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In this issue:

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Worldwide Internet Usages and Online Multi-Linguistic Population Comparison Study

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Abstract

The Internet plays an important role in the globalization of business, which is changing traditional business practice; meanwhile, the worldwide Internet users have undergone a dramatic increase in the past few years. This study analyzes and compares the worldwide Internet users and global online multi-linguistic populations using a panel in top 15 countries with the most Internet users and a penal with 11 online linguistic populations, respectively. Index and growth rates are used to analyze and compare the current patterns on Internet usages and online multi-linguistic populations. Time series forecasting analysis is used to predict the future trends on Internet users across countries and online multi-linguistic populations. Specifically, S-curve and quadratic forecasting models are used to predict the future trends. The current research provides a large picture on the current and future international Internet industry and market trends. The results from the current paper can help people who are interested in global Internet business to better understand international Internet market, and help people to better understand the design of global multi-linguistic websites in order to conduct global business.

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1. INTRODUCTION

Internet is the most important new communications system during the second half of the twentieth century. The Internet users is estimated to be greater than 50% annually: a level of growth that is fabulous. The volume of Internet traffic continues to double about every 100 days (Computer Industry Almanac Inc., 2002). However, the level of take-up that is still available to the expansion of the Internet: 95% of the global population still does not have any access to it. Like the number of Internet users is surging, the number of Internet Websites is increasing dramatically as well. It is estimated that the number of Websites on the Internet worldwide will reach 200 million at the end of 2005 (Essinger, 2001).

The worldwide Internet growth rate has undergone a dramatic increase in the past three years. Two key factors, which have led to this tremendous rise, is Internet technology development including expanded bandwidth, increased speeds and reliability, and reduced Internet surfing charges (Global Reach, 2003). With the proliferation of faster access speeds and affordable high-performance PCs, Web users have found that it is very easy to download and install a wide range of Internet application. Internet applications include instant messaging applications, media players, ISP applications (non-browsing), wireless content systems, chat, web phones, news and information toolbars, downloading software and games, connected games, weather applications, auction assistants, and shopping assistants. Web users need an accurate picture of how consumers use Internet applications

provides marketers with a versatile tool for developing a marketing campaign with impact. Therefore, it is important to provide the most accurate and comprehensive analysis of online usages (Essinger, 2001).

With the Internet replacing the traditional style of doing business, the globalization of business is a factor changing traditional business practice. Since people always access media in their own language, and marketing always takes place in the language of a country, not only in English, internationalizing a website in multiple languages is a future trend. The major factor for success in international e-commerce is to speak the customer's language. Europeans and Asians have used multiple languages for centuries when selling to one another, recognizing that marketing occurs in the language of the target market. By the end of 2002, 80% of European based corporate sites are multi-lingual. However, the number of U.S. based multi-lingual Websites available is limited. Non-English speakers are the fastest growing group of new Internet users, and so far there are 80% of what is available on the Internet is in English. There is a big world outside of English-speaking countries, and if companies do not translate their Website, they pave the way for aggressive competition for international business from other countries (Wallraff, 2000).

Panagariyta (2000) asserts that in the long run developing countries may benefit more from e-commerce than developed countries. In the recent three years, the Internet usages in developing countries such as China grow faster than those in developed countries such as U.S. A comparison study of the different e-commerce characteristics and trends between the U.S. and China is made by Bin, Chen and Sun (2003). This study also provides insights as to how language barriers can be alleviated in order to enhance e-commerce growth.

Singh et al (2001) pointed out the premise that an insufficient number of Web sites in multiple languages is negatively affecting e-commerce in Europe. Lo and Everett (2001) describe the historical factors involved with e-commerce and the specific relationship between e-commerce strategic factors and potential e-commerce growth. by Haley (2002) analyzed the effect of how the economic infrastructure will integrate with the growing e-commerce.

1.1 Problems

The estimate and forecasting of Internet users for many countries help Internet marketers make better marketing decisions by increasing visibility into Internet buying and selling decisions by identifying target audiences; evaluating business development and marketing opportunities for stand-alone and cross comparisons of Internet applications and Web-based traffic; and by gaining detailed insights on Internet behavior to perform effective competitive analysis. However, to make an estimate and forecast of Internet users for many countries are a daunting task (Computer Industry Almanac Inc., 2003; Global Reach, 2003). Ideally such estimating and forecasting would be based on data from comprehensive and identical surveys in every country and such survey would have been conducted on a regular basis over many years. However, such data does not exist and will not be available for a long time since such surveys are too expensive to do for a single organization. There is a variety of survey data from many different organizations. These surveys use different methodologies, which are mainly done in the major countries. Since some surveys are excellent, some fair, and a few misleading, this results in conflicting survey data and requiring effort and knowledge to determine the quality of information and data.

1.2 Objectives

A key objective of this paper was to analyze global online usage patterns by providing accurate and comprehensive information on Internet usage estimates and forecasting to help people understand online consumer behavior and trends. The global Internet usage forecasting helps people who are interested in global Internet business to better understand global Internet market, and to give them a large picture of international Internet industry and market. This analysis provides insights with respect to future Internet commerce worldwide by providing a better understanding of projected worldwide growth in the global Internet market. The online multi-linguistic

populations trend analysis and guidance with regard to the design of multi-linguistic Website of multi-lingual web pages and sites helps web based international business and global e-commerce. The time series forecasting can also be instrumental in helping to spot problems in e-commerce growth and in finding out where the difficulties originate.

Moreover, the Internet usage trend analysis could help telecommunications and networks sectors to estimate and forecast the Internet traffic, access speed, and Internet devices including high performance PCs to improve Internet performance. This study also provides an open environment for researchers to analyze the estimates and forecasting results, and share this information with interested parties including various individuals and groups in the academic, research, and industrial community, such as informational technology professionals, network and telecommunication analyst, Web designers, Internet analyst, and decision makers (executives and mangers) in companies etc.

2. METHODOLOGY

This study projects and analyzes the global Internet users across the world, using a panel in top 15 countries with the most Internet users from 1997 to 2002. Online population across languages is also conducted using a panel in 11 online languages from 1997 to 2002. Data for this study of the top 15 countries with most Internet users was extracted from the press releases of Computer Industry Almanac Inc. These press releases are provided in the Website http://www.c-i-a.com/pr_info.htm. Founded in 1986, Computer Industry Almanac Inc. is a most important resource that serves as a roadmap to the Internet Industry (Computer Industry Almanac Inc., 2003).

Since people speaking the same language form their own online community no matter what country they happen to live in, languages are also classified in addition to countries. Data for this study of the number of people online in each language zone (native speakers) was extracted from the Website belonging to the Global Reach organization. The complete data set for the 6-year period can be downloaded from

http://www.global-reach.biz/globstats/evol.html

Founded in 1981, Global Reach brings international marketing to the Web to attract Internet users to a Website on a country-specific basis. Global Reach has been building traffic to client Web sites since 1996, and served clients from a team of top online marketing specialists in 11 countries. The objective is to drive Web traffic from other countries, to make online businesses successful on a global scale, and assure a truly global approach to Web promotion in each language.

An Internet user in the current research is defined as being over 16 years old and uses the Internet on a regular or occasional basis. This includes adult Internet users with weekly usage in businesses and homes. The Internet population analysis for countries was based on the data set from top 15 countries with the most Internet users from 1997 to 2002. Table 1 illustrated Internet usages, shares of worldwide Internet usages, and ranks of these top 15 countries for each of these six years.

In Table 1, there are total twenty countries that are included once or more than once in the top 15 countries with the most Internet users from 1997 to 2002. These twenty countries include USA, Japan, United Kingdom, Canada, Germany, Australia, Netherlands, Sweden, Finland, France, Norway, Spain, Brazil, Italy, Switzerland, Taiwan, South Korea, China, Russia, and India, which account for 89.79%, 90.21%, 85.02%, 77.64%, 74.74%, and 74.48% of the worldwide Internet users from 1997 to 2002, respectively. Since some countries in the top 15 countries with the most Internet users for one year and might not be in the other year, for example, Norway is ranked 11 of the top 15 countries in 1997 accounting for 1.01% of the worldwide Internet users, while not in 1998-2002; Finland is ranked 9 in 1997 for 1.25% and ranked 15 in 1998 for 1.02%; Brazil is ranked 13 in 1997 for 0.86%, ranked 7 in 1999 for 2.62%, and ranked 11 in 2002 for 2.38%; Switzerland is ranked 15 in 1997 for 0.77%; Russia is ranked 11 in 2000 for

Table 1. Internet Users for Top 15 Countries with the Most Users 1997 to 2002.
Internet Usage (Million), Share of Worldwide Internet Usage (%), and Ranks

Country	End of 1997	End of 1998	End of 1999	End of 2000	End of 2001	End of 2002
U.S.	54.68 54.70% 1	90.00 49.51% 1	110.83 42.79% 1	134.60 32.54% 1	142.82 26.80% 1	160.70 24.13% 1
Japan	7.97 7.97% 2	13.50 7.43% 2	18.16 7.01% 2	33.90 8.19% 2	55.93 10.49% 2	64.80 9.73% 2
U.K.	5.83 5.83% 3	9.85 5.42% 3	13.98 5.40% 3	16.80 4.06% 6	24.00 4.50% 6	27.15 4.08% 5
Canada	4.33 4.33% 4	8.00 4.40% 5	13.28 5.13% 4	15.40 3.72% 7	13.5 2.53% 9	17.83 2.68% 8
Germany	4.06 4.06% 5	10.50 5.78% 4	13.29 5.13% 5	19.90 4.81% 4	30.8 5.64% 4	30.35 4.56% 4
Australia	3.35 3.35% 6	5.50 3.03% 6	6.84 2.64% 6	7.60 1.84% 10	7.20 1.35% 13	10.45 1.57% 13
Nether lands	1.39 1.39% 7	3.25 1.79% 8	2.93 1.13% 14	5.50 1.33% 14	7.90 1.48% 10	9.73 1.46%
Sweden	1.31 1.31% 8	3.25 1.79% 8	3.95 1.53% 13	4.40 1.06% 15	4.60 0.86% 15	6.10 0.92%
Finland	1.25 1.25% 9	1.85 1.02% 15	N/A	N/A	N/A	N/A
France	1.18 1.18% 10	3.90 2.15% 7	5.70 2.20% 9	9.00 2.18% 9	15.65 2.94% 8	16.65 2.50% 9
Norway	1.01 1.01% 11	N/A	N/A	N/A	N/A	N/A
Spain	0.92 0.92% 12	2.65 1.46% 13	2.91 1.12% 15	5.60 1.35% 13	7.39 1.39% 12	10.39 1.56% 14
Brazil	0.86 0.86% 13	N/A	6.79 2.62% 7	N/A	N/A	15.84 2.38% 11
Italy	0.84 0.84% 14	2.75 1.51% 12	4.75 1.83% 12	12.50 3.02% 8	16.40 3.08% 7	20.85 3.13% 7
Switzer land	0.77 0.77% 15	N/A	N/A	N/A	N/A	N/A
Taiwan	1.66 1.66%	3.25 1.79% 8	4.79 1.85% 11	7.00 1.69% 12	7.82 1.47% 11	9.51 1.43% 15
South Korea	2.50 2.50%	3.25 1.79% 8	5.69 2.20% 10	19.00 4.59% 5	24.38 4.57% 5	26.90 4.04% 6
China	0.62 0.62%	2.50 1.38% 14	6.31 2.44% 8	22.50 5.44% 3	33.70 6.32% 3	54.50 8.18% 3
Russia	N/A	N/A	N/A	7.50 1.81% 11	N/A	13.50 2.03% 12
India	N/A	N/A	N/A	N/A	7.00 1.31% 14	16.58 2.49% 10
Top 15 Countries	89.75 89.79%	164.00 90.21%	220.20 85.02%	321.20 77.64%	389.37 74.74%	496.00 74.48%
Worldwide	99.96	181.79	259.00	413.70	533.00	665.91

1.81% and ranked 12 in 2002 for 2.03%; and India is ranked 14 in 2001 for 1.31% and ranked 10 in 2002 for 2.49%, these six countries will not be discussed in the current

Table 2. Internet Users Indices

Country	Internet Users Indices (End of Year)					
	97	98	99	00	01	02
U.S.	100	165	203	246	261	294
Japan	100	169	228	425	702	813
U.K.	100	169	240	288	412	466
Canada	100	185	307	356	312	412
Germany	100	259	327	490	741	748
Australia	100	164	204	227	215	312
Netherlands	100	234	211	396	568	700
Sweden	100	248	302	336	351	466
France	100	331	483	763	1326	1411
Spain	100	288	316	609	803	1129
Italy	100	327	565	1488	1952	2482
Taiwan	100	196	289	422	471	573
South Korea	100	130	228	760	975	1076
China	100	403	1018	3629	5435	8790
Average	100	233	352	745	1037	1405

study since the Internet users in these countries only account for a very small percentage of the worldwide Internet users. Therefore, there are total 14 countries, including USA, Japan, United Kingdom, Canada, Germany, Australia, Netherlands, Sweden, France, Spain, Italy, Taiwan, South Korea, and China will be discussed in this paper. The Internet population analysis for languages was based on data of eleven languages from 1997 to 2002. These eleven languages are English, Japanese, German, French, Scandinavian, Spanish, Italian, Chinese, Dutch, Korean, and Portuguese.

An index was used for assessing the long-term behavior of the data set since this mathematical tool allows the use of a base year for assessing longitudinal changes. In this study, the base year selected was 1997, if the data is available that year. In some countries, the data was only available in 1998 so that was selected as the base year for those countries. Percentages were used to evaluate the short-term behavior that is inherent in the data set. Major fluctuations between immediate periods observed can easily be detected using this simple mathematical tool. Analysis of Variance (ANOVA) was used to test for differences in the average annual indices as well as the percent of change between immediate periods. Based on the results obtained from analyzing the indices and the average percentages between years, the ANOVA tests were performed to determine if the differences were statistically significant.

Time series analysis techniques are utilized in order to analyze Internet-user populations for top 15 countries with most Internet users and multi-linguistic online populations for 11 online languages. Because all data sets have an increasing trend, four time series models are used to analyze data. These are the Linear Trend Model, the Quadratic Trend Model, the Exponential Trend Model, and the S-Curve Trend Model (Yaffee, 2000).

3. FINDINGS

This section discussed the findings of the existing global trends analysis of Internet growth rates across countries and languages from 1997 to 2002. Growth rate is defined as the percentage of the differences between Internet users of the current year and these of the previous year divided by the Internet users of the previous year. Findings on time series forecasting analysis of global Internet users by countries and languages from 2003 to 2005 are also discussed.

3.1 Internet Users Growth Analysis Across Countries

The Internet users indices in 14 countries from the period 1997 through 2002 are presented in Table 2. With the exception of Canada and Australia in the year 2001 and Netherlands in the year 1999 that showed a decrease in Internet users, all the Internet users showed a stable or continuous upward movement. Other major trends that can be identified in Table 2 are:

Table 3. Growth Rate of Internet Users

Country	Growth Rate of Internet Users (%) (End of Year)					
	98-97	99-98	00-99	01-00	02-01	Avg
U.S.	64.6	23.1	21.4	6.1	12.5	25.56
Japan	69.4	34.5	86.7	65.0	15.9	54.28
U.K.	69.0	41.9	20.2	42.9	13.1	37.41
Canada	84.8	66.0	16.0	-12.3	32.1	37.29
Germany	158.6	26.6	49.7	51.2	0.9	57.40
Australia	64.2	24.4	11.1	-5.3	45.1	27.91
Netherlands	133.8	-9.8	87.7	43.6	23.2	55.70
Sweden	148.1	21.5	11.4	4.5	32.6	43.64
France	230.5	46.2	57.9	73.9	6.4	82.97
Spain	188.0	9.8	92.4	32.0	40.6	72.57
Italy	227.4	72.7	163.2	31.2	27.1	104.32
Taiwan	95.8	47.4	46.1	11.7	21.6	44.53
South Korea	30.0	75.1	233.9	28.3	10.3	75.53
China	303.2	152.4	256.6	49.8	61.7	164.74
Average	133.39	45.13	82.45	30.19	24.51	63.13

- At the end of year 2002, China showed the largest index (8790) from the base year. The lowest index (294) was found in the U.S.; in other words, the Internet populations in China grew the fastest and that in U.S. the lowest.

- Within each respective year, some of the countries exhibited similar indices. However, the range between the highest and lowest indices can be rather large. Compared to the yearly average, many of the indices are not even within the plus and minus 100 range.

- Among the different countries, some of the annual indices are similar. Again, there were also wide variations in the indices among those that were different.

- Three countries had ending indices at the end of 2002 that exceeded the computed average Internet user growth index of 1405 for 14 countries. These countries and their indices for the period examined were China, 8790; Italy, 2482; and France, 1411. Two countries had indices close to the average compute Internet user growth index. These countries and their indices were Spain, 1129; and South Korea, 1076. All the other 9 countries lag behind the computed average growth index. Their countries and indices were U.S., 294; Japan, 813; U.K., 466; Canada, 412; Germany, 748; Australia, 312; Netherlands, 700; Sweden, 466; and Taiwan, 573.

Growth rates of Internet users in 14 countries with the most Internet users are presented in Table 3. Using growth rates, the magnitude of the increases provided some additional insight into the behavior of the indices explained earlier. Again, it is important to note that every country showed an increase in Internet usage with the exception of Canada and Australia of 2000 - 2001 period, and Netherlands of 1998 to 1999 period. Some of the other principal outcomes are:

- The period 1997 to 1998 appeared to be the best year for Internet user increases. The average percent growth of all the countries was found to be 133.39%, the highest of the six years examined. Much of this raise went to Germany, Netherlands, Sweden, France, Spain, Italy, and China. These are the countries that received a more than the computed average percent Internet user growth during the period 1997 to 1998. All the growth rates obtained during this period 1997 to 1998 were greater than the computed average percent Internet user increases of 63.13% awarded to the respective countries during the six-year period, except South Korea.

- In any given year, a very small number of countries showed similar percent growth patterns. However, the range between the highest and lowest percent is also rather large. Compared to the yearly average, many of the percentages are also not within the plus and minus 10 range.

Table 4. Online Linguistic Populations Indices

Language	Online Linguistic Populations Indices (End of Year)					
	1997	1998	1999	2000	2001	2002
English	100	126	206	267	321	325
Japanese	100	129	286	557	686	871
German	100	150	350	550	925	1075
French	100	150	500	850	900	1150
Scandinavian	100	150	400	450	550	800
Spanish	100	200	1300	2100	3500	5000
Italian	100	200	1000	1200	2000	2400
Chinese	100	200	1000	3100	4800	7800
Dutch	100	200	600	700	1100	1300
Korean	N/A	100	500	1700	2500	2800
Portuguese	N/A	100	400	1100	1400	1900
Average	100	189	727	1397	2076	2825

- Among the different countries, a very small number of the annual percentages are similar. However, there are also wide variations in the percentages among the countries.

- Using the annual average computed to gauge the changes, the percentage growth patterns do not fit a constant pattern. In some years, the respective country percentages were growing faster than its annual average. In other words, their respective Internet user growth was bigger in some years and less in others.

Analysis of Variance (ANOVA) tests were conducted on these Internet users indices and the growth rates. Using a 2-tailed test, the outcomes as indicated by the p-values were statistically significant at the 0.000 levels. In other words, all the countries Internet usages exhibit different rates of change as measured using the indices and amount of change as assessed by the percent of change each year. Therefore, the Internet populations' growth patterns of these countries are significantly different.

3.2 Internet Users Growth Analysis Across Languages

The online linguistic populations data from Global Reach (2003) are not meant to represent the number of people who speak the languages in question. They correspond to the number of people online in each language (i.e. native speakers).

The online linguistic population indices from the period 1997 through 2002 are presented in Table 4. All the online users showed a stable or continuous upward movement. After 1998, every online linguistic population is showing a large increase than the previous year. Other major trends that can be identified in Table 4 are:

- In the year 2002, online Chinese-speaking population showed the largest index (7800) from the base year. The lowest index (325) was found of online English-speaking population. In other words, online Chinese-speaking population grew the fastest and English-speaking the slowest.

- Within each respective year, some of the online populations exhibited similar indices. However, the range between the highest and lowest indices can be rather large. Compared to the yearly average, many of the indices are not even within the plus and minus 20 range.

- Among the different online populations, some of the annual indices are similar. Again, there were also wide variations in the indices among those that were different.

- Two online populations had ending indices that exceeded the computed average population growth index of 2825 in 2002. These are online Chinese and Spanish-speaking populations. In 2002, the growth index of online Korean-speaking population (2800) closely matched the average computed for all the online population listed. Seven online population growth index lag behind the computed average growth index

Table 5. Growth Rate of Online Linguistic Populations

Language	Growth Rate of Online Linguistic Populations (%) (End of Year)					
	98 - 97	99 - 98	00 - 99	01 - 00	02 - 01	Avg
English	26.39	62.64	29.73	20.31	1.30	28.07
Japanese	28.57	122.22	95.00	23.08	27.08	59.19
German	50.00	133.33	57.14	68.18	16.22	64.97
French	50.00	233.33	70.00	5.88	27.78	77.40
Scandinavian	50.00	166.67	12.50	22.22	45.45	59.37
Spanish	100.00	550.00	61.54	66.67	42.86	164.21
Italian	100.00	400.00	20.00	66.67	20.00	121.33
Chinese	100.00	400.00	210.00	54.84	62.50	165.47
Dutch	100.00	200.00	16.67	57.14	18.18	78.40
Korean	N/A	400.00	240.00	47.06	12.00	139.81
Portuguese	N/A	300.00	175.00	27.27	35.71	107.60
Average	67.22	269.84	89.78	41.76	28.10	96.89

in 2002. These languages and their indices for the period examined were English, 325; Japanese, 871; German, 1075; French, 1150; Scandinavian, 800; Italian, 2400; Dutch, 1300; and Portuguese, 1900.

Online linguistic populations growth rate are presented in Table 5. Using growth rates, the magnitude of the increases provided some additional insight into the behavior of the indices explained earlier. Again, it is important to note that every online linguistic populations showed an increase since 1997, since all the computed growth rates came out positive. Some of the other principal outcomes are:

- The period 1998 to 1999 appeared to be the best year for online linguistic populations increases. First, the average percentage growth of all the online linguistic populations was found to be 269.84%, the highest of online linguistic populations percentage increase between years examined in the six years. Much of this raise went to the Spanish, Italian, Chinese, and Korean-speaking populations. Second, all the online linguistic population raises obtained during this period were greater than the computed average percent raise awarded to the respective language during the six-year period. Third, all the online linguistic populations percentage raise between 1998 to 1999 were greater than the computed overall average percent raise 96.89% except online English-speaking population percentage increases.

- In any given year, a very small number of online linguistic populations showed similar percent growth patterns. However, the range between the highest and lowest percent is also rather large. Compared to the yearly average, many of the percentages are also not within the plus and minus 10 range.

- Among the different online linguistic populations, a very small number of the annual percentages are similar. However, there are also wide variations in the percentages among the different online linguistic populations.
- Using the annual average computed to gauge the changes, the percentage growth patterns do not fit a constant pattern. In some years, the respective online linguistic population percentages between years were growing faster than its annual average. In other words, their respective online linguistic population growth was bigger in some years and less in others.

Analysis of Variance (ANOVA) tests were conducted on the online linguistic population indices and the growth rates for the six-year period. Using a 2-tailed test, the outcomes as indicated by the p-values were statistically significant at the 0.000 levels. In other words, all the languages were found to exhibit different rates of change as measured using the indices and amount of change as assessed by the percent of change each year. Therefore, the online linguistic population growth patterns are significantly different.

Table 6. Time Series Analysis for Internet Users Across Countries

Country	Time Series Model: Yt =	MAPE	MAD	MSD
U.S.	21.4320 + 37.5573*t - 2.4579*t**2	2.4540	2.6522	8.4988
Japan	4.0220 + 1.4326*t + 1.5389*t**2	9.2172	2.5683	11.1945
UK	2.4030 + 3.3479*t + 0.1416*t**2	3.2341	0.5870	0.6035
Canada	-0.7920 + 5.6381*t - 0.4540*t**2	8.3780	1.0936	1.7670
Germany	-1.8650 + 5.7841*t - 2.30E-02*t**2	8.3261	1.5511	3.5837
Australia	2.4440 + 1.3642*t - 2.61E-02*t**2	9.5070	0.6151	0.5417
Netherlands	1.0830 + 0.3222*t + 0.1917*t**2	12.5405	0.4116	0.2563
Sweden	0.3900 + 1.3379*t - 0.0750*t**2	11.5511	0.3629	0.1555
France	(10**2)/(4.1790 + 158.1960*(0.4460**(t-1)))	11.7748	0.8554	1.0823
Spain	0.6290 + 0.2773*t + 0.2227*t**2	12.0380	0.3187	0.1361
Italy	(10**2)/(3.9231 + 282.2600*(0.3791**(t-1)))	8.99159	0.581738	0.919979
Taiwan	-0.2420 + 1.8738*t - 0.0425*t**2	3.4747	0.1790	0.0498
South Korea	-2.8150 + 3.1009*t + 0.3680*t**2	38.7146	2.6195	7.6793
China	2.7960 - 4.6860*t + 2.2171*t**2	18.2927	1.1590	2.6409
Worldwide	(10**4)/(10.2410 + 153.7890*(0.5607**(t-1)))	3.0298	7.3673	106.1840

Table 7. Time Series Forecasting Values of Internet Users from End of 2003 to 2005

Country	Forecasting Values (Million)		
	03	04	05
U.S.	163.8960	166.5848	170.3578
Japan	89.4563	113.9724	141.5663
U.K.	32.7767	38.2486	44.0037
Canada	16.4287	15.2568	17.1769
Germany	37.4967	42.9358	48.3289
Australia	10.7145	11.6872	12.6077
Netherlands	12.7317	15.9294	19.5105
Sweden	6.0803	6.2932	6.3561
France	18.4362	21.1224	22.5903
Spain	13.4824	17.1002	21.1634
Italy	21.0042	23.5808	24.7310
Taiwan	10.7921	12.0284	13.1797
South Korea	36.9233	45.5442	54.9011
China	78.6319	107.2024	140.2071
Worldwide	665.7928	773.9693	851.5461

3.3 Internet Users Forecasting Across Countries

Time series analyses techniques are utilized in predicting Internet users trends. Because all data sets have an increasing trend, four time series models are used to analyze data. These are the Linear Trend Model, the Quadratic Trend Model, the Exponential Trend Model, and the S-Curve Trend Model. The results show that the Quadratic Trend Model and the S-Curve Trend Model have better fits than the other two models based on the comparison study for Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD), and Mean Squared Deviation (MSD) values (Yaffee, 2000). The best model from time series study for each country and its MAPE, MAD and MSD values are presented in Table 6. The best model for each country Internet users as well as the worldwide Internet users are selected from one of the Quadratic Trend Model and S-Curve Trend Model based on MAD, MSD, and MAPE values; therefore, projects either quadratic or S-curve growth of Internet users. The residual analysis from the best model for each country shows that there are random patterns.

In Table 7, the forecasting values of Internet users from 2003 to 2005 are calculated based on the best time series models shown in Table 6. From Table 7, some trends can be identified that:

- The Internet user grow rate is slow in the developed countries as much of the industrialized world is approaching the top of the S-curve. Specifically, U.S. Internet market users and several other countries Internet users will be maturing as the other countries are still in the growth phase of this market. There are two classes can be identified based on Internet users forecasting value trends from 2003 to 2005. The first is the maturing class that showed very small varieties on Internet users from 2003 to 2005, including U.S., Canada, Italy, Australia, Taiwan, and Sweden. The second is the increasing class that showed large increasing trends from 2003 to 2005, including Japan, China, Germany, U.K., South Korea, France, Spain, and Netherlands.

- U.S. will remain the leading country for Internet users until at least 2005 with above 160 million. Japan is growing faster than

Table 8. Time Series Analysis for Online Linguistic Population

Language	Fitted Trend Equation Yt =	MAPE	MAD	MSD
English	(10**3)/(3.7093 + 22.6537*(0.5103**(t-1)))	5.3557	5.9458	54.1142
Spanish	2 - 3.8214*t + 1.5357*t**2	30.8735	0.8980	1.3674
Japanese	(10**3)/(13.3399 + 334.4730*(0.4641**(t-1)))	15.7601	1.7312	4.5230
German	(10**3)/(15.6305 + 555.7390*(0.4713**(t-1)))	17.9994	1.2902	2.4242
French	(10**2)/(4.6609 + 191.5560*(0.2978**(t-1)))	16.4261	1.0427	1.5416
Chinese	9.1429 - 11.1548*t + 2.9881*t**2	47.8620	1.6191	3.3810
Scandinavian	1 + 0.2619*t + 0.2619*t**2	17.8945	0.7755	0.8708
Italian	-1.8571 + 0.6667*t + 0.4524*t**2	29.5470	1.2177	1.9116
Dutch	-1.4286 + 0.9524*t + 0.1667*t**2	15.5562	0.5646	0.4014
Korean	-1.1429 - 0.9286*t + 0.7857*t**2	62.1954	2.2449	6.2041
Portuguese	-4.3E-01 - 0.7024*t + 0.5119*t**2	31.1696	0.8503	1.095
Non-English Total	20.1429 - 14.2857*t + 10.2143*t**2	16.0934	7.4694	82.9184
Total	13.4286 + 25.6310*t + 9.2738*t**2	7.4747	17.8231	375.2180

U.S. and will be a close second by 2005 with 142 million. China is growing even faster and will have nearly 140 million Internet users by 2005, which is expected to be close to Japan. Other countries and their respective Internet users at the end of 2005 are Germany, 48; U.K., 44; South Korea, 55; Italy, 25; Canada, 13; France, 23; Australia, 13; Spain, 21; Taiwan, 13; Netherlands, 20; and Sweden, 6 million.

- The number of worldwide Internet users surpassed 665 million in 2003 and will continue to grow in the next years. By the end of year 2005, the worldwide number of Internet users will top 852 million.

3.4 Internet Users Forecasting Across Languages

The online linguistic Internet populations forecasting are based on reports from Global Reach (2003). Since all data sets have an increasing trend, four time series models are used to analyze data. The results show that the Quadratic Trend Model and the S-Curve Trend Model have better fits than the Linear Trend Model and the Exponential Trend Model based on the comparison study for MAPE, MAD, and MSD values (Yaffee, 2000). The best model from time series study for each online linguistic population and its MAPE, MAD and MSD values are presented in Table 8. The best model for each online linguistic population is selected from one of the Quadratic Trend Model and S-Curve Trend Model based on MAD, MSD, and MAPE values; therefore, projects either quadratic or S-curve growth of online linguistic populations. The residual analysis from the best model for each online linguistic population shows that there are random patterns.

In Table 9, the forecasting values of online linguistic populations from 2003 to 2005 are provided based on the best time series models shown in Table 8. From Table 9, some trends can be identified that:

- The online linguistic populations grow rate is slow in some languages with approaching the top of the S-curve. Specifically, online English-speaking population and several other online linguistic populations will be maturing as the other online linguistic populations are still in the growth phase of this market. There are two classes can be identified based on online linguistic populations forecasting value trends from 2003 to 2005. The first is the maturing class that showed very small varieties on online linguistic populations from 2003 to 2005, including English, Japanese, German, Korean, Italian, French, Portuguese, Scandinavian, and Dutch. The second is the increasing class that showed large increasing trends on online linguistic populations from 2003 to 2005, including Chinese, and Spanish.

- Online English-speaking population will remain the leading until at least 2005 with above 262 million. Online Chinese-speaking

Table 9. Time Series Forecasting for Online Linguistic Populations from 2003 to 2005

Language	Online Linguistic Populations (Million) (End of Year)		
	2003	2004	2005
English	243.3487	255.5300	262.2283
Spanish	50.4995	69.7136	91.9991
Japanese	59.9446	67.1546	71.1249
German	46.0383	54.0512	58.8812
French	20.8572	21.2735	21.4007
Chinese	77.4762	111.1429	150.7858
Scandinavian	15.6664	19.8568	24.5710
Italian	24.9774	32.4301	40.7876
Dutch	13.4065	16.8594	20.6457
Korean	30.8562	41.7131	54.1414
Portuguese	19.7363	26.7124	34.7123
Non-English Total	420.6437	559.5725	718.9299
Total	647.2618	811.9998	995.2854

population is growing faster than all of the other online linguistic populations and will be a second by 2005 with a close to 151 million. Online Spanish-speaking populations is growing the second fastest among other online linguistic populations, only slower than online Chinese-speaking population, and will have be ranked 3 with nearly 92 million Internet users by 2005. Other languages and their respective online linguistic population estimates at the end of 2005 are Japanese, 71; German, 59; Korean, 54; Italian, 41; French, 21; Portuguese, 35; Scandinavian, 25; and Dutch, 21 million.

- The number of total online linguistic populations surpassed 647 million in 2003 and will continue to grow in the next years. By the end of year 2005, the worldwide number of Internet users will top 995 million, however, the yearly growth rates of total online linguistic populations will remain below 20% from now on. Most of this growth is coming from online Chinese and Spanish-speaking populations.

- The online English-speaking populations will increase to 243 million in 2003 and continue grow to 262 million by the end of 2005, with an increase of 19 million (262-243). The number of total Non-English-speaking populations surpassed 420 million in 2003 and will continue to grow in the next years. By the end of year 2005, the total non-English-speaking population will top 719 million with an increase of 299 million (719-420). Most contributions come from online Chinese-speaking with 74 million (151-77), and online Spanish-speaking with 42 million (92-50) among all these 10 online non-English-speaking users.

4. CONCLUSIONS AND IMPLICATIONS

This study provides comprehensive global Internet usages trend analysis and forecasting across countries and languages with historical research for the last 6 years. The Internet usage analysis in this study provides a view of Internet behavior as a whole by illustrating not only the current scale of the take-up of the Internet but also the likely future growth. Specifically, there are two major findings:

First, Internet users showed a stable or continuous upward movement since 1997. China ranked top three with the highest growth rate among all countries at the end of 2002. It is forecasted that at the end of 2005, the countries with top 3 most Internet users that has more than 140 million Internet users are U.S. (173 million), Japan (141 million), and China (140 million). All the other 11 countries have less than 50 million Internet users at the end of 2005.

The Internet users growth trend patterns discovered in this research show that internationally, the international market will be especially crucial for conducting effective e-business in countries for higher forecasted Internet users not only in developed countries such as US and Japan, but also in developing countries such as China. Developing countries such as China will play an important role in future global Internet e-

commerce. Moreover, the future global communications and networks sectors need to estimate and forecast the Internet traffic, access speed, and Internet devices including high performance PCs with an emphasis on developing countries such as China to improve global Internet performance.

Second, online linguistic populations showed a stable or continuous upward movement since 1997, and each online linguistic population is showing a large increase than that in the previous year since 1999. English-speaking populations have an overwhelming lead in online linguistic populations between 1997 and 1999. However, shares of online English-speaking populations are dropping rapidly to 37% by the end of 2002, since non-English-speaking countries are adopting the Internet technology. Internet technology reaches the mature phase in English speaking countries such as U.S. It is forecasted that at the end of 2005, the languages with top 4 most online linguistic populations are English (262 million), Chinese (150 million), Spanish (92 million), and Japanese (71 million). The online multi-linguistic populations figures show that internationally, the designing of Web sites in languages with high online linguistic population and growth rates will be especially crucial for conducting effective global e-commerce. It is forecasted that at the end of 2005, the total non-English speaking online population will reach 719 million from 418 million at the end of 2002, which will top online English-speaking population of 262 million at the end of 2005. Therefore, in order to conduct global e-commerce, design Websites in multi-language, not only in English is a very critical factor to gain international market profits.

In this study, the global Internet trends analysis utilizes a harmonized methodology to measure Internet usages across countries and languages, allowing for consistent comparisons. Data were collected from rigorous sampling methodologies that employed, ensuring highly accurate and reliable information. Specifically, Internet usage data for countries were collected from publications of Computer Industry Almanac Inc. and those for languages from Global Reach. These two companies collected available data and provided survey and projections from market research companies, associations, government agencies, computer companies and other resources across the world based on knowledgeable judgments by experts. These collected data allow clients to analyze audience measurement data across multiple countries/languages on a global level. This breadth and depth of data is indispensable to all companies involved in or considering multi-country/multi-language expansion. Therefore, these data are more accurate and comprehensive.

While it is true that the data covered a global sample and was collected by highly regarded companies, the results of the research should still be interpreted with a number of limitations. First, the data extracted contained information from persons responding to the survey. As with all survey data collected, non-response rate might be a problem. Second, there are some important factors affecting Internet usages forecasting and some of them might be the random factors, including economic climate, telecommunications infrastructure and pricing, gross domestic product per capita and political and religious freedom.

However, these two limitations above did not reduce the significance of the identified findings in any way. These limitations were stated to ensure that the findings were interpreted and used in their proper context. Great cares were taken in the selection of the targeted database for this study. Data collected from companies and organizations are nationally respected companies and organizations, such as Global Reach and Computer Industry Almanac. Moreover, robust analysis and statistic techniques were used for assessing and interpreting the results. Therefore, the findings presented in this study are definitely representative and acceptable.

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NOTE

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