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Factors Affecting the Internet Adoption in Riyadh City

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Abstract. The objective of this article is to study the use of Internet in Saudi Arabia (SA) by companies and organizations. A survey covered a sample of different profit companies and non-profit organizations in Riyadh City, SA. Several descriptive statistics related to the Internet use and non-use of these companies and organizations are provided. In addition, Chi-Square tests for independence are carried out to see which factors affect the use or non-use of internet.

The results showed that there is a relationship between the adoption of the Internet and the type of ownership, annual revenue, budget, size of a company, availability or unavailability of department for computer center. However, the way these factors affect the adoption and the degree of this relationship vary among these factors.

Keywords: Saudi Arabia (SA), Companies, Use, Bandwidths, Internet service providers (ISPs), Chi-Square independence tests.

Introduction

Since the advent of the World Wide Web (www) in the early 90s , it has been considered the most comprehensive and largest source of information the human being has ever had. It consists of millions of smaller computer networks such as universities, research centers, private companies, governments, military agencies, etc. By the end of 2001, users of the Internet have increased to nearly 700 million people with an increase of 50% of the number in the year before [1]. As a result of the expansion in the geographical area and increase in the number of people who embrace this new technology, the Internet use among commercial companies and non-profitable organizations started to spread all over the world.

The introduction of the Internet in Saudi Arabia coincides with the 1st of January 1999 [1]. However, some companies and organizations in SA have started to use the Internet earlier than that using external ISPs.

King Abdulaziz City for Science and Technology (KACST) has been authorized to control the service in SA. The Internet Service Unit (ISU) at the KACST has selected up to 40 companies to serve as Internet service providers (ISPs). These companies have met the minimum requirement that ISU imposed upon companies to be selected for providing this service. However, some companies have withdrawn and others merged, so the number of the actual ISPs dropped down to only 30 ISPs. In addition, the Saudi Telecommunication Company (STC) provides the infrastructures for the Internet connection to the rest of the world [2].

Filtering the Information

All information going or coming through these lines flow through a proxy service controlled by the ISU. The purpose of this proxy is to protect the society from materials that do not fit with the Saudi values or against the security of SA. A committee was assigned to this task under the name "Committee of the Internet Security". The committee consists of 12 representative members from 12 different ministries headed by a deputy minister from the Ministry of Interior. This committee has contracted with companies to classify and identify Internet sites that should not be accessed by Saudi citizens [1].

Network Capacity

The Saudi Telecommunication Company (STC) connected the 40 ISPs through 5000 modems, each of which has a speed of 512 kbps. The ISU has distributed the modem ports equally between the ISPs. Therefore, each ISP has been given 125 modem ports. The ISU has left the ratio of subscribers to the modem port opened to each ISP. However, the ISU has suggested that the best ratio of subscribers to each modem port should be 5:1 for a better quality of service achieved. In addition, a good service would be achieved if the ratio is around 10-12:1. But, the ISU would not allow the ISPs to increase the ratio of subscribers to the modem ports to exceed 20:1 in any case. STC has increased its capacity to the Internet up to 155 mega bite per second (mbps) using a sea cable. This cable increased the capacity of the bandwidth to three times that in August 2000 [3].

Pricing

The ISU at KACST imposes a price range within which the ISPs can charge each subscriber. It ranges from 100 SR to 240 SR per month. In addition, since the maximum number of customers that each ISP can take is 1250 users, the overall maximum number of customers that all ISPs can take is nearly 50,000 users. This figure was based on what ISU has suggested to maintain a good service level. However, this figure is considered

too small compared with the estimated demand, which will stimulate the ISPs to accept more than the suggested number of customers per modem port. Therefore, the ISPs would increase the number of subscribers, which in turn will increase the traffic of information and reduce the quality of access to the Internet. On the other hand, the prices that Saudi Telecommunication Company (STC) has charged for the connection to the Internet is 7.5 Halalas per minute (more than double the charge for the ordinary phone calls). The high cost imposed by STC was meant to meet the high investments paid in building its infrastructure. In addition to that, the STC receives 408,000 SR (i.e. 108,800 $) monthly from ISU for each EI line. This monthly cost is considered as very high compared with international prices.

Improvement of Services Internationally

The ISU proposed some studies to improve the Internet services at SA by preventing the slow connection to the Internet. The ISU speculates to allow the ISPs to use one-way satellite connection. However, there is a technical problem related to that, which is how to control the information going using the "push" technique. The connection via satellite is faster 12 times than the connection via the dial-up and using the ordinary phone lines. In addition, some American companies such as Vsat company, is planning to offer this service in the Middle East. Also, the STC has started to increase the number of modem ports to allow more users to connect to the Internet simultaneously.

ISU at KACST has increased its connection ports with the ISPs up to 50 thousand ports and increased its bandwidth to the Internet up to 201 mbps. However, despite this large increase, the ISPs did not buy more that 70 mbps, which they had before. This bandwidth consists of only 35% from the available capacity of KACST. The ISPs did not buy of available capacity (i.e. 201 mbps) due to the high prices of E1s that the KACST charges, as the ISPs indicated. Since the price of a line with 8 mega bite costs 1.368 million SR (i.e. 0.3648 million $), this cost is added to the operational, technical and marketing costs that each ISP has to endure. However, KACST offered a discount up to 40%, especially for a line with 18 mega bite bandwidth, to urge these ISPs to buy from these new bandwidths.

In December 2000, KACST and STC have finished providing two more fast ways to connect to the Internet through two sea cables. One service is using the continental cable while the other is using the Falaj cable to ensure that at least there is one cable working in case of a failure in one of them. Each of which absorbs up to 155 mbps. This means the total connection to the Internet using those cables has increased by 310 mbps. In addition, this makes the connection to the Internet improved by 100% by the end of year 2000. In addition, a new connection to the Internet through New York is added in April 2001 by Uunet company. This is the 3rd international connection to the Internet with a speed of 155 mbps. Therefore, the bandwidth to the Internet will be increased up to 465 mbps [3].

Improving the Service Nationally

In January 2001, STC announced two more services to speed up the Internet connection nationally. The first one is called Integrated Services Digital Network "ISDN". This service uses digital telecommunications lines that can transmit both voice and digital network services up to 128 K, and much faster and more reliable than high-speed analog modems. ISDN lines are offered by many telephone companies. The other service is called Asymmetric Digital Subscriber Line, or Asymmetric Digital Subscriber Loop "ADSL". ADSL is a technique that changes copper cable of ordinary telephone lines to a very high-speed line. SA is considered as one of the first countries in the Middle East that utilized this technique. However, some other countries have used ISDN before SA in the Middle East. A Digital Subscriber Line (DSL) technology in which the transmission of data from server to client is much faster than the transmission from client to server. The speed of DSL is 384 kbps, which is 7 times faster than the ordinary phone lines with dial-up connection (i.e. 56 kbps).

Whereas with HDSL (High-speed Digital Subscriber Line), transmission is 784 kbps in both directions, with ADSL, the rate from client to server is 640 kbps and from server to client can be up to 6 mbps. This type of connection is useful with applications such as interactive TV and video on demand since the data that the server sends is much more than the data sent by the client. ADSL uses a bandwidth that is not used by voice; therefore voice and data can be transmitted at the same time. In addition, there are two more services that STC introduced in 2001. These services are Relay Frame and ATM. Relay Frame is a digital medium that provides a digital connection from point to point, while Asynchronous Transfer Mode (ATM) is a type of fast packet switching that uses a fixed size packet called a *cell*. Relay Frame can transfer information ranges from 64 kbps to 2 mbps, while ATM technique makes it possible to transmit data at great speed, and can make voice, multimedia, full-motion video and video conferencing available to all users. It also makes dynamic allocation of bandwidth possible; telephone and cable TV companies can charge individual customers based on the amount of bandwidth they use. It is capable of transferring information up to 155 mbps.

Importance of the study

The importance of this study stems from the fact that the subject is new and important. In addition, and as far as the author knows, this study may be the first of its type in SA. Therefore, it is hoped that this study may give a useful information related to the adoption or non-adoption of Internet among SA companies.

Objectives of the study

This study aimed to find answers for the following questions:

- To what extent these companies and organizations have adopted the Internet?
- Which type of these companies and organizations has adopted the Internet more?

- What factors affect the adoption?

Tools of the study

A questionnaire has been designed to carry out this study. This questionnaire has been submitted to specialists in survey designing. The questionnaires were distributed randomly in Riyadh City to different companies (i.e. commercial, industrial, educational, agricultural, etc..), and to different non-profit organizations such as: schools, universities, and so on. The total number of companies and organizations that responded were about 1485.

Hypotheses

In this study, we assume that the Internet adoption is independent from the type of company, annual revenue, annual budget, size of the company and the availability of a computer department in these companies. In other words, it can be stated as follows:

H_0: Internet adoption is independent from the type of company, annual revenue, annual budget, size of the company, and the availability of a computer department in these companies.

H_1: Internet adoption is not independent from the type of company, annual revenue, annual budget, size of the company, and the availability of a computer department in these companies.

Literature review

Since the advent of UGI browsers, that can browse text, images and sounds of the web is considered as new, the published papers in this subjects is also a few. However, there are some published papers related to the adoption of the Internet. In Singapore, for example, an empirical study to examine the organizational characteristics, benefits of adopting the Internet, reasons for not adopting the Internet, and criteria for selecting ISPs has been carried out [4].

In Saudi Arabia also, a study discussed the needs and wants of the Internet users in Riyadh. The findings of the study showed the following: Most users use the Internet for finding knowledge, sentimental, social, entertainment and commercial purposes. The average time that the user spends every day on the Internet ranges between 1 hour to 5 hours. Most of the users use Internet alone. In addition, the users use the Internet most at home or in Internet cafes but not in business. The Internet reduced the time dedicated to the newspapers but has not affected the time that users dedicated to listening to radio or watching TV. Most of the users are at undergraduate level [1].

Research Methodology

Population and sample size

The population of the study consisted of all companies located in Riyadh City. A stratified random sample was used to represent various companies that have different

types of ownership, annual budget or revenue, number of employees, and availability or unavailability of computer department. Nearly 2000 questionnaires were distributed, but a total of 1486 responses have been collected.

Instrument

The instrument of the study was a questionnaire that consists of 19 questions. Some questions have yes or no type of answers, and therefore they were put in a binary scale. Other question answers were classified in categories, so their data have been encoded using an ordinal scale. The rest of the missing data were giving number 99 to be excluded from the analysis.

Procedure

These data were fed into Excel spreadsheets software, which is a part of Microsoft Office package. Excel was used instead of other statistical packages because of its availability and capability of analyzing and manipulating data. In addition, it has advantages over the other statistical softwares. Since Excel is part of MS Office, this makes it compatible with MS Word and therefore it is possible to edit tables and graphs within the word document.

Results of Statistical Analysis

Since the adoption of the Internet is the most important factor in this study, pivot tables were used to examine other factors against the factor of Internet adoption. The number of frequencies in each table has been transferred to percentages after eliminating the missing data.

The first factor which has been measured is the type of ownership of a company. As Fig. 1 shows, the companies that are owned by shareholders are the most adopters of the Internet. The second adopters of the Internet are companies that are owned by both the government and the public (mixed), whereas the non-adopters of private or public companies are considered more than the adopters.

In addition, the Crosstab table (Table 1) shows that there is a difference between the observed and expected cases when testing the adoption against the type of ownership factor. Also, as the Chi-Square tests show (Table 2), the calculated value for this factor is 50.597. However, the tabulated value (i.e. α=0.05, df=3) is equal to 7.815. The calculated value is larger than the tabulated value and it falls in the rejection region. Therefore, the probability of accepting the null hypothesis is almost zero (i.e. Asymp. Sig. = 0). This means that the adoption of Internet depends on the type of ownership.

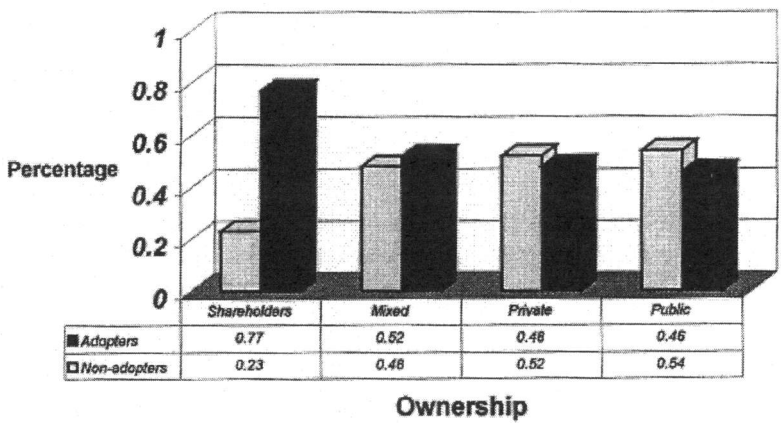

Fig. 1. Adoption based on ownership.

Table 1. Crosstab between type of ownership and Internet adoption

			Internet adoption		
			1	2	Total
Type of ownership	Public	Count	118	140	258
		Expected count	132.6	125.4	258.0
	Private	Count	372	408	780
		Expected count	401.0	379.0	780.0
	Mixed	Count	117	106	223
		Expected count	114.6	108.4	223.0
	Share holders	Count	123	36	159
		Expected count	81.7	77.3	159.0
	Total	**Count**	**730**	**690**	**1420**
		Expected count	**730.0**	**690.0**	**1420.0**

Table 2. Chi-Square test between type of ownership and Internet adoption

	Value	df	Asym. sig. (2-sided)
Pearson Chi-Square	50.597	3	.000
Likelihood ratio	53.276	3	.000
Linear-by-linear association	37.352	1	.000
No. of valid cases	1420		

The second factor, annual revenue (Fig. 2), also shows us that the adoption of the Internet increases as the annual revenue increases. For example, companies or organizations that have annual revenue of more than 10 million SR are likely to adopt

the Internet with a probability more than 66%. In addition, 54% of the companies will adopt the Internet if their revenue is equal to or more than 5 millions and less than 10 millions. Therefore, the probability of adoption decreases steadily as the annual revenue decreases and *vice versa*. This is expected, especially if we know that the larger companies are usually interested in international customers in addition to local customers, whereas the small companies are concerned with local customers. Therefore, its logical for the big companies to adopt the Internet to reach its international customers too, while it is not important for small ones.

The Crosstab table (Table 3) shows that there are differences between the counted and expected cases when testing the adoption against the revenue factor. Also, and as the Chi-Square tests show (Table 4), the calculated value for this factor is 144.555. However, the table value (i.e. α=0.05, df=5) is equal to 11.070. Since the calculated value is far bigger than the table value, then it falls in the rejection side. Therefore, the probability of accepting the null hypothesis is almost zero (i.e. Asymp. Sig. = 0). In other words, there is a relationship between the annual revenue and the adoption of the Internet. Note that the total number of cases that used in this factor is only 839 cases. However, the total number of companies and organizations that responded was about 1485. The difference was caused by the removal of missing cases.

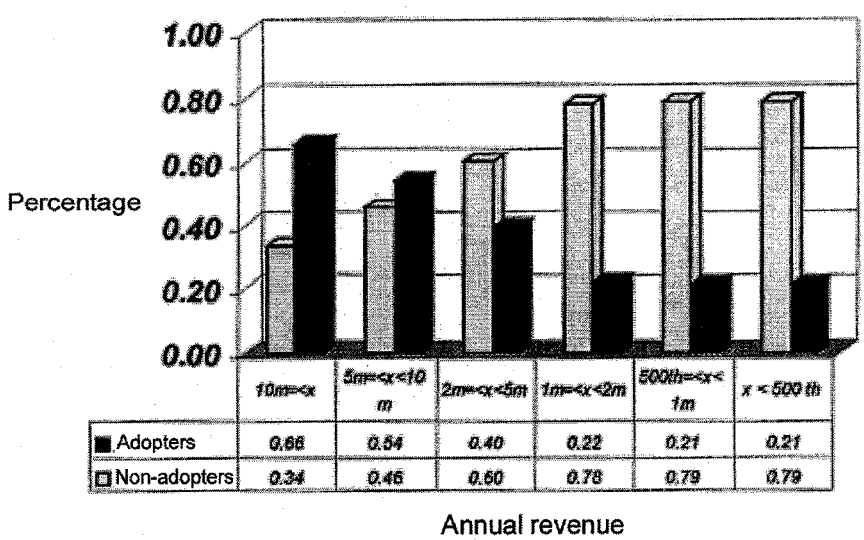

Fig. 2. Adoption based on annual revenue.

Table 3. Crosstab between revenue and Internet adoption

			Internet adoption		
			Adopted	Non-adopted	Total
Revenue	0 ≤ Revenue < 500 thousand	Count	70	136	206
		Expected count	108.8	97.2	206.0
	500 The ≤ R < 1 Million	Count	49	94	143
		Expected count	75.5	67.5	143.0
	1 M ≤ R < 2 M	Count	32	60	92
		Expected count	48.6	43.4	92.0
	2 M ≤ R < 5 M	Count	48	38	86
		Expected count	45.4	40.6	86.0
	5 M ≤ R < 10 M	Count	55	23	78
		Excepted count	41.2	36.8	78.0
	10 M ≤ R	Count	189	45	234
		Expected count	123.6	110.4	234.0
	Total	**Count**	**443**	**396**	**839**
		Expected count	**443.0**	**396.0**	**839.0**

Table 4. Chi-Square test between type of ownership and Internet adoption

	Value	df	Asymp. sig. (2-sided)
Pearson Chi-Square	144.555	5	.000
Likelihood ratio	151.923	5	.000
Linear-by-linear association	133.120	1	.000
No. of valid cases	839		

The third factor, budget (Fig. 3) is similar to the annual revenue factor except that the profitable companies are concerned with the annual revenue while non-profit organizations are more interested in annual Budget. Non–profit organizations are more interested in providing free services to the public based on a pre-specified annual budget. This can be seen in some hospitals, colleges, universities and so on.

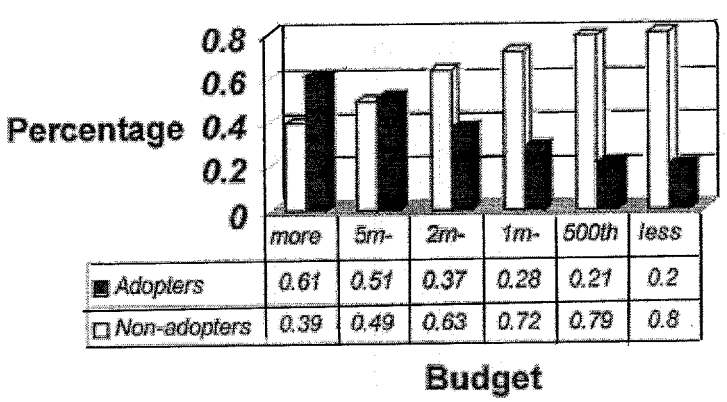

Fig. 3. Adoption based on annual budget.

The Crosstab (Table 5) shows that there are some differences between the counted and expected cases when testing the adoption against the budget factor. In addition, the Chi-Square test (Table 6) shows the calculated value for this factor is 106.945, while the table value (i.e. α=0.05, df=5) is equal to 11.070. Since that the calculated value is far bigger than the table value, then it falls in the rejection side. Therefore, the probability of accepting the null hypothesis is almost zero (i.e. Asymp. Sig. = 0), and this means that the budget factor is affecting the adopting or not adopting the Internet.

Table 5. Crosstab between budget and Internet adoption

			Internet adoption		
			Adopted	**Non-adopted**	**Total**
Budget	0 ≤ Budget < 500 thousand	Count	61	127	188
		Expected count	97.8	90.2	188.0
	500 The ≤ B < 1 Million	Count	40	78	118
		Expected count	61.4	56.6	118.0
	1 M ≤ B < 2 M	Count	37	49	86
		Expected count	44.8	41.2	86.0
	2 M ≤ B < 5 M	Count	39	34	73
		Expected count	38.0	35.0	73.0
	5 M ≤ B < 10 M	Count	41	20	61
		Excepted count	31.7	29.3	61.0
	10 M ≤ B	Count	176	55	231
		Expected count	120.2	110.8	231.0
	Total	**Count**	**394**	**363**	**757**
		Expected count	**394.0**	**363.0**	**757.0**

Table 6. Chi-Square test between budget and Internet adoption

	Value	**df**	**Asymp. sig. (2-sided)**
Pearson Chi-Square	106.945	5	.000
Likelihood ratio	110.916	5	.000
Linear-by-linear association	103.909	1	.000
No. of valid cases	757		

The fourth factor, the relationship between Internet adoption and the size of the companies or organizations (Fig. 4) coincides with the relationship between the Internet adoption and the annual revenue or budget. Since that the relationship between the revenue or budget of a company or organization is correlated to the number of employees. For example, the probability of adopting the Internet for a company or organization that has more than 500 employees (500=<X) are more than 67%, while it is less than 24% for companies or organizations that have less than 50 employees. The following figure (Fig. 4) shows us more details.

The Crosstab table (Table 7) shows that there are differences between the counted and expected cases when testing the adoption against the budget factor. The Chi-Square test (Table 8) also shows the calculated value for this factor is 152.707, and the table value (i.e. α=0.05, df=4) is equal to 9.488. This means that the calculated value is far

bigger than the table value and it falls in the rejection side. Therefore, the size of a company affects the adoption of the Internet factor positively and the probability of rejecting the existence of this relationship is almost zero (i.e. Asymp. Sig. = 0). In addition, note that the total number of cases that used in this factor is only 757 cases. However, the total number of companies and organizations that responded was about 1485. The difference appears after excluding missing cases.

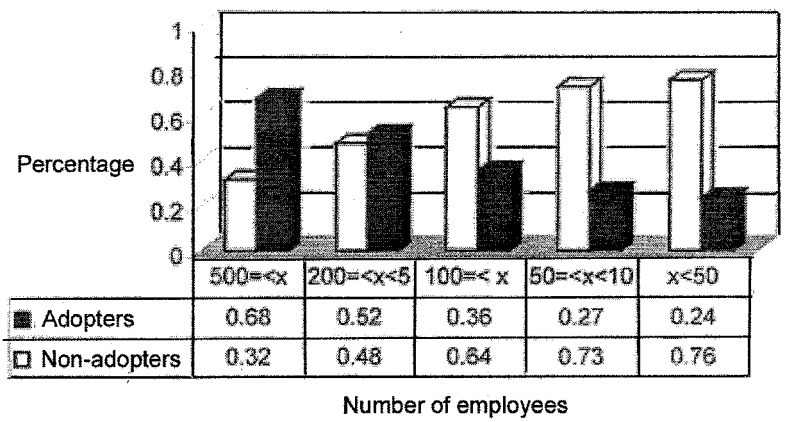

Fig. 4. Adoption based on thenumber of employees.

Table 7. Crosstab between number of employees and Internet adoption

			Internet adoption		
			Adopted	**Non-adopted**	**Total**
Number of employees	0 ≤ Employees < 50	Count	218	349	567
		Expected count	292.3	274.7	567.0
	50 ≤ E < 100	Count	116	159	275
		Expected count	141.8	133.2	275.0
	100 ≤ E < 200	Count	94	84	178
		Expected count	91.8	86.2	178.0
	200 ≤ E < 500	Count	103	47	150
		Expected count	77.3	72.7	150.0
	500 ≤ E	Count	197	45	242
		Excepted count	124.8	117.2	242.0
	Total	**Count**	**728**	**684**	**1412**
		Expected count	**728.0**	**684.0**	**1412.0**

Table 8. Chi-Square test between number of employees and Internet adoption

	Value	**df**	**Asymp. sig. (2-sided)**
Pearson Chi-Square	152.707	4	.000
Likelihood ratio	160.924	4	.000
Linear-by-linear association	146.819	1	.000
No. of valid cases	1412		

The fifth factor, the adoption of the Internet based on the availability of a department for computer center (Fig. 5), has revealed that the more computer center departments are available the more likely the Internet will be adopted. However, the probability of adopting the Internet based on the availability of a computer center is not very high because the probability of adoption based on this factor is only about 42%.

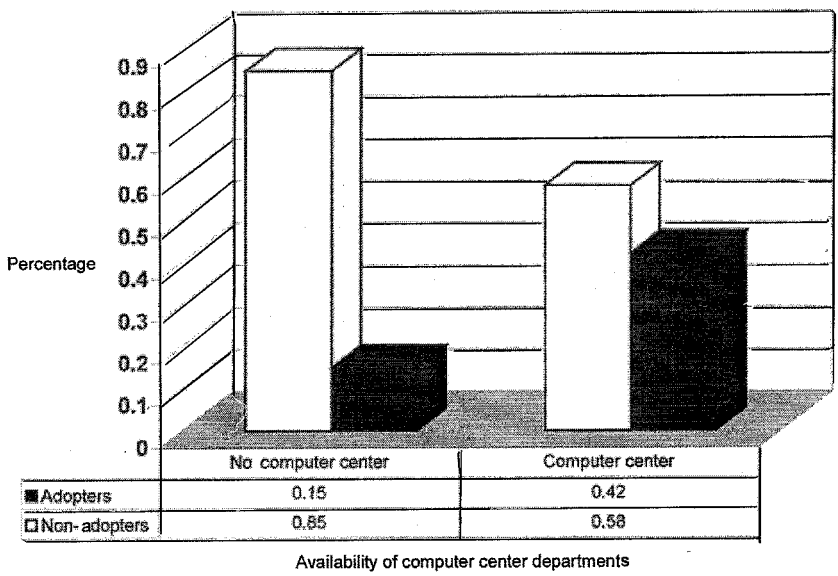

Fig. 5. Adoption based on the availability of a computer center department.

The Crosstab results (Table 9) show that there are differences between the counted and expected cases, and the Chi-Square test (Table 10) shows the calculated value for this factor is 121.639. However, the table value (i.e. α=0.05, df=1) is equal to 3.841. Therefore, this factor is also affecting the adoption of the Internet.

Table 9. Crosstab between availability of a computer center department and Internet adoption

			Internet adoption		
			Adopted	**Non-adopted**	**Total**
Availability of computer center departments	Yes	Count	641	436	1077
		Expected count	552.6	524.4	1077.0
	No	Count	85	253	338
		Expected count	173.4	164.6	338.0
	Total	**Count**	**726**	**689**	**1415**
		Expected count	**726.0**	**689.0**	**1415.0**

Table 10. Chi-Square test between availability of computer center department and Internet adoption

	Value	df	Asymp. sig (2-sided)	Exact. sig. (2-sided)	Exact. sig. (1-sided)
Pearson Chi-Square	121.639	1	.000		
Continuity correction	120.267	1	.000		
Likelihood ratio	125.626	1	.000		
Fisher's exact test				.000	.000
Linear-by-linear association	121.553	1	.000		
No. of valid cases	1415				

Conclusion

The main question that this study tries to answer if there is any relation between the adoption of the Internet and the type of company, annual revenue, annual budget, size of the company, and the availability of a computer department in these companies? The answer was positive; there is a relationship between each of these factors and the adoption of the Internet. It has been found in this study that the adoption of the Internet depends most on the size of the company and the budget. This also shows that most of the companies and organizations have realized the importance of the Internet. However, it can be inferred from the factors that have been examined in this study that the adoption of the Internet depends on financial issues.

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العوامل المؤثرة على تبني الإنترنت في مدينة الرياض

عثمان بن إبراهيم السلوم

قسم الأساليب الكمية، كلية العلوم الإدارية، جامعة الملك سعود، الرياض، المملكة العربية السعودية

(قدم للنشر في ١٤٢٥/١/١٩هـ؛ وقبل للنشر في ١٤٢٥/٨/٢٢هـ)

ملخص البحث. تهدف هذه الدراسة إلى التعرف على الخصائص والعوامل التي تؤثر على تبني الإنترنت بواسطة الشركات الربحية والمنظمات الحكومية وغير الربحية في مدينة الرياض، وتم التعرف على مدى تأثير هذه العوامل بتحليل استبيانات شملت جميع طبقات هذه المنظمات والمؤسسات حيث تم توزيع ما يقرب من ٢٠٠٠ استبانة عشوائيا على مختلف الشركات والمؤسسات الربحية والحكومية وغير الربحية وتم الحصول على ١٤٨٦ استجابة. هذه البيانات تم إدخالها عن طريق الحاسب وتحليلها إحصائيا وتم عمل اختبارات مربع كاي للاستقلال لمعرفة العناصر أو الخصائص التي تؤثر على عملية تبني الإنترنت وكذلك درجة التأثير. أظهرت النتائج أن هناك علاقة بين تبني الإنترنت وبين طبيعة ملكية هذه الشركات والمؤسسات ووجود علاقة بين حجم الميزانية أو الإيرادات لهذه الشركات وتبني الإنترنت، كذلك هناك علاقة بين حجم الشركات وعدد موظفيها وبين تبني الإنترنت وكذلك وجود مركز للحاسب الآلي أو عدمه بتلك الشركات.