data recorded is 0.991.

The number of Internet users in China also closely follows a path of logistic growth. However, the rate of increase reached its maximum in June 2008, so we project that the total number of Internet users in China will be close to 616 million in 2013—approximately 46 percent of China’s population. The fitted logistic function for China (in millions) is

$$IU_{Year}^{China} = \frac{690}{1 + e^{-0.47(Year-2008.5)}}$$

The correlation between the regenerated data using this equation and the actual data is 0.995. While working on this article, the CNNIC released the 29th China Internet Development Statistics Report, saying that the number of Internet users in China was 513 million in 2011, representing merely 1.5 percent less than the value predicted (521 million) using our equation.

Figure 2 shows the number of IP addresses in China for 2002 to 2010. At the end of 2010, the number of IPv4 addresses in China reached 278 million, so researchers have predicted that all available IPv4 spaces will be exhausted in approximately two years.

The correlation between the regenerated data using this equation and the actual data is 0.995. While working on this article, the CNNIC released the 29th China Internet Development Statistics Report, saying that the number of Internet users in China was 513 million in 2011, representing merely 1.5 percent less than the value predicted (521 million) using our equation.
number of IP addresses in China to increase from 278 million in 2010 to 389 million in 2013. The large-scale commercial deployment of IPv6 will begin at the end of 2013.

Figure 3 shows the number of webpages in China for 2003 to 2010. By fitting a logistic function to the number of webpages, we project that the number of webpages in China will increase to 148 billion in 2013.

Figure 4. The number of websites in China. The number of websites dropped from 3.23 million in 2009 to 1.91 million in 2010, owing to control measures carried out by the government.

caused by control measures carried out by the government to achieve better network security and to restructure the network operators in 2010 (we further discuss government censorship later in the article).

Uses of Internet Technologies in China
According to the 27th China Internet Development Statistics Report, the top three most popular uses of the Internet were “search engine,” “Web music,” and “Web news.” The report highlighted that Internet users are increasingly relying on the Internet to search for information, news, and items of interest. An estimated 374 million users actively searched the Internet for information in 2010.

The report also ranked popular applications for 2010, with “instant messaging,” “microblogs,” and “social networking” ranked 4th, 6th, and 9th, respectively. In fact, these applications had growth rates of 29.5, 33, and 33.7 percent, respectively (see Table 1). On average, over 300 million Internet users regularly used these applications in 2010 to establish, maintain, and develop interpersonal relationships with their peers and friends. China’s Internet users obviously used the Internet as a channel to protect their rights, and “instant messaging” and “microblogs” have become the dominant channels for spreading events and news.

Economic Perspectives
With rapid growth in IT applications—in particular, those related to e-commerce and interpersonal communications—China has become fertile ground for IT development. Many domestic companies, including Alibaba, Baidu, Sohu, Taobao, and Tuduo, now rank in the top 75 of Alexa-ranked websites worldwide; Baidu, China’s leading search engine, is ranked 5th globally.

However, the rapid growth of these sites is likely to decrease due to market saturation when China’s Internet users hit 50 percent of the
population, a point currently projected to occur sometime in 2013 (see Figures 1–3). After this point, Chinese Internet companies will need to reach outside the country’s borders in search of further business, while at the same time Western companies will be reaching into China. What challenges will appear during this period of Internet interaction for both Chinese and Western companies?

One factor that both Chinese and Western companies must consider is the difference in access modes by consumers. As noted earlier, over 65 percent of Chinese Internet users access the Internet through mobile devices, such as smartphones or other small-screen, low-power devices. This is in contrast to Western users, who commonly use desktop or laptop computers for the majority of their browsing. This means that Chinese users can find some Western services unsatisfying because of the overly complex style and the requirement to use fixed devices. Chinese companies are well aware that approximately two-thirds of their market consists of mobile users, so they have factored this into their site designs. To deal with the surge of demand in e-banking, online shopping, and e-payments (see Table 1), both Chinese and Western firms must develop specific secure, mobile cloud technologies to cater to these customers’ needs.

In particular, firms will have to overcome the problem of Internet piracy, which is commonplace in China and driven by a combination of social factors (including the resistance to and rejection of control) and pragmatic economic factors (including cost issues and the availability of materials). Nevertheless, the situation has improved, with Chinese computer manufacturers pre-installing authorized operating systems on their computers, and Internet companies in China purchasing the copyright to broadcast videos online.

### Social Perspectives

In addition to the commercial aspects of competition between Chinese and Western firms, let’s look at some of the social issues related to Internet diffusion in China. Such issues include heavy

---

**Table 1. Internet use—the number of users and growth rates.**

<table>
<thead>
<tr>
<th>Category</th>
<th>Users (in millions)</th>
<th>Growth rate (%)</th>
<th>Rank using the number of users in 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E-commerce</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online shopping</td>
<td>108.0</td>
<td>48.6</td>
<td>11</td>
</tr>
<tr>
<td>E-banking</td>
<td>94.1</td>
<td>48.2</td>
<td>13</td>
</tr>
<tr>
<td>Online payment</td>
<td>94.0</td>
<td>45.9</td>
<td>14</td>
</tr>
<tr>
<td>Online stock trading</td>
<td>56.8</td>
<td>24.7</td>
<td>15</td>
</tr>
<tr>
<td>Travel booking</td>
<td>30.2</td>
<td>19.5</td>
<td>17</td>
</tr>
<tr>
<td>Group buying</td>
<td>—</td>
<td>18.8</td>
<td>18</td>
</tr>
<tr>
<td><strong>Social applications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instant messaging</td>
<td>272.3</td>
<td>29.5</td>
<td>4</td>
</tr>
<tr>
<td>Blogs</td>
<td>221.4</td>
<td>33.0</td>
<td>6</td>
</tr>
<tr>
<td>Email</td>
<td>218.0</td>
<td>14.6</td>
<td>8</td>
</tr>
<tr>
<td>Social networking</td>
<td>175.9</td>
<td>33.7</td>
<td>9</td>
</tr>
<tr>
<td>Forum/bulletin board system</td>
<td>117.0</td>
<td>26.5</td>
<td>12</td>
</tr>
<tr>
<td>Microblogs</td>
<td>—</td>
<td>—</td>
<td>16</td>
</tr>
<tr>
<td><strong>Information seeking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search engine</td>
<td>281.3</td>
<td>33.1</td>
<td>1</td>
</tr>
<tr>
<td>Web news</td>
<td>307.7</td>
<td>14.7</td>
<td>3</td>
</tr>
<tr>
<td><strong>Entertainment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web music</td>
<td>320.7</td>
<td>12.9</td>
<td>2</td>
</tr>
<tr>
<td>Online games</td>
<td>264.5</td>
<td>15.0</td>
<td>5</td>
</tr>
<tr>
<td>Web videos</td>
<td>240.0</td>
<td>18.1</td>
<td>7</td>
</tr>
<tr>
<td>Cyberliterature</td>
<td>162.6</td>
<td>19.8</td>
<td>10</td>
</tr>
</tbody>
</table>
Internet use by Chinese youth, content sharing and copyright infringement, and censorship. As Table 1 shows, among the top 10 Internet applications in 2010 were instant messaging, blogging, email, online games, Web music, and Web videos.

One of the largest groups of Internet users in China comprises young users, although this user group has already peaked with the recent entry of other groups. In 2010, nearly 65 percent of Internet users were under age 30. The appeal of the Internet for youth users includes the ability to engage in a collective fashion, follow a particular trend, exchange information relatively freely, and access information and resources that otherwise might be difficult to obtain. Youth users also comprise a major portion of bloggers in China, despite limitations on blogging and freedom of expression. Such users commonly see the Internet as a means of self-expression and self-organization, which are some of the reasons behind its continued use. However, the youthful Internet user group also represents a major factor in the development of Internet entrepreneurship, offering the best opportunity for growth in this market.

Another challenge for both Chinese and Western companies, as well as for Chinese Internet users in general, is the ever-present prospect of censorship. The drastic drop in the number of websites in China from 2009 to 2010 (see Figure 4) can largely be attributed to the Chinese government’s intervention. Its policy of blocking negative information (including information the state considers both morally and politically undesirable) has, so far, been largely successful in reducing the flow of such information into China.

However, the rapid growth of blogging among Chinese students and other Internet users has challenged this blockage, and the entry of Western companies into the Chinese market is expected to further challenge the prevailing censorship structure. Yet according to Rebecca MacKinnon, the simple use of the Internet in China, including entry by Western companies (who have been complacent or even colluded in this censorship), won’t eliminate censorship. Still, the gradual erosion of censorship could be a significant side effect of increased Internet use.

Given the sheer size of the Chinese Internet-using population, it would be impossible for the country to not influence the Internet environment. At the same time, the Internet will influence China as broader economic and social horizons open.

Because the majority of Chinese Internet users access services via mobile devices, organizations must explore secure mobile cloud technologies to enable e-banking, online shopping, and e-payment developments. Also, marketers and public policy makers must listen carefully to Chinese youth—who actively engage in instant messaging, blogging, email, online games, Web music and Web video—to follow the voice of their customers in delivering their products and services.

Acknowledgment

This research was supported by a grant (RP/ESCE-01/2010) from the Macao Polytechnic Institute.

References


Selected CS articles and columns are available for free at http://ComputingNow.computer.org.

IEEE Computer Society

PURPOSE: The IEEE Computer Society is the world’s largest association of computing professionals and is the leading provider of technical information in the field.

MEMBERSHIP: Members receive the monthly magazine Computer, discounts, and opportunities to serve (all activities are led by volunteer members). Membership is open to all IEEE members, affiliate society members, and others interested in the computer field.

COMPUTER SOCIETY WEBSITE: www.computer.org

Next Board Meeting: 5–6 Nov., New Brunswick, NJ, USA

EXECUTIVE COMMITTEE

President: John W. Walk* 

*voting member of the Board of Governors

BOARD OF GOVERNORS

Term Expiring 2012: Elizabeth L. Burd, Thomas M. Conte, Frank E. Ferrante, Jean-Luc Caudiot, Paul K. Joannou, Luis Kun, James W. Moore, William (Bill) Pitts

Term Expiring 2013: Pierre Bourque, Dennis J. Frailey, Atsuhiro Goto, Andre Ivanov, Dejan S. Milojicic, Paolo Montuschi, Jane Chu Prey, Charlene (Chuck) Walrad

EXECUTIVE STAFF

Executive Director: Angela R. Burgess; Associate Executive Director, Director, Governance; Anne Marie Kelly; Director, Finance & Accounting: John Miller; Director, Information Technology & Services: Ray Kahn; Director, Membership Development: Violet S. Doan; Director, Products & Services: Evan Butlerfield; Director, Sales & Marketing: Chris Jensen

COMPUTER SOCIETY OFFICES

Washington, D.C.: 2001 L St., Ste. 700, Washington, D.C. 20036-4928 Phone: +1 202 371 0101 • Fax: +1 202 728 9614 Email: hq.ofc@computer.org
Los Alamitos: 10662 Los Vaqueros Circle, Los Alamitos, CA 90720-1314 Phone: +1 714 821 8380 • Email: help@computer.org

MEMBERSHIP & PUBLICATION ORDERS

Phone: +1 800 272 6657 • Fax: +1 714 821 4641 • Email: help@computer.org
Asia/Pacific: Watanabe Building, 1-4-2 Minami-Aoyama, Minato-ku, Tokyo 107-0062, Japan Phone: +81 3 3408 3118 • Fax: +81 3 3408 3553 Email: tokyo.ofc@computer.org

IEEE OFFICERS

President: Gordon W. Day; President-Elect: Peter W. Staecker; Past President: Moshe Kam; Secretary: Celia L. Desmond; Treasurer: Harold L. Flescher; President, Standards Association Board of Governors: Steven M. Mills; VP, Educational Activities: Michael R. Lightner; VP, Membership & Geographic Activities: Howard E. Michel; VP, Publication Services & Products: David A. Hodges; VP, Technical Activities: Frederick C. Mintzer; IEEE Division V Director: James W. Moore, CSDP; IEEE Division VIII Director: Susan K. (Kathy) Land, CSDP; IEEE Division VIII Director-Elect: Roger U. Fuji; President, IEEE-USA: James M. Howard

revised 22 May 2012

IEEE

computer.org/ITPro