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E-commerce security

Bachelor Thesis

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Declaration

I declare that I have worked on my bachelor thesis titled "E-commerce Security" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not violate copyrights of any third person.

In Prague on 30th Nov 2013

Bimal Giri

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E-COMMERCE SECURITY

Abstract

With the ever increasing cyber threats and the rapid expansion of e-commerce globally, the security of the Internet and e-commerce in general will become more paramount. The aim of the thesis is to find out the current e-commerce user perception regarding online transaction and security issues in e-commerce from the user's perspective. The research is divided into two parts. Firstly, the research tries to find out current e-commerce user's perception. The social media (Facebook) has been applied for this purpose. The survey is made from 40+ e-commerce users. The Chi-squared test and Fisher's exact test are used for analyzing the obtained data to answer the statistical significance. Secondly, MADM (Multiple Attribute Decision Making) is used in this thesis to compare the best open source software from the selective software. The result of first part of research shows that there is no association between security and consumers preference of spending. Similarly, result of second part shows that the Wordpress is chosen best and as a criteria security is highly attributed in open source software. Finally, we can say that the majority of e-commerce users need online transaction for online shopping and they need to think twice whether they are using secure software application or not. It can be suggested that e-commerce user should have prior knowledge on online fraud.

Keywords- IT, IT security, E-commerce, E-commerce security, IT standards.

Abstrakt

S neustále se zvyšujícím počtem kybernetických hrozeb a rapidní expanzí elektronického obchodu v globálním měřítku se zabezpečení internetu a elektronického obchodování stále zvyšuje. Cílem této práce je zjistit aktuální uživatelské vnímání e-obchodování ohledně online transakcí a bezpečnostních otázek v e-obchodování z pohledu uživatele. Výzkum je rozdělen do dvou částí. Za prvé se snaží zjistit současné vnímání e-obchodování pohledem uživatele. K tomuto účelu byly použity sociální sítě (Facebook). Průzkum byl vytvořen na základě výpovědi více než čtyřiceti uživatelů e-obchodování. Test dobré shody (chí-kvadrát test) a Fisher's exact test jsou použity k analyzování získaných dat tak, aby odpovídaly statistické významnosti. Za druhé je MADM (Rozhodování při mnohočetných vstupech) využit v této práci pro porovnání nejlepších otevřených softwarů z dostupných programů. Výsledek první části výzkumu ukazuje, že zde není žádná asociace mezi zabezpečením a zákazníkovou prioritou placení. Podobně i výsledek druhé části ukazuje, že Wordpress je vybrán nejlepším a jakožto kritérium bezpečnosti vysoce ceněným v otevřeném softwaru. Konečně můžeme říci, že většina uživatelů e-obchodování potřebuje online transakce, aby mohli nakupovat online, a je třeba, aby si rozmysleli, zda využívat bezpečný software a aplikace nebo ne. Doporučením může být, že by uživatel e-obchodování měl mít předchozí znalosti o online podvodech.

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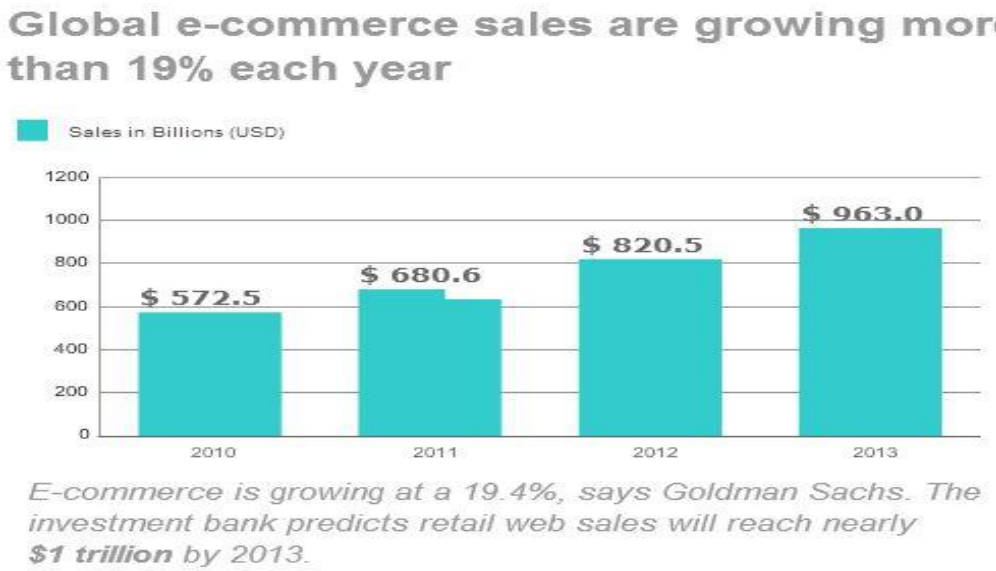
1 Introduction

Information Technology (IT) usually refers to the combination of computer hardware and software applications to manage data (Haigh, 2010). Protection of information and information system from unauthorized access, disruption, modification, recording or destruction is known as Information Security (Michael E. Whitman). Along with the development of Information Technology, there is also development in security threats. Security in general is the quality of state of being secure or in other words to be free from danger. Management Information Services (MIS) is responsible for the storage, protection, processing, transmission and retrieval of the information as required.

Globally e-commerce is growing; however, it comes with a risk that some part of the transaction is compromised which may lead to financial loss or unintended shared private information. It is therefore, the security of e-commerce transactions that is a critical part of the ongoing success and growth of e-commerce (Letvin). E-commerce is also becoming more prevalent as mobile devices are becoming extremely popular with over 298 million mobile device users and 30% of them will use their mobile device to purchase items on the internet (Gartner). Global e-commerce sales are growing at more than 19% per year. (Morgan, J, 2011)

Figure 1 E-commerce Growth



Source- (web1)

1.1 Objective and Methodology

The main objective of this thesis is to find out the current e-commerce user perception regarding online transaction and security issues in e-commerce from the user's perspective.
The partial objective of the study is also to characterize user's preferences in making online transaction and to analyze selected open source software and find out which one suits the best under given conditions.

Firstly, the research tries to find out current e-commerce user's perception. The social media Facebook has been applied for this purpose. The survey is made from 40+ e-commerce users. The data for the analysis are obtained from the survey of e-commerce users through SurveyMonkey.com webpage. Furthermore, the selection of security related questions is done from the survey. Hypothesis is created from the survey question no. 5 and question no. 8 that were chosen to make statistical analysis.

Secondly, MADM (Multiple Attribute Decision Making) is used in this thesis to compare the best open source software from the selective software. Similarly, AHP (Analytical Hierarchical Process) method is used to compare pair-wise and find which part of criterion attribute is most important for choosing any of the software. The analysis is made among Drupal, Wordpress and Joomla.

1.2 Hypothesis

H0= There is no association between security and consumers preference for spending
H1= There is an association between security and consumer preference for spending.

The Chi-squared test and Fisher's exact test are the effective methods for analyzing the obtained data to answer the statistical significance.

1.3 Literature review

Security in web applications is the most important issue of today, as vulnerable sites present a vector for both client side and server side attacks. The simple answer is that internet connects people to each other. The benefit of internet in the modern world is amazing, far-reaching and unstoppable in which it connects people together. The internet allows people to communicate with each other over vast distances, and across all kinds of boundaries that formerly made communication difficult or impossible. Using the internet, individuals are able to connect with each other to form and re-form group based on new and/or suppressed common interests.

The internet fosters new relationship and perhaps even more importantly new kinds of relationship. The kinds of far-reaching, causal relationship that people create using internet have never existed before on the scale, which they do now and in the future. These relationships will become more deeply connected in the business. The invention and spread of information technology changed the way of human society. The spread of the worldwide network changes the way human society deals with relationship. Almost, every single business and political institution on the planet will be eventually using the internet. The real question is how they will use it?

Every existing power structure in the world is facing the question of how to deal with the new technologies of information. Most people want to use these technologies to maintain and extend their existing powers. They are working as hard as they can do so. We have passed the point (if it ever existed) when the internet could be shut down. Existing institution are deeply committed to extending the reach of information networks, even as each group tried to shape those systems for their own benefit, and as newly connected people and group try to further their (previously un-connected) interests using the new technologies. (web2)

When the web became popular in the mid-1990s, many companies rushed to obtain an interactive presence. Many of these early web sites consisted of little more than a collection of static web pages, mostly containing marketing literature and product descriptions. To order any of the advertised products, we had to pick up the phone and call our orders in. (Gromov, 2012(updated))

It didn't take some business long, however, to see that they could easily sell products directly from their site. And, as well all know, a new business model electronic commerce (e-commerce) was born. It's one thing to allow a customer to purchase products on the web, but how can it help different company create personal interactions with customers? It is believed the goal of the next generation web sites will be to create the kind of sales interactions on the web that customers now experience face-to-face.

The first step toward deriving extra value from our web site is to understand the customer. It's usually expensive to advertise and create brand awareness to attract new customers to the company and significantly less so to obtain repeat business from existing customers. Too many companies focus on customer's satisfaction or acquiring new customers, rather than on foresting customer loyalty and relating existing, profitable customers. The key elements to creating customer loyalty in either a traditional or e-commerce business included knowing and anticipating the individual's needs, treating the customer as an individual, adding value to the relationship the customer has with different company, and having the right products and product attributes available at the right location and a the right place. (Krueger, 2006)

E-commerce follows the same basic principles as traditional commerce-that is, buyers and sellers come together to exchange goods for money. But rather than conducting business in the traditional way in stores and other "brick and mortar" buildings or through mail order catalogs and telephone operators, in e-commerce buyers and sellers transact business over networked computer.

E-commerce offers buyers convenience. Users can visit the World Wide Web (WWW) sites of multiple vendors 24 hours a day and seven days a week to compare between prices and make purchases from different suppliers, without having to leave their homes or offices. In some cases, consumers can immediately obtain a product or service, such as an electronic book, a music file, or computer software, by downloading it over the internet.

For sellers, e-commerce offers a way to cut costs and expand their markets. They do not need to build, staff, or maintain a store of print and distribute mail order catalogs. Automated order tracking and billing system cut additional labor costs, and if the product or service can be downloaded, e-commerce film has no distribution costs. Because they sell over the global internet, sellers have the potential to market their products or services globally and not limited by the physical location of a store. Internet technologies also permit sellers to track the interests and preferences of their customers with the customer's permission and then use this information to build an ongoing relationship with the customer by customizing products and services to meet the customer's need.

E-commerce also has some disadvantages. However, Consumers are reluctant to by some product online, furniture businesses for example, because customers want to test the comfort of an expensive item such as a sofa before they purchase it. Many people also consider shopping a social experience. For instance, they may enjoy going to a store or shopping all with friends or family that credit card transactions are secure and that their privacy is respected. (web3)

1.4 Types of E-commerce

A variety of business are conducted online, including retail businesses that sell products to consumer, service providers that sell services to consumers, auctioneers that create a marketplace for products and services, and business-to business commerce. Retail transactions make up the largest part of e-commerce. Consumers can find computers, automobiles, clothing, books, music, airline and event tickets, food, and just about anything else for sale on the internet. Different types of E-commerce

Table I Types of E-commerce

	Business	Consumer	Government
Business	B2B	B2C	B2G
Consumer	C2B	C2C	C2G
Government	G2B	G2C	G2G

From (Web 4)

1.4.1 Business-to-Business Transactions

Business-to-Business commerce represents one of the fastest growing segments of e-commerce. Business order supplies and coordinates complicated project electronically. For example, construction companies use e-commerce to order construction materials and coordinate the work of subcontractors. Before e-commerce, this work was conducted through telephone, facsimile, and regular mail. Subcontractors often lost time waiting for necessary parts to arrive or for another part of the project to be completed. With e-commerce, however, software can automatically track the inventories of manufactures and suppliers so that both have adequate supplies on hand and no longer need to have excess inventories. Reducing inventories enables both manufactures and suppliers to lower costs. The labor-intensive method of printing and then faxing or mailing purchase order can also be avoided because software can create purchase order and send them electronically.

1.4.2 Business to Costumer Transaction

Retail web sites typically include electronic catalogs that describe and display products for sale. Consumers can search for individual items or randomly browse electronic catalogs, some much larger than their mail order print counterparts. An internet book retailer, for example, can offer millions of different book titles for sale on its website, far more titles than could fit into a store or that could be included cost effectively in a print catalog.

Many online retailers allow customers to order products and then track the shipment of their order. Some computer manufacturers also allow consumers to choose different combinations of computer components, selecting the combination that best suits their budget and needs. Customers can then visit the company's web site to track the progress of their computer purchase as it is being built and shipped. Many online retailers also automatically notify their customers by e-mail when the product has been shipped.

1.4.3 Business to Government transaction

It is a kind of e-commerce in which business sells its services or products to government. For example, a government has a projects, it needs some material, so different companies fill the tender, and one of them gets contract from government. Then, that company will provide the material for the government project. If all these processes are taking place through websites, then it will be B2G e-commerce.

1.4.4 Costumer to Business transaction

This type of e-commerce transaction in which customers sells their products or services to businesses. For example advertisement that people put on different sites.

1.4.5 Costumer to Costumer transaction

It’s kind of e-commerce in which individual consumer sells its products to other consumer, through internet or computer network.

1.4.6 Costumer to Government transaction

It is the type of e-commerce in which consumer sells its products or services to government. If a person sells something to government through a website, then it can be C2G e-commerce.

1.4.7 Government to Business Transaction

It is type of e-commerce in which government sells its information or services to businesses. This process takes place on some special government websites. A business can get the business rules, permission for starting business and some other information. For example, if government sells the bankrupt a business firm to another business through a web site, it will be G2B e-commerce.

1.4.8 Government to Costumer Transaction

It is the type of e-commerce in which government sells its services or products directly to consumers, through computer network. For example, if a government sells its property to general public, through a website, it will be G2C e-commerce.

1.4.9 Service Transactions:

Other E-commerce businesses offer services. Financial services represent a large segment of e-commerce. For a small fee, online investment brokerages trade stocks on behalf of their clients. Online stock brokerages typically charge customers lower fees than traditional stock brokerages. Other sites provide consumers with a way to research and obtain mortgages and other loans online.

Travel sites offer a method of scheduling airline flights, renting carts, and booking hotel room. Travelers can plan all the details of their vacation or business trip, make reservations, and purchase tickets at the same site. Such sites also offer maps, travel literature, and booking information for travelers.

1.4.10 Overall Description

E-commerce is online electronic and online procurement management system that permits teams to compile online tender documentation, pre-qualifies, invite and receive closed bids with messaging, audit trails and worldwide 24x7 access using new web technologies.

Electronic commerce systems reduce procurement periods to days rather than weeks, providing significant improvements to current non-automated working practices. It is revolutionizing procurement and is likely to pave the way towards a change in contractual legislation, reducing errors, waste, time, risk and costs.

E-Commerce involves the use of electronic methods in every stage of the business process and helps to advertise different procurement processes. It is an efficient standardized simple process that reduces the cost, fast return of procurement. (htt1)

Figure 2 working mechanism of E-commerce

From (www.nationalmerchants.org/services/ecommerce.php)

2 Definition of E-commerce Security

E-commerce Security is a part of the Information Security framework and is specifically applied to the components that affect e-commerce that include Computer Security, Data security and other wider areas of the Information Security framework. E-commerce security has its own particular rules and is one of the highest visible security components that affect the end user through their daily payment interaction with business. The "E-commerce" term refers to online payment transaction between different kind of e-comerce transaction. (Niranjanamurthy M, 2013).

This is clear that electronic commerce will revolutionize businesses, and customers offered new and exciting services to costumer. As E-commerce businesses are increasingly growing, many secure technologies are being developed and implemented every day although, the recent internet security polices and technologies fail to meet the needs of end e-commerce users. The success or failure of an e-commerce operations hinges on myriad factors, including but not limited to the business model, the team, the customers, the investors, the product, and the security of data transmissions and storage. Any business that wants to have a competitive edge in today's global marketplace should adopt a comprehensive security policy in consultation with partners, suppliers, and distributors that will provide safe environment for the recent competative E-commerce user. (Al-Slamy, 2008)

2.1 Importance of study

E-commerce security is the collection of technologies, standards, policies and management practices that are applied to information to keep it secure. In today's high technology environment, organisations are becoming more and more dependent on their e-commerce security systems. The E-commerce users are increasingly concerned about the proper use of information, particularly personal data. The threats to E-commerce security systems from criminals and terrorists are increasing day by day. All organisations will identify information as an area of their operation that needs to be protected as part of their system of internal control (Turnbull, 2003). As people all over the globe are exponentially increasing for e-business, there is the increase of security threats so it is important to study about E-commerce security.

It is also important to be worried about e-commerce security because much of the value of a business is concentrated in the value of its information. Information is the basis of competitive advantage and in the not-for-profit sector, with increased public awareness of identity theft and the power of information; it is also, as Turnbull claims, the area of an organisation's operations that most needs control. Without information, neither businesses nor the not-for-profit sector could function. Valuing and protecting information are crucial tasks for the modern organisation.

2.2 Present e-commerce security condition.

In comparision e-commerce websites are increasingly common these days. Global Security Report that 20% of their incident response investigations related to e-commerce sites in 2012. This was up from 9% the year before. In Asia-Pacific, this figure is closer to 40%. In almost all of these cases the motive was simple - the theft of credit card data (web7).

E-commerce security is the collection of technologies, standards, policies and management practices that are applied to information to keep it secure. E-commerce security underpins the commercial viability and profitability of enterprises of all sizes and the effectiveness of public sector organisations. This unit begins by explaining why information security and its management are important for any modern organisation. The unit continues by examining the value that can be placed on information as an organisational asset. The protection of information assets is the subject of the Iso standard on information security management, and

the unit goes on to explain how an information security management system should be planned, documented, implemented and improved, according to the standard. This unit is based on readings from the book IT Governance: A Manager's Guide to Data Security & BS 7799/ISO 177799 (2nd edition) by Alan Calder and Steve Watkins (Kogan Page, 2003).

E-commerce is also konwn as a system that allows online movements buying , selling goods, information and services.

It also allows electronic movements that support revenue generation, such as promoting the demand for those goods and services and information. It also allows online customer operation service and sales support (web6).

Although, e-commerce security is more intangible but equally important benefit of information security which is creating the perception of trust. Obviously, trust is the most important component in the field of finance and of any successful brand. Customers will always be more willing to conduct business within an organization that they trust. The Internet has placed even more importance on trust across all. Therefore, this study demonstrates the ultimate value of trust in the ecommerce. Since, customers now do business in a much less personal manner, trust is an mechanism which can determine the financial value of the shareholders. E-commerce security also ensures the solution for its components of loss of competitive advantage, Identity theft Equipment theft Service interruption (e.g., e-mail and application). First, although a desirable benefit of an experimental design is the ability to isolate particular variables of interest and test for predicted effects, a weakness of such design is its inability to truly capture other dynamic processes at work within a complex business environment. Toward this end, after theoretically driven research models have been developed and tested, future research should employ other methods in order to provide a triangulation with the present findings. It is suggested that a survey and interview approach that targets both experienced and non-experienced potential consumers should be undertaken. An important outcome of such a research strategy should be the ability to contrast the attitudes, motivations, and intentions of experienced and less experienced consumers by the nature of the desired e-commerce relationship (high versus low relational customers).

3 Need of security in e-commerce

The CIA triad (confidentiality, integrity and availability) is one of the core principles of information security. Often, ensuring that the three facts of the CIA triad protected is an important step in designing any secure system. However, it has been suggested that the CIA triad is not enough. Alternative models such as the Parkerian hexad (Confidentiality, Possession or Control, Integrity, Authenticity, Availability and Utility) have been suggested. Other factors besides the three facts of the CIA triad are equally important in certain scenarios, such as non-repudiation. There have been debates over the pros and cons of such alternative models, but it is a post for another time. The explanations of core principles are as follows. (Hussain, 2013)

3.1 Confidentiality

Confidentiality means prevention of unauthorized access and discloser by an individual in the system. The card detail to be transmitted from buyer to seller and seller to transaction processing network is required a credit card transaction. The system attempts to enforce confidentiality by encrypting the card number during transmission, by limiting the places where it might appear (in databases, log files, backups, printed receipts, and so on), and by restricting access to the places where it is stored. If an unauthorized party obtains the card number in any way, a breach of confidentiality has occurred. It is necessary (but not sufficient) for maintaining the privacy of the people whose personal information a system holds. (Hussain, 2013)

3.2 Integrity

Integrity means maintaining and assuring the accuracy and consistency of data over its entire life-cycle. This means that data cannot be modified unauthorized or undetected. This is not the same thing as referential integrity in databases, although this can be viewed as a special case of consistency as understood in the classic model of transaction processing. Integrity is violated when a message is actively modified in transit. Information security systems typically provide message integrity in addition to data confidentiality.

3.3 Availability

For every information system in order to serve its purpose, the information must be available when it is needed. It means that the systems used to store and process the information, the security controls used to protect it, and the communication channels used to access it must be functioning accurately. High availability system aim to remain available at all times, preventing services disruptions due to power outages, hardware failure, and system upgrades. Ensuring availability also involves in preventing DOS attacks.

3.4 Recent cyber crime and e-commerce Security

Everyone using Internet should be aware of security issues. Mainly companies that make online transaction and collect customer data need to be especially careful. While much of the emphasis for ecommerce merchants is the protection of credit card information, in the age of big data and behavioral targeting, vendors collect a good deal of other information that is valuable to cyber criminals. (WEIGEL, 2011)

While cyber security is frequently associated with foreign espionage, 75 percent of security breaches are driven by financial motives, according to the Verizon's RISK Team's "2013 data Breach Investigations Report." (KAPLAN).

Cyber crime can get access to customer information in several ways mainly from data stored on the business network, and from the access to user physical components. The increasing use of modern devices for online transaction creates even more vulnerability because these electronic devices are not as secure and users are more prone to losing them.

Malware possibly infect an e-commerce merchant's server. Hackers utilize backdoors a programming tool that creates an undocumented method of gaining access to a network to allow repeated intrusions in the computer systems. Breaches get into undetected for months. Cyber security measures include installing a firewall that monitors incoming and outgoing network traffic, anti-virus software, intrusion detection and prevention of systems, and encryption encoding.

The increase in e-commerce and the rapid rise of the electronic device usage in e-commerce is not only bringing business benefit, but also increasing the threat of cyber crime as criminal organisations (and individuals alike) are exploiting its vulnerabilities for financial gain. The

numbers are staggering but are reportedly more than $388 billion globally per year attributed to cyber crime in general; and a large portion of that would be related to e-commerce. Vorizon has published that in 2011 over 174 million records where compromised with 95% of them involving personal information. (WEIGEL, 2011)

3.5 ISO STANDARDS

The International Organisation for Standardizations (ISO), established in 1947, is a non-governmental international body that collaborates with the International Electro technical Commission (IEC) and the International Telecommunication Union (ITU) on information and communications technology (ICT) standards. The following are commonly referenced ISO security standards:

1. ISO/IEC 27002:2005 (Code of Practice for Information System Management)

ISO/IEC 27002:2005 (replaced ISO/IEC 17799:2005 in April 2007) is an international standard which was originated from the BS7799-1; it was originally laid down by the British Standards Institute (BSI). ISO/IEC 27002:2005 refers to a code of practice for information security management, and is intended as a common basis and practical guideline for developing organisational security standards and effective management practices. (Myler, 2006)

Although, there are a number of information security standards available, an organization can only benefit if those standards are implemented properly. Security is something that all parties should be involved in. Senior management, information security practitioners, IT professionals and users all have an equal role to play in securing the assets of an organisation. The success of information security can only be achieved by full co-operation at all levels of an organisation, both inside and outside (web4).

3.6 An Overview of Information Security Standards

This standard compromise of guidelines and best practices recommendations for ten security domains these ten security domains are as follows:

Table II Overview of security domain

(1) Security policy
(2) Organisation of information security
(3) Asset management
(4) Human resources security
(5) Physical and environmental security
(6) Communications and operations management
(7) Access control
(8) Information systems acquisition, development and maintenance
(9) Information security incident management
(10) Business continuity management and compliance

Among these 10 security domains, a total of 39 control objectives and hundreds of best-practice information security control measures are recommended for organisations to satisfy the control objectives and protect information assets against threats to confidentiality, integrity and availability (An Overview of Information Security Standards).

4 Practical part

The respondents are presented with list of questions from very general questions to security related questions, the answer choice are in multiple format (appendix 1), so they have the option to choose the best result among multiple choice, from where its easy to analyze their perception regarding current overall e-commerce user and security issue.

4.1 Qualitative research

Qualitative research is made in order to fulfill the main goal of the thesis which is to find out the current e-commerce situation, how e-commerce users are secure with the e-commerce application?

Document is one of the principle sources of data in qualitative parts of the research. Similarly, qualitative research will be operated through interviews with representatives. This method is conducted in order to fulfill the aim of the thesis. For this purpose, Questionnaire method is selected. In order to find out problems of e-commerce security, 18 questions are selected and published in social media, It gives the psychological perception of different individual who are involved in the e-commerce business. This method is also known as sample and survey method. Therefore, to conduct the survey 40 + respondents are selected from various countries. The result from the answer will be helpful to analyze current state of security problem in e-commerce**.**

4.2 Survey Monkey

Survey Monkey is a web-based survey tool for conducting market research, capturing customer feedback and evaluating educational offerings. This allows users to define surveys and get responses from a variety of sources, including email, Facebook, Twitter, websites, blogs and banner advertisement. It exists with predefined survey templates for market, political or academic research, fundraising and customer satisfaction and includes fifteen question types (web3).

The questionnaire method will proceed from very general e-commerce introduction to the specific problem in security issues. Current e-commerce user perception on spending and different online frauds.

Questions description. Number 5

Do you feel comfortable to insert your card detail during online transaction?

Inserting card detail is the process of e-commerce transaction. When there asked to insert card detail everybody should think if it is appropriate to insert detail or not. This question is prepared to understand their perception if they feel comfortable or not when they are making online transaction.

Figure 3 Question description first

Answer Choices	Responses
yes	43.90%
No	56.10%
Total	

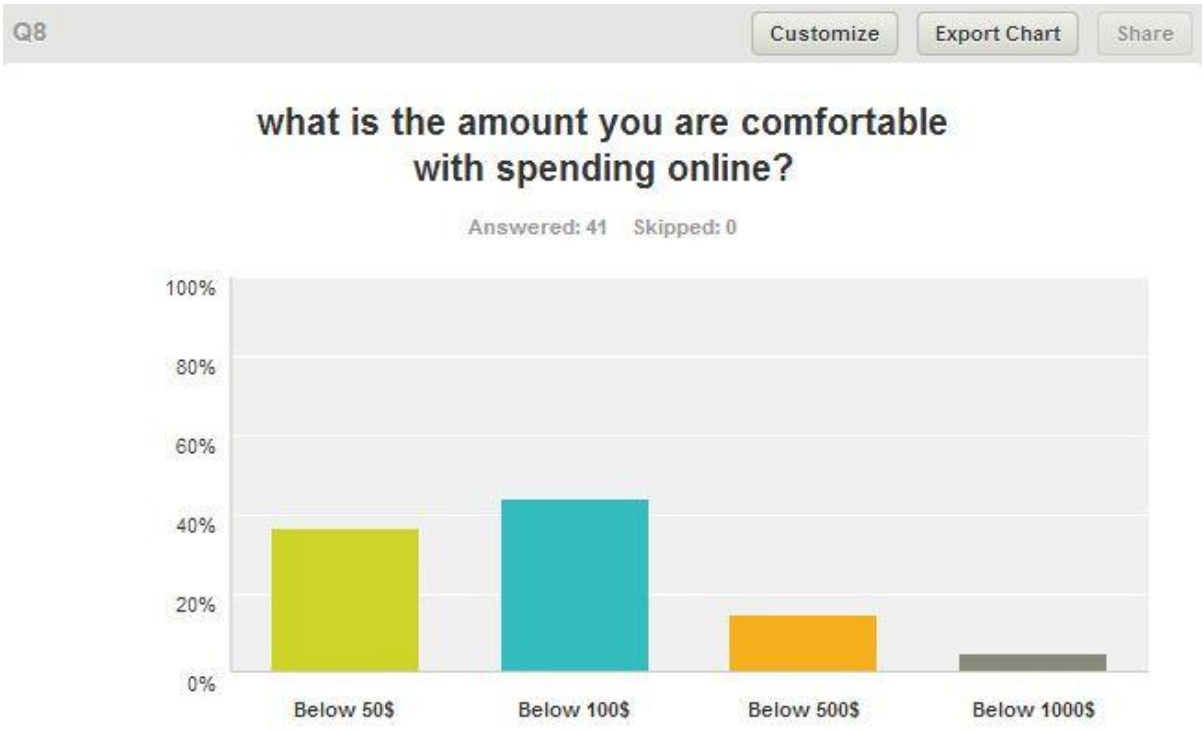
It shows 55%+ respondent don't feel comfortable to insert card detail.

Question description. Number 8

Making payment depends on the consumer's income, although some e-commerce user feel unsecure to spend lot of money via online. The reason can be security, they can take risk for small amount of money but doesn't make transaction for big amount via online.

From the survey mostly respondent who are in between 20-30 years specially student who don't have high income so they prefer to spend below 100 $.

Figure 4 Question Description second



Answer Choices	Responses
Below 50$	36.59%
Below 100$	43.90%
Below 500$	14.63%
Below 1000$	4.88%

From the graph maximum respondent are ready to make transaction below 100$.

4.3 Hypothesis

As far as it was made a survey between e-commerce users, the result doesnot answer everything, to find weather the result is significant, contingency table is made taking data from asked questions related with e-commerce security, if people feel secure to make online transaction. Below is the contengency table from the obtained fact.

This study tries to prove the respondent view how secure they feel to spend money via online. The related question from the survey were choosen. Question no 5 and question no. 8

Table III Data from respondent

	Respondents feel secure spending	Respondents feel unsecure Spending	Total
Less than 50 USD	6	4	10
Less than 100 USD	5	2	7
Less than 500 USD	5	5	10
Less than 1000 USD	2	11	13
Total	18	22	40

4.3.1 Chi Squire Test for Independence

Expected Value=Row total*Column total/ Overall total

Chi-Square Hypothesis test

H0= There is no association between security and consumers preference for spending

H1= There is an association between security and consumer preference for spending.

Number of degree of freedom (v) = (r-1)(c-1)=3*1=3

Level of significance = 5%

Critical value $\boldsymbol{X^2 = 7.816}$

Test statistic calculated from contingency table. Which include both the observed and expected value for the frequency of e-commerce user. The data is tabulated as the contribution from of each cell may be calculated directly and then the test statistics found as the sum of these contributions.

Test statistic =

$$\sum \frac{(\boldsymbol{O} - \boldsymbol{E})^2}{\boldsymbol{E}}$$

The observed and expected frequencies for each cell are transferred from previous table

Table IV Solution Table

Observation	E	(O-E)	$\frac{(\boldsymbol{O}-\boldsymbol{E})^2}{\boldsymbol{E}}$
6	4.5	1.5	0.375
4	5.5	-1.5	0.409091
5	3.15	1.85	1.086508
2	3.85	-1.85	0.0888961
5	4.5	0.5	0.055556
5	5.5	-0.5	0.045455
2	5.85	-3.85	2.533761
11	7.55	3.45	1.57649
		Total Sum	6.970821

Statistic 6.970821

Conclusion test stastic < cricital value therefore accept H0. There is no association between security and consumer preference for spendings.

4.3.2 Fisher's test

Fisher's exact test of independece was carried out on the data collected as the expected values for the test were smaller than 5 . After the calculate it was found that there is no significance in the relationship among the consumer behavior of spending and security concerns. Hence the the null hypothesis was accepted. P value was 0.56 with our P limit and 0.6.

This test was made possible from Online calculator http://vassarstats.net/fisher2x4.html

Result from Fisher's exact test (appendix 2)

4.3.3 Multiple Attribute Decision Making

The decision-maker sets the minimal attribute values (standard levels) he/she will accept for each attribute. Any alternative that has an attribute value less than standard level will be rejected (is not acceptable). This procedure is called conjunctive method. If the variant is accepted in the case at least one attribute is over or equal to standard level the method is called disjunctive. Decision making process is the selection of method or courses of action from different alternatives, acts such that it will produce optimal result under some criteria of optimization. (web5)

As defined by international society on Multiple Attribute Decision Making (MADM) is the study of method and procedure concerning multiple conflicting attributes which can be formally incorporated into the management planning process, Multiple Attribute Decision Making (MADM) includes following steps.

Setting Goal- A goal of a company or any particular individual (interest group) attempts to achieve.

Criteria identification- decision maker should determine the character of the analyzed problem. It's needed to confirm specifically those criteria to be thought- about and which of the decision- making ways are to be employed.

Open source software are most the famous in current e-commerce application plateform. This research is based on the criteria to be choosen for popular open source software i.e the best open source software from the selected softwares.

In order to know best way to choose the open source software the research is made based on the Multiple Attribute Decision Making among experts. The criteria were given in this format. The ranking given from 1-10. And from their view

Table V Software evaluation from Experts

Open source Softwares	Security	Performance	Commerce	Supports	Sys. Req
Drupal	6	7	4	8	9
Wordpress	7	8	7	9	5
Joomla	5	7	5	7	8
	Max	Max	Max	Max	Min

In Multiple Attribute Decision Making (MADM) process there are many methods for example

- Scoring or sequence methods
- Standard level methods
- Simple additive weighting method

Attributes must be measured in the same scale (here the scale is 1-10).

4.3.4 Selection and description of software

According to the objective of this thesis, these open source software are selected, it is because these software are most popular in current e-commerce applications. Wordpress, Joomla and Drupal are the three most popular content management systems (CMS) online. This all are open sources and built on PHP + MySQL. All of these vary significantly in terms of features, capability, flexibility and ease of use (MIKOLUK, 2013). Even though Wordpress, Joomla and Drupal are built on the same technology stack, they are different in features and capabilities. Above table shows the ranking scale among experts.

For instance, the standard method is selected to show which attribute plays important role in selection of the best open source software among different alternatives. To explain Standard level method given by expert is shown in the following table. According to the standard value (standard weight)

Table VI Standard value

Standard	7	8	7	9	5	
Softwares	Security	Performance	Commerce	Supports	System Req.	Total
Drupal	6	7	4	8	9	34
Wordpress	7	8	7	9	5	36
Joomla	5	7	5	7	8	32
	Max	Max	Max	Max	Min	

Wordpress got the exact criterian value as the standard weight and this is the application with standard score according to the expert. But to find out the exact evaluation on why expert chose wordpress as the best application data were analysed according to AHP (Analytic Hierarchy Process) (web2).

4.3.5 AHP (Analytic Hierarchy process)

AHP is one of the multiple criteria decision-making method that was originally developed by Prof. Thomas L. Saaty (1977). It provides measures of judgement, derives priorities among criteria and alternatives and simplifies preference ratings among decision criteria using pair wise comparisons.

Steps

1. Decomposing the decision-making issue into a hierarchy.
2. Making pair wise comparisons and establish priorities among the elements in the hierarchy.
3. Synthesise judgments in order to obtain the set of overall weights for achieving goal.

Analytical Hierarchy Process (AHP) Matrix to analyze open source software from the view of software experts.

Table VII AHP Solution

Criteria Observed	Security	Performance	Commerce	Support	System Req.
Security	1	7	7	8	8
Performance	0.142857143	1	7	8	8
Commerce	0.142857143	0.142857143	1	8	5
Support	0.125	0.125	0.125	1	9
System Req.	0.125	0.125	0.2	0.111111111	1
COL. TOTAL	1.535714286	8.392857143	15.325	25.11111111	31

Table VIII After Normalization

Criteria Observed	NORMALIZED SCORE Security	NORMALIZED SCORE Performance	NORMALIZED SCORE Commerce	NORMALIZED SCORE Supports	NORMALIZED SCORE System Req.	CUMULATIVE NORMALIZED SCORE OR ROW SUM	NORMALIZED PERCENTAGE OR PERCENT RATIO SCALE OF PRIORITY
Security	0.651162791	0.834042553	0.456769984	0.318584071	0.258064516	2.518623915	50.37247829
Performance	0.093023256	0.119148936	0.456769984	0.318584071	0.258064516	1.245590763	24.91181525
Commerce	0.093023256	0.017021277	0.065252855	0.318584071	0.161290323	0.655171781	13.10343561
Supports	0.081395349	0.014893617	0.008156607	0.039823009	0.290322581	0.434591162	8.691823244
System Req.	0.081395349	0.014893617	0.013050571	0.004424779	0.032258065	0.14602238	2.920447602
COL. TOTAL	1	1	1	1	1	5	

Normalized Percentage or percent ratio 50.37247829% of security mentioned by the data.

5 Result and discussion

Firstly, the survey was made among e-commerce users from fifteen different nationalities. Many of the respondent are between 20-30 years. 50% of the respondent are student and they are knowledgable about online transaction but they don‘t have high income. The result shows that null hypothesis is accepted and alternate hypothesis is rejected. It means that there is no association between security and consumers preference of spending. For this purpose, the following question were asked:

a) How secure they feel in inserting card detail during online transactions?
b) How many amount are you ready to spend via online transaction ?

The research finds out majority of the respondent feel unsecure even though result shows no relation between consumer preference and security.

Secondly, WordPress, Joomla and Drupal are built on the same technology stack and they are heavily different in features and capabilities. According to the expert, ranking of the software is different for each criteria . Among these software,wordpress is choosen best depending on standard method under MADM (Multiple Attribute Decision Making). Similarly, To find inter-relation between attribute,AHP method is used under pairwise comparision .

The result shows that Security (50%) is high among other attribute. So, We can strongly say to choose open source software , Security is the main reason. From the perspective of experts, wordpress is the best CMS (Content Management System), out of these three softwares.

6 Recommendation

From this finding for any of the e-commerce users, e-commerce sites are still unsecure to make online transaction unless knowing the secure way, compromising online fraud and privacy. However, in e-commerce there exist security risks. E-commerce user should have prior knowledge on online fraud. There will always be risks, but as the e-commerce world evolves, everybody should embrace this and keep the following basic security.

Table IX Secure way for e-commerce user

• Share with caution -Share only what is required
• Think before sharing devices
• Verify all URLs
• Question before you buy, save without question
• Keep Payment Methods Separate from Bank Accounts
• Use virtual credit cards as needed
• You only have one online Identity, to Protect It

7 Conclusion

With the ever increasing cyber threats and the rapid expansion of e-commerce globally, the security of the Internet and e-commerce in general will become more paramount. There are number of government, organizational and industry initiatives that assists in providing businesses and consumer's guidance which will help in addressing some of the risks.

As per the goal set in the main objective, this research finds that the e-commerce users are growing very rapidly in comparison to previous years. Because of the exponential growth in number of e-commerce users, there is increase in security threats inside e-commerce business transactions.

According to the first part of study, it shows that the majority of e-commerce users need online transaction for online shopping and they need to think twice whether they are using secure software application or not. The respondents' answers were that they feel unsecure for making online transactions. But from hypothesis we accept H_O, which means that there is no association between spending online and security. It is used for online shopping, ticketing, banking, e-bidding etc. From the obtained fact we can also conclude that there is no association between consumer's preference for spending and e-commerce security. It is true because many consumers prefer to purchase online because they wants to save time. From this survey, it is clear that the most of the e-commerce users feel secure online for spending below 100$.

In the second part of the study based on MADM (Multiple Attribute Decision Making) the experts evaluated several secure webpage platforms according to given criteria. The criteria of software are security, performance, commerce, supports and system requirement. The result is for any open source software, security is the most important part. As standard weight given by expert Wordpress is best among three selected open source software.

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9 Apendix

9.1.1 Questionnaire

1) How many percentage of population in the world do you think are computer literate?
   - A 0-25%
   - B 25-50%
   - C 50-75%
   - D 75-100%
2) How often are you involved in online transaction?
   - A Everyday
   - B Once a week
   - C Sometimes
   - D Never
3) Why do you purchase online instead of going to market?
   - A Consumption of Time
   - B Home Delivery facility
   - C Easy comparision of goods from home.
   - D To be a trustworthy of site
4) How much amount you spend in online purchasing in a week?
   - A 0-100$
   - B 100-500$
   - C 500-1000$
   - D 1000+
5) Do you feel comfortable to put your card detail when online transaction?
   - A yes
   - B No
6) How often you use to check you card number in second confirmation?
   - A sometimes
   - B always
   - C Never
   - D Depend upon transaction

7) What the main activities you used to do in E-commerece?
   A E-bidding
   B Online shopping
   C Online banking
   C Online ticketing
8) What amount below is comfortable for you to spend via online?
   A below 50$
   B Below 100$
   C Below 500$
   D Below 1000$
9) Have you got the right product which you wish to get via online?
   A Yes
   B No
10) Does the time for delivery used to be exact as they mention to be in online shipping ?
   A Yes
   B No
11) Have you ever been in online fraud?
   A Yes
   B No
12) what the first step you would do if they fraud you ?
   A Complain
   B Block
   C Never use online transaction again
   D Nothing
13) what would be the risk that in online transaction?
   A Phishing
   B Hacking
   C Fraud
   D Lost of card detail

14) Do you prefer to share your personal information via online ?

A Yes

B No

15) Which security problem would you like to address in E-commerce?

A Viruses

B Bug

C Trojan Horse

D Transaction with stranger

16) Have you ever faced the viruses problem during E-commerce transaction?

A Yes

B No

17) How often you use a user rating mechanism ?

A Once a week

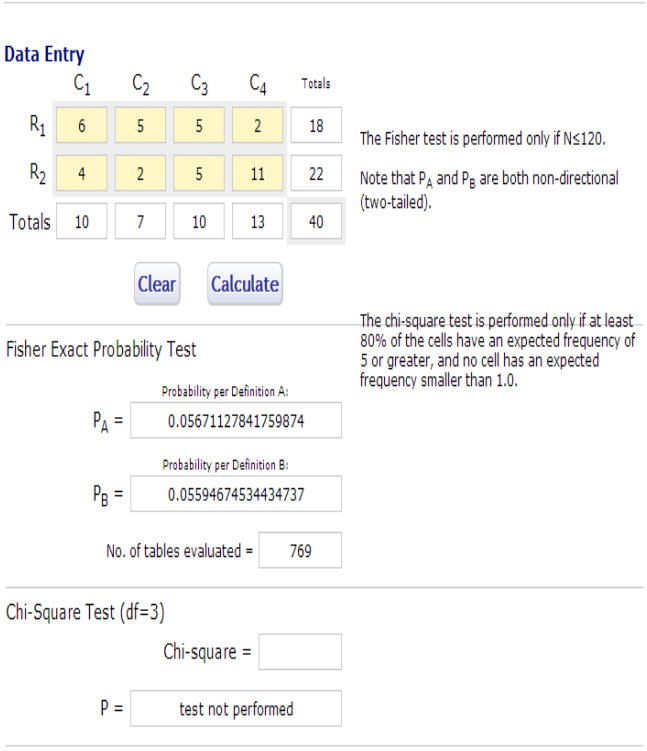
B Most often

C Always

D Never

9.1.2 Calculation for Fishers Test

Result from online calculator



Comparison of open source software (wordpress, joomla, Drupal) Based on security criteria model.

Open source software	Php requirement	Database	web server	Disk space
Drupal 8	5.4+	MySQL, MongoDB, MariaDB, PostgreSQL, SQLite, or Microsoft SQL Server	Apache, IIS, Lighttpd, Hiawatha, Cherokee or Nginx	15 mb
Wordpress 3.7	5.2	Mysql, PHP	Apache, Nginx	4.8 mb
Joomla 3.1	5.3.1+	Mysql, PostgreSQL	Apache, Nginx, MS IIS	50 mb

10 LIST OF ABBREVIATIONS

IT:	Information Technology
MIS	Management Information System
E-commerce:	Electronic Commerce
E-security:	Electronic Security
IS:	Information Security
GPL:	General Public License
IP:	Internet Protocol
HTML:	Hyper Text Markup Language
HTTP:	Hyper Text Transfer Protocol
PHP:	Hypertext Preprocessor
SQL:	Standard Query Language
XML:	Extensible Markup Language
MADM	Multiple Attribute Decision Model
AHP	Analytic Hierarchy Process