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# PRODUCTIVITY OF BUSINESS ENTERPRISES: EFFECT OF COMPUTER VIRUS INFECTION ON FILES

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## ABSTRACT

This study is carried out to evaluate the effect of computer virus infection of files and productivity of business enterprises. Chi-square test, tables, graphs, percentage and other simple statistical tools were used in the analysis of the data collated. The findings show that virus infection has effect on productivity of business enterprise. The magnitude of the effect depends on installation or uninstallation of anti-virus software on computer system. The study recommends that business enterprise owners should make sure that their computers run antivirus software; this software must be updated regularly as new virus appears daily; files should be regularly backed up in case the computer becomes infected, that way valuable data would not be lost.

***Keywords: computer system, files, computer virus, anti-virus, business enterprise***

## 1. INTRODUCTION

Nigeria's population of approximately 160 million people is the largest in Africa. It is anticipated to surpass the USA and become the third largest in the world by 2020 (Persianas, 2017). The population grew by 33% in the last decade alone (Persianas, 2017). Nigeria contributes approximately 20% of the African continent's GDP (Persianas, 2017). It has thriving telecoms, banking, oil and gas sectors and provides a reliable access point to sub-Saharan Africa (see Figure 1 for map of Nigeria).

A 'business enterprise' or business centre', in the Nigerian context, is an outfit where various services, ranging from photocopying, secretary works, spiral binding and laminating of paper materials, instant passport photographing, typesetting, installation of systems, computer training, internet services (for computer business centre with cybercafé ), typing and printing project work, letters, correspondence, memoir etc., and other computer services are delivered (Nnodim, 2011; and Onwuka, 2015). The business centres are sometimes expanded to include other services like computer sales, recharge cards vendorship and call centre operations.



Figure2: A business centre in Anyigba, Kogi state  
Source: Photo by Authors

The demand for computer services is high especially in tertiary institutions, offices and in different work areas. This business is one of the profitable medium scale businesses in Nigeria; the business can give a high profit margin when managed properly and run alongside with a cybercafé (Onwuka, 2015). A cybercafé or internet café is a place where Internet access is provided to the general public, usually for a fee. This business usually provides snacks and drinks, hence the café in the name. The fee for using a computer is usually charged as a time-based rate, in minutes or hourly.

Most computer business centre runs computer services alongside with cybercafé for the purpose of maximizing profit and as well as providing a complete computer services package to their customers.

Computer virus infection is the process whereby the third part of the virus, the self – propagation component, allows the virus to quickly spread to other programs to which the virus is not already attached. Computer virus is made up two other components the first is the missing component, the second part is the trigger mechanisms. It's the third part mentioned earlier that is the self-propagation component, that infect systems (NSA, 2008). Computer virus in one partition can escape to other partitions. Virus quickly infects virtually all programmes in the partition. The process is simple and very fact. The algorithm for infection requires only read, write and file renaming. Infection spread from machine to machine, and from organization to organization, in a number of ways (Sophos, n.d.). Viruses can be transmitted by booting a PC from an infected medium, executing an infected program and opening an infected file.

While the early age viruses were mainly spreading through floppies, the later age viruses predominantly spread through internet (Mishra, n.d.). A virus can spread from a LAN/WAN based file server to any of the client systems attached to the server.

Computer viruses can affect the productivity of business enterprise, depending on how the computers are deployed in the business enterprise, either as online system,

connecting the business to outside world, thus as the computer system are affected by viruses, they cut the business from the outside world, thereby leading to loss of production (online shopping, n.d.).

Where the computer systems are employed in managing the enterprise's information and tying employees data together in a database, attaching these systems by computer virus will make information processing challenging, thereby affecting productivity.

Computer systems use as control system in a production facilities, when attack by computer viruses, will close down, their by halting production and affecting productivity. This means we can not ignore the effect of computer viruses on the productivity of business enterprises.

## **1.2. Objective of the Study**

The main aim of the study is to find out the effect of computer virus infection on the productivity of Business Enterprise. The study attempts to:

- i. Examine the Nature of computer virus infection.
- ii. Find out the effect of infection on productivity of business enterprise.
- iii. Report the maintenance work down on infected systems.

## **2. LITERATURE REVIEW**

### **2.1. Nature of Computer Virus Infection**

Computer virus infection occurs when a virus code replicates itself to other programs or computers. It does these by looking for a suitable host program and copying its code to the host program such that the infected programme find another program to infect further (Umakant, n.d.).

Virus infection are of several patterns. Some add themselves at the beginning of the host program. Some append themselves to the host program and modify the header of the original host so that execution starts at the virus rather than the host. The overwriting viruses overwrite a portion of the host and modify the header of the host. While the modified overwriting viruses, may write themselves at the beginning, end and other places in the program.

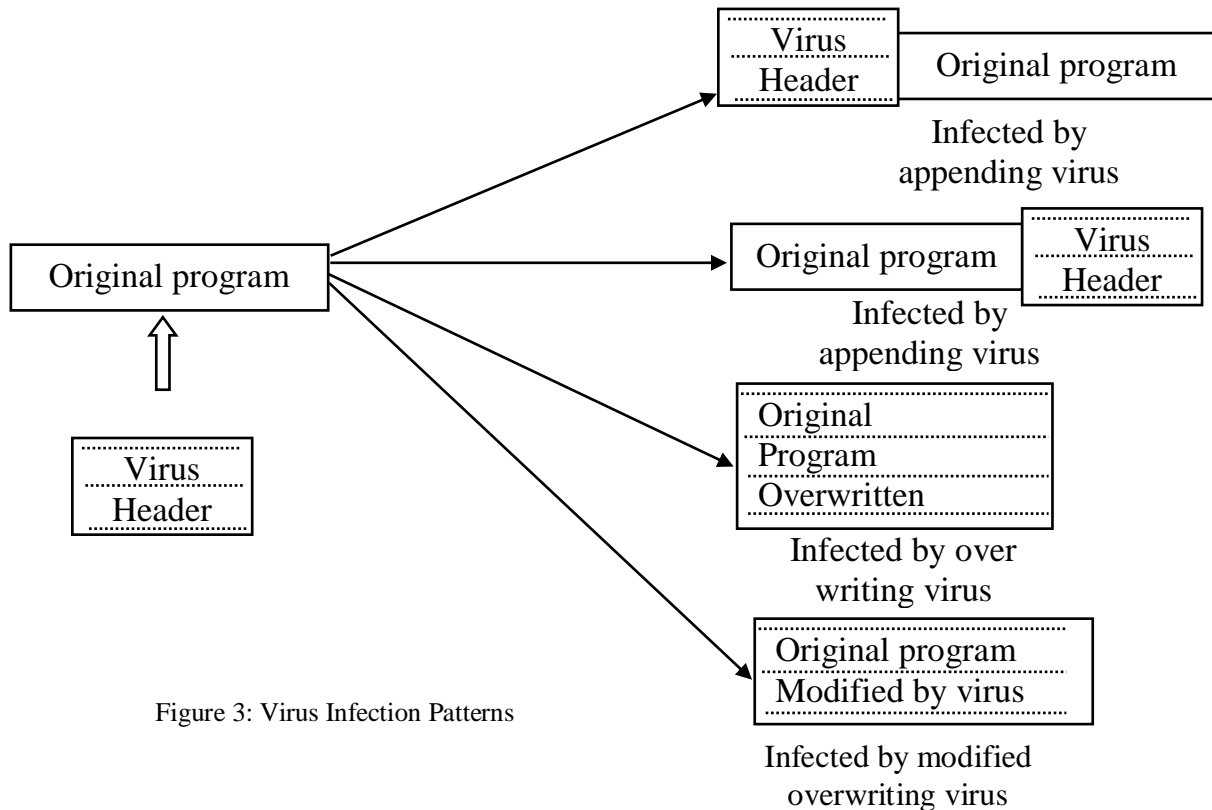


Figure 3: Virus Infection Patterns

## 2.2. Effect of Infection on Productivity of Business Enterprise

Virus infection is taking its toll on businesses globally. This is a major concern because of the sheer number of new viruses that have been introduced over the past 12 – 18 months, in addition is a rising mobile workforce that can now connect to internet resources from any where. The financial impact of viruses from 1995 to 2004 has grown from \$500m to a \$16.7b (Checkpoint, n.d.).

According to an FBI tally, ransomware attacks cost their victims a total of \$209 million in the first three months of 2016, a stunning surge upward from \$24 million in all of 2015 (Chandler, 2016).

The costs used to calculate the damages associated with viruses include the following:

- i. Labour
- ii. Tools needed
- iii. Productivity loss
- iv. Loss of income.

Also the virus called “I LOVE YOU” caused over \$1 billion loss in productivity as it crippled e-mail systems worldwide (Learnthenet, 2007).

The chance of contracting one of these computer viruses over the internet has increased dramatically (Paradeep and Shubha, 2010). Some viruses are relatively harmless to individuals. They just attach themselves to outgoing messages or email themselves to all the contacts that are listed in your address book. As a result, the sudden flood of e-mail overwhelmed mail servers causing the system to crash.

Some viruses are more destructive and may live dormant until a certain date. Then they spring to life to do their dirty deeds. For instant a strange message may appear on your screen, or data and programs may be modified. In other case, all the files on your hard drive may be wiped out.

**Table 1: Name of Virus and the Date they were Discovered**

Virus name	Spreading	Damage	Discovered
Exploit.CVE-2014-176.Gen	VERY LOW	MEDIUM	2014 April 01
JS:Exploit.CVE-2014-0322.B	VERY LOW	VERY LOW	2014 Feb 15
JS:Exploit.CVE-2014-0322.A	VERY LOW	VERY LOW	2014 Feb 15
Exploit.CVE-2013-5065.A	VERY LOW	LOW	2013 Nov 28
PDE:Exploit.CVE-2013-5065A	VERY LOW	LOW	2013 Nov 28
Rootkit.Sirefef.Gen	MEDIUM	HIGH	2012 Nov 21
Rootkit.MBR.TDSS	MEDIUM	MEDIUM	2012 Nov 04
Trojan.FakeAV.	VERY LOW	VERY LOW	2012 Sep 22
Trojan.Startpage.AA.BI	VERY LOW	VERY LOW	2012 Aug 14
Trojan.OlympicGames	VERY LOW	VERY LOW	2012 Aug 14
Trojan.Flame.A	MEDIUM	VERY HIGH	2012 May 28
Trojan.Ransom.IcePol	MEDIUM	HIGH	2012 Mar 20
Exploit.CVE-2011-3402.Gen.	VERY LOW	LOW	2011 Nov 07
Backdoor.IRCBot.Dorkbot.A	MEDIUM	MEDIUM	2011 May 15
Backdoor.Lavandos.A	MEDIUM	HIGH	2011 Jan 06
Trojan.Android.Geinimi.A	VERY LOW	HIGH	2011 Jan 03

Source: Compiled by authors from different sources.

### 2.3. The Nature of Computer System Infected

The infected system (Wave) Pentium IV computer with the following characteristics.

- i. Processor. Intel<sup>(R)</sup> Pentium<sup>(R)</sup>  
 Dual CPU E2180 @ 2.00 GHZ  
 2.00GHZ  
 Installed Memory (RAM): 1.00GB  
 System Type 32 bit operating system  
 Pen and touch: To pen and touch input is available for this display  
 Hard Disk Capacity. 298GB  
 Drive A capacity: 1.4MB  
 CD Rom  
 Power Ratings: 250 Volts.

### 2.4. Types of Virus found on Infected System

Types of viruses found on systems are listed below:

**Table 2: Types of viruses found on the systems**

Virus	Effect
Mouatoo	Attacks driver and hiders the files and folder in them (Spafford, 1990)
Ralia Odinga	This is a worm that attacks Microsoft word files, but it look like JPG file and mostly found on the desktop (Szor, 2005).
XXX.ALL	Attacks removable driver such as flash drive attacks all files and folder and makes them un-readable (Szor, 2005).
Recycler	Attacks systems with window 2000 or window XP (Howard and long staff, 1998)
Trojan	Attacks hard disks and cause system to slow down or crash (Howard and long staff, 1998).
New folder	The virus hides folder in USB drives, disable task manager, disable registry editor disable folder options and disable run option from start menu (Szor, 2005).
I love you	Is a computer worm, it attacks window personal system (Spafford, 1990).
Network virus	It spreads through wifi network and attacks the system on the network. The wifi can be infected like a human virus (Priggs, 2014)
Adwares virus	Does not affect the system file but intermittently displays unwanted advertisement when a user is online, collects marketing data and other information without the user's knowledge or redirects search requests to certain advertising websites (Kaspersky, 2017). It also can attack to extract vital information from the system especially details

	like credit card information and passwords
Browser hijacker	Browser hijacker alters the search and error page of a definite browser and redirects the user to its own page. System users are redirected to pages that they hardly have any intention of visiting (Combofix, n.d.).

**Source:** Authors’ compilation

### 3. RESEARCH METHODOLOGY

#### 3.1. Study Area

Anyigba, the study area is in Dekina Local Government Area in eastern part of Kogi State of Nigeria (see Figure 4). Anyigba lies between longitude 7° 12’ East of the Greenwich Meridian and latitude 7° 36’ North of the Equator (Awosusi and Oriye, 2015). It is on the south eastern direction of Lokoja (capital of Kogi State) and the bearing of Anyigba from Lokoja is 135° (Awosusi and Oriye, 2015).



Figure 1- Map of Nigeria showing Kogi state.  
Source: Google.com (n.d).



Figure 4 – Map of Kogi State showing Dekina LGA where Anyiba town is located.  
Source: Abusidiqu Blog(n.d.).

#### 3.2. Data Collection and Technique of Analysis

In this research, primary data was used; the data used were collected from a sizeable population of the computer business centers within Anyigba. A total of 50 questionnaires were distributed. The questionnaire was composed of 16 questions and it was formatted with “yes” or “no” questions, multiple choice questions, and questions using a Likert-type scale for answering. Each questionnaire took about five to seven



minutes to be completed. Tables, graphs, percentage and other simple statistical tools were used in the analysis of the data collated.

### 3.3. Hypothesis of the study

#### Hypothesis I

**H<sub>0</sub>:** The income generated is independent on the status of attack on the system with Anti-Virus installed.

**H<sub>1</sub>:** The income generated is dependent on the status of attack on the system with Anti-Virus installed.

#### Hypothesis II

**H<sub>0</sub>:** The income generated is independent on the status of attack on the system without Anti-Virus installed.

**H<sub>1</sub>:** The income generated is dependent on the status of attack on the system without Anti-Virus installed.

**Test Criterion:** IF P-value calculated is less than the level of significance, we reject H<sub>0</sub> if otherwise we do not reject H<sub>0</sub>.

### 3.4. Chi-square (x<sup>2</sup>) distribution test

The Chi-square technique was employed to test the stated hypothesis. The chi-square distribution is one of the most widely used theoretical probability distributions in inferential statistics, i.e. in statistical significance tests. The chi-square distribution has one parameter, its degrees of freedom  $\nu$ . It has a positive skew; the skew is less with more degrees of freedom. As the degree of freedom increase, the chi square distribution approaches a normal distribution. The mean of chi-square distribution is its degree of freedom  $\nu$ .

Chi-square test assumes we have observed absolute frequencies on and expected absolute frequencies  $e_i$  under the null hypothesis of the test then it holds

$$V = \sum^k \sum_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} = X^2 \text{fi}$$

Might denote a simple index running from 1, ... i, j or even a multi-index (i..., i<sub>p</sub>) (j<sub>1</sub>.....j<sub>p</sub>). The test statistics V is approximately X<sup>2</sup> distributed, if (1) for all absolute expected frequencies E<sub>i</sub> holds E<sub>i</sub> ≥ 1 and (2) for at least 80% of the absolute expected E frequencies holds  $\underline{E} \geq 5$ . The degree of freedom can be computed by the numbers of absolute observed frequencies which can be chosen freely .we know that the sum of absolute expected frequencies- is  $\sum O_i = n$  which means that the maximum number of degrees of freedom is i – 1, we might have to subtract from the number of degree of freedom the number of parameters we need to estimate from the sample, since this implies further relationships between the observed frequencies. Chi-square distribution is a statistical technique which is used to test the significance difference between two samples by the use of point percentage and contingency table at a given degree of freedom.

**4. DATA ANALYSIS**

**Table 3: Cross-classification of status of attack on the system with Anti-Virus installed based on income generated**

INCOME GENERATED	STATUS OF ATTACK		TOTAL
	ATTACK ON SYSTEM	NO ATTACK ON SYSTEM	
< 5000	8	8	16
5000-10000	26	14	40
11000-20000	15	10	25
>20000	2	17	19
Total	51	49	100

Source: computed by authors using SPSS 20 software

**Table 4: Chi-square test on the status of attack on the system with Anti-Virus installed**

	Value	Df	Asymp. Sig. (2 – sided)
Pearson Chi – Square	16.409a	3	.001
Likelihood Ratio	18.176	3	.000

Linear-by-Linear Association	7.022	1	.008
N of Valid Cases	100		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.84.

Source: computed by authors using SPSS 20 software

### Decision

Using 0.05 level of significance. From Table 4.0 it can be observed that the P-value is 0.001. Since, P-value < 0.05, which is the significance level, we reject H<sub>0</sub> and conclude that the income generated is dependent on the status of attack on the system with Anti-Virus installed.

**Table 5: Cross-classification of status of attack on the system without Anti-Virus installed based on income generated**

#### Income \* Status Cross-tabulation

INCOME GENERATED	STATUS OF ATTACK		TOTAL
	ATTACK ON SYSTEM	NO ATTACK ON SYSTEM	
Income Below N5,000 Count	28	3	31
Expected Count	15.5	15.5	31.0
N5,000 – Count	13	21	34
N10,000 Expected Count	17.0	17.0	34.0

Source: computed by authors using SPSS 20 software

**With Anti – Virus Software Installed**

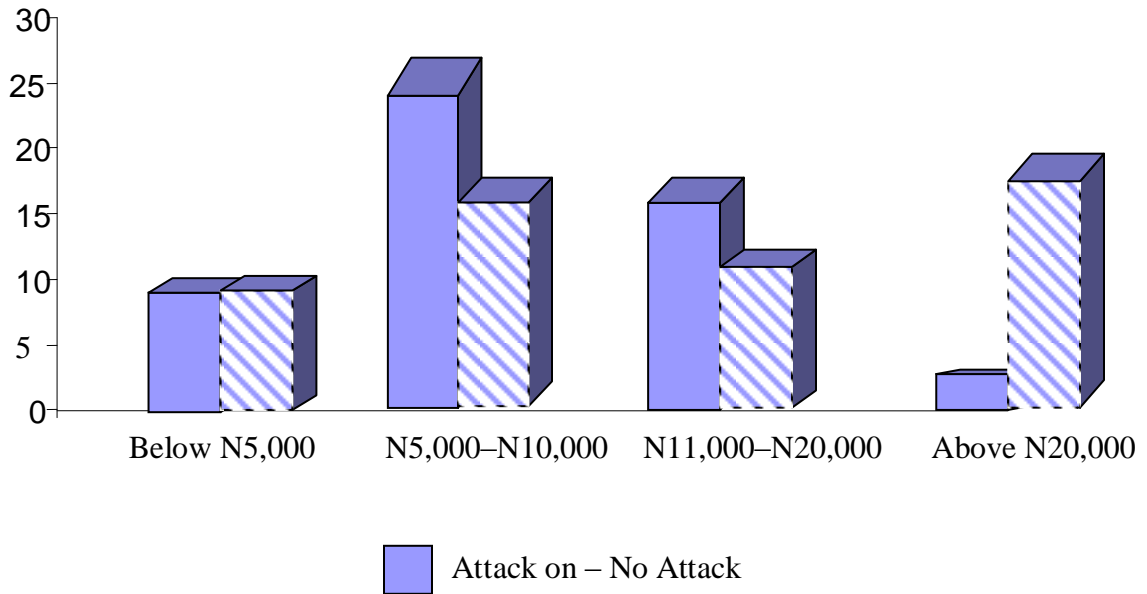


Figure 5: Status of attack on the system with Anti-Virus installed based on income generated

**Without Anti-Virus Software Installed**

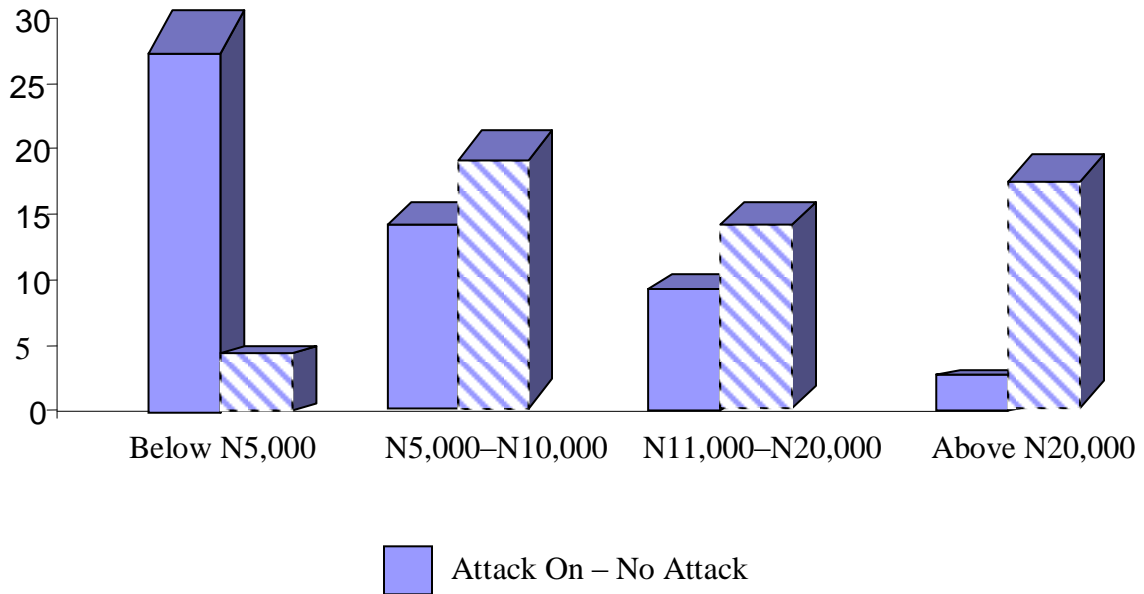


Figure 6: Status of attack on the system with Anti-Virus installed based on income generated

**Table 6: Chi-square test on the status of attack on the system without Anti-Virus installed based on income generated.**

N5,000 – N20,000	Count	7	12	19
	Expected	9.5	9.5	19.0
	Count			
Above N20,000	Count	50	50	100
	Expected	50.0	50.0	100.0
	Count			

Source: computed by authors using SPSS 20 software

**Table 7: Chi-Square Tests**

	Value	Df	Asymp. Sig. (2 – sided)
Pearson Chi – Square	32.359 <sup>a</sup>	3	.000
Likelihood Ratio	36.619	3	.000
Linear-by-Linear Association	26.244	1	.000
N of Valid Cases	100		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.00.

Source: computed by authors using SPSS 20 software

### Decision

Using 0.05 level of significance. From Table 6.0, it can be observed that the P-value is 0.001. Since,  $P\text{-value} < 0.05$ , which is the significance level, we reject  $H_0$  and conclude that, the income generated is dependent on the status of attack on the system without Anti-Virus installed.

## 5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

### 5.1. Summary

This study is carried out to evaluate the effect of computer virus infection of files and productivity of business enterprises. Using Chi-square test, it was revealed that the income generated in business enterprises is dependent on the status of virus attack on the computer system (with Anti-Virus installed or without Anti-Virus installed).

## 5.2. Conclusion

Based on the major findings of this study, it can be concluded that virus infection has effect on productivity of business enterprise which is reflected in the income generated. The magnitude of the effect depends on installation or uninstallation of anti-virus software.

## 5.3. Recommendations

This paper recommends that business enterprise owners should undertake the following:

- (i) Make sure that their computers run Antivirus software. They can purchase and download software from popular websites. McAfee.Com and Symantec are two most popular sites
- (ii) This software must be updated regularly as new virus appears daily; configure the program to automatically download updates.
- (iii) An attachment e-mail should not be opened unless they know who sent it.
- (iv) If a suspicious message is received, it should be deleted immediately from the inbox. When a message is deleted, however, it is still on the computer system. It is wise to go into the deleted mail folder and delete the message again to permanently remove it from the computer system.
- (v) Files should be regularly backed up in case the computer becomes infected, that way valuable data would not be lost.
- (vi) Better still an expert should be called.

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