Chapter II

Literature Review and Theory

2.1 E-business

Electronic business (e-business) can be defined as the use of the internet to network and empower business processes, electronic commerce, organizational communication and collaboration within a company and with its customers, suppliers, and other stakeholders. E-businesses utilize the internet, intranets, extranets and other networks to support their commercial processes. Electronic commerce (e-commerce) is the buying and selling, marketing and servicing of products and services via computer networks. Since e-business includes the process of transacting with suppliers and customers there is an overlap in activities with e-commerce. Although the terms ‘e-business’ and ‘e-commerce’ are often used synonymously, the distinction between them lies in the broader range of processes in e-business that incorporates internal transactions within an organization. These include transactions relating to procurement, logistics, supply chain management, payments, stock control and order tracking. As Chaffey (2004) notes, e-commerce can best be conceived as a subset of e-business. Where the two concepts overlap is in the buying and selling of products and services.

Buy-side e-commerce refers to electronic transactions between a purchasing organization and its suppliers and sell-side e-commerce refers to electronic transactions between a supplier organization and its customers. [4]

2.1.1 E-business for customers and Companies

2.1.1.1 Convenience to the Customer

Every product is at the tip of your fingers on the internet, literally. Type in the product you are looking for into your favorite search engine and every option will appear in a well-organized list in a matter of seconds.

Side by side comparisons are readily available and easy to do. When products are placed online, they come with all the specifics, and they
want you to compare them with others, know they have the best options and come back for more!

The customer base is every business’s main concern, online or off. When online, a business doesn’t have to worry about getting the best property in town, people from around the world have access to their products and can come back at any time.

If it's snowing and the roads are closed, or it’s too hot and humid to even step outside in the summer, or a holiday that every store in town closes, your online business is open for consumers 24/7 every day of the year. The doors never close and profits will keep rising.

With a little research, every business can set up recurring payments. Find the provider that best suits your needs and billing will be done in a consistent manner; payments will be received in the same way.

Because the competition is high, companies’ online want you to look at other consumer reviews. Good and bad reviews are on every site, not only can you see if the product is liked, you can also see the reasons behind the thumbs up or down. [5]

2.1.1.2 Saving the Time and Transaction

With E-business there is no driving in circles while looking and digging in hopes of finding what you need. Stores online offer their full line as well as use warehouses instead of store fronts—products are easy to locate and can be delivered to your door in just days.

A great tool on the internet is…translation! A business online does not have to make a site for every language. With the right marketing, every consumer around the globe can find the business site, products and information without leaving home.

Without driving from store to store the consumer can easily compare and contrast products. See who offers the best pricing and have more
options to choose from. While a physical store has limited space, the same store on the internet will have full stock.

With E-business there is no more waiting for the check to clear or a 30-day wait for certain other types of payment. Transactions are cleared immediately or at most two to three days for the money to clear through the banking system. [1]

2.1.1.3 Loyalty for the Customers

With every online business wanting you, more and more coupons and deals can’t be avoided, which are totally great for customers. With major sites that act as department store, you may find items up to 80% off. Take advantage of the competition and find the best price available. [1]

2.1.1.4 More Benefit of E-business

By not managing a storefront, any business will have more sales online with a higher profit margin. They can redistribute money to make the consumer shopping experience faster and more efficient. While being available to international markets, more products will sell. [5]

2.1.2 Shopping Cart

Shopping cart software keeps track of what the user selects to buy from the website before proceeding to the “checkout”. An online shopping cart consists of three parts:

✓ Product Catalogue
✓ Shopping List
✓ Checkout System

The product catalogue is made up of all the information needed to present any product to the customer and to complete a sales transaction online. Information to be included in the product database generally includes the price, identification number (SKU), image or other multimedia information, product options or choices. A shopping list (i.e. list of selected products) allows users
to track the items they want to purchase. A shopping cart image is generally
used to show what items the shopper has selected for purchase. In order for the
shopping cart to function properly the user’s computer must be set to allow
“cookies”. The checkout system allows customers to select products by clicking
an “add items to cart” butt [2]

2.2 Business to Customer (B2C)

The worldwide expansion of the internet should be considered an integral
part of any country’s economy as the world has been revolutionized by technology
and the near future is e-commerce and e-business. The increasing confidence and
trust in engaging in purchasing online are a source of initiatives to support the
development of the digital global economy. [6]

According to a report by the Interactive Media in Retail Group (IMRG, 2014),
ecommerce statistics reveal a staggering rate at which this industry is
developing as globally, the sales of B2C e-commerce accounted for more than US
1.2 trillion dollars in 2013. Currently 40% of the worldwide internet users have
bought products online through mobiles, computers, tablets or other devices. This
coins the total number of Internet users to be 3.5 billion from around 2.2 billion at
the end of 2012 (UNCTAD 2014). Mobile commerce which is an extension of
ecommerce to smart phones is another trend to study in terms of e-commerce facts
and figures. In 2013, US mobile revenue amounted to approximately 38 billion
dollars (Satista, 2015). The US claims to be the world’s single biggest e-commerce
market according to IMRG (2014), followed by the United Kingdom and Japan.
IMRG predicts that growth rates in these countries will be nearly 10-15% annually.
However, China’s e-commerce sale is currently experiencing a growth of more than
130%. It is supposed to be only a matter of time, when this Asian giant becomes
the largest single market in the world superseding US, UK and Japan. In terms of
regions, Europe has the upper hand as it currently stands to be the largest e-
commerce market in the world. According to a report by (European MultiChannel
and Online Trade Association, 2014), European B2C e-commerce sales posted an
estimated 307 billion USD in 2011 which helped them to surpass the North America
which accounted for 297 billion USD. IMRG (2014) also argued that Italy, France, Russia, Turkey, Spain and Poland the fastest-growing markets in European region.

2.3 Website

A website is a collection of related web pages, including multimedia content, typically identified with a common domain name, and published on at least one web server. A website may be accessible via a public Internet Protocol (IP) network, such as the Internet, or a private local area network (LAN), by referencing a uniform resource locator (URL) that identifies the site. [7]

Websites have many functions and can be used in various fashions; a website can be a personal website, a commercial website for a company, a government website or a non-profit organization website. Websites are typically dedicated to a particular topic or purpose, ranging from entertainment and social networking to providing news and education. All publicly accessible websites collectively constitute the World Wide Web, while private websites, such as a company's website for its employees, are typically a part of an intranet. [7]

Web pages, which are the building blocks of websites, are documents, typically composed in plain text interspersed with formatting instructions of Hypertext Markup Language (HTML, XHTML). They may incorporate elements from other websites with suitable markup anchors. Web pages are accessed and transported with the Hypertext Transfer Protocol (HTTP), which may optionally employ encryption (HTTP Secure, HTTPS) to provide security and privacy for the user. The user's application, often a web browser, renders the page content according to its HTML markup instructions onto a display terminal. [7]

2.3.1 HTTP

The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. HTTP has been in use by the World-Wide Web global information initiative since 1990. HTTP is a generic and stateless protocol which can be used for other purposes as well using extensions of its request methods, error codes, and headers. The first version of HTTP, referred to as HTTP/0.9, was a simple
protocol for raw data transfer across the Internet. HTTP/1.0, as defined by RFC 1945, improved the protocol by allowing messages to be in the format of MIME-like messages, containing metainformation about the data transferred and modifiers on the request/response semantics. However, HTTP/1.0 does not sufficiently take into consideration the effects of hierarchical proxies, caching, the need for persistent connections, or virtual hosts. In addition, the proliferation of incompletely-implemented applications calling themselves “HTTP/1.0” has necessitated a protocol version change in order for two communicating applications to determine each other’s true capabilities. [8]

2.3.2 Web Server

A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer to the entire system, or specifically to the software that accepts and supervises the HTTP requests. Web servers allow you to serve content over the Internet using the Hyper Text Markup Language (HTML)

2.4 Programming Language

A programming language is a formal language that specifies a set of instructions that can be used to produce various kinds of output. Programming languages generally consist of instructions for a computer. Programming languages can be used to create programs that implement specific algorithms.

2.4.1 HTML

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS), and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a webserver or from local storage and render them into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document. [9]
HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects, such as interactive forms may be embedded into the rendered page. It provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items. HTML elements are delineated by tags, written using angle brackets. Tags such as <img /> and <input /> introduce content into the page directly. Others such as <p>...</p> surround and provide information about document text and may include other tags as sub-elements. Browsers do not display the HTML tags, but use them to interpret the content of the page. [9]

HTML can embed programs written in a scripting language such as JavaScript which affect the behavior and content of web pages. Inclusion of CSS defines the look and layout of content. The World Wide Web Consortium (W3C), maintainer of both the HTML and the CSS standards, has encouraged the use of CSS over explicit presentational HTML since 1997. [9]

2.4.2 CSS

Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable. CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images or colors are used, as well as a variety of other effects. CSS is easy to learn and understand but it provides a powerful control over the presentation of an HTML document. Most commonly, CSS is combined with the markup languages HTML or XHTML. [9]

CSS is designed primarily to enable the separation of document content from document presentation, including aspects such as the layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple HTML pages to share formatting by specifying the relevant CSS in
a separate .css file, and reduce complexity and repetition in the structural content. Separation of formatting and content makes it possible to present the same markup page in different styles for different rendering methods, such as on-screen, in print, by voice (via speech-based browser or screen reader), and on Braille-based tactile devices. It can also display the web page differently depending on the screen size or viewing device. Readers can also specify a different style sheet, such as a CSS file stored on their own computer, to override the one the author specified. Changes to the graphic design of a document (or hundreds of documents) can be applied quickly and easily, by editing a few lines in the CSS file they use, rather than by changing markup in the documents. The CSS specification describes a priority scheme to determine which style rules apply if more than one rule matches against a particular element. In this so-called cascade, priorities (or weights) are calculated and assigned to rules, so that the results are predictable. The CSS specifications are maintained by the World Wide Web Consortium (W3C). Internet media type (MIME type) text/css is registered for use with CSS by RFC 2318 (March 1998). The W3C operates a free CSS validation service for CSS documents. [9]

2.4.3 PHP

PHP is a programming language for building dynamic, interactive Web sites. As a general rule, PHP programs run on a Web server, and serve Web pages to visitors on request. One of the key features of PHP is that you can embed PHP code within HTML Web pages, making it very easy for you to create dynamic content quickly. PHP is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. Originally created by Rasmus Lerdorf in 1994, the PHP reference implementation is now produced by The PHP Development Team. PHP originally stood for Personal Home Page, but it now stands for the recursive acronym PHP: Hypertext Preprocessor. [10]

PHP code may be embedded into HTML code, or it can be used in combination with various web template systems, web content management systems and web frameworks. PHP code is usually processed by a PHP
interpreter implemented as a module in the web server or as a Common Gateway Interface (CGI) executable. The web server combines the results of the interpreted and executed PHP code, which may be any type of data, including images, with the generated web page. PHP code may also be executed with a command-line interface (CLI) and can be used to implement standalone applications. The standard PHP interpreter, powered by the Zend Engine, is free software released under the PHP License. PHP has been widely ported and can be deployed on most web servers on almost every operating system and platform, free of charge. The PHP language evolved without a written formal specification or standard until 2014, leaving the canonical PHP interpreter as a de facto standard. Since 2014 work has gone on to create a formal PHP specification. [10]

2.4.4 JavaScript

JavaScript is a lightweight, interpreted programming language. It is designed for creating network-centric applications. It is complimentary to and integrated with Java. JavaScript is very easy to implement because it is integrated with HTML. It is open and cross-platform. A JavaScript program consists of statements and expressions formed from tokens of various categories, including keywords, literals, separators, operators, and identifiers placed together in an order that is meaningful to a JavaScript interpreter, which is contained in most web browsers. [11]

JavaScript is a high-level, dynamic, untyped, and interpreted programming language. It has been standardized in the ECMAScript language specification. Alongside HTML and CSS, JavaScript is one of the three core technologies of World Wide Web content production; the majority of websites employ it, and all modern Web browsers support it without the need for plug-ins. JavaScript is prototype-based with first-class functions, making it a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles. It has an API for working with text, arrays, dates and regular expressions, but does not include any I/O, such as networking, storage, or graphics facilities, relying for these upon the host environment in which it is embedded. [11]
Although there are strong outward similarities between JavaScript and Java, including language name, syntax, and respective standard libraries, the two are distinct languages and differ greatly in their design. JavaScript was influenced by programming languages such as Self and Scheme. [11]

JavaScript is also used in environments that are not Web-based, such as PDF documents, site-specific browsers, and desktop widgets. Newer and faster JavaScript virtual machines (VMs) and platforms built upon them have also increased the popularity of JavaScript for server-side Web applications. On the client side, developers have traditionally implemented JavaScript as an interpreted language, but more recent browsers perform just-in-time compilation. Programmers also use JavaScript in video-game development, in crafting desktop and mobile applications, and in server-side network programming with run-time environments such as Node.js. [11]

### 2.5 Database

Database is a collection of information stored in the computer in a systematic way so that it can be checked using a computer program to obtain information from the database. The software used to manage and call the query of database called database management system (DBMS). Database systems are studied in information science. The basic concept of the database is a collection of records, or pieces of knowledge. A database has a structured description of the type of facts that are stored in it: this description called scheme. Scheme describes the object that represented a database, and the relationships between these objects. There are many ways to organize the scheme, or model the database structure; these are known as database models or data models. The model commonly used right now is the relational model, which according to layman's terms represents all information in the form of tables that are interconnected where each table consists of rows and columns (the true definition uses mathematical terminology). In this model, the relationship between tables is represented by using the same values between tables.

A database is an integrated collection of logically related records or files consolidated into a common pool that provides data for one or more multiple uses. The collected information could be in any number of formats (electronic, printed,
phpMyAdmin is a free and open source tool written in PHP intended to handle the administration of MySQL or MariaDB with the use of a web browser. It can perform various tasks such as creating, modifying or deleting databases, tables, fields or rows; executing SQL statements; or managing users and permissions.

### 2.5.1 DBMS
A database management system (DBMS) is a computer software application that interacts with the user, other applications, and the database itself to capture and analyze data. A general-purpose DBMS is designed to allow the definition, creation, querying, update, and administration of databases. Well-known DBMSs include MySQL, PostgreSQL, MongoDB, MariaDB, Microsoft SQL Server, Oracle, Sybase, SAP HANA, MemSQL and IBM DB2. A database is not generally portable across different DBMSs, but different DBMS can interoperate by using standards such as SQL and ODBC or JDBC to allow a single application to work with more than one DBMS. [12]

A Database Management System (DBMS) consists of software that organizes the storage of data. A DBMS controls the creation, maintenance, and use of the database storage structures of organizations and of their end users. It allows organizations to place control of organization-wide database development in the hands of Database Administrators (DBAs) and other specialists. In large systems, a DBMS allows users and other software to store and retrieve data in a structured way. [12]

### 2.5.2 MYSQL
MySQL is an open source relational database management system (RDBMS) based on Structured Query Language (SQL). MySQL runs on virtually all platforms, including Linux, UNIX, and Windows. Although it can be used in a wide range of applications, MySQL is most often associated with web-based applications and online publishing and is an important
component of an open source enterprise stack called LAMP. LAMP is a Web
development platform that uses Linux as the operating system, Apache as the
Web server, MySQL as the relational database management system and PHP
as the object-oriented scripting language. (Sometimes Perl or Python is used
instead of PHP.)

phpMyAdmin is a free and open source tool written in PHP intended to handle
the administration of MySQL or MariaDB with the use of a web browser. It
can perform various tasks such as creating, modifying or deleting databases,
tables, fields or rows; executing SQL statements; or managing users and
permissions.

![Database Management System](image)

**Figure 2. Database Management System**

### 2.6 Unified Modeling Language (UML)

#### 2.6.1 Use Case Diagram

A use case illustrates a unit of functionality provided by the system. The main purpose of the use-case diagram is to help development teams visualize the functional requirements of a system, including the relationship of "actors" (human beings who will interact with the system) to essential processes, as well as the relationships among different use cases. Use-case diagrams generally show groups of use cases -- either all use cases for the complete system, or a breakout of a particular group of use cases with related functionality (e.g., all security administration related use cases). To show a use case on a use-case diagram, you draw an oval in the middle of the diagram and put the name of the use case in the center of, or below, the oval. To draw an actor (indicating a system user) on a use-case diagram, you draw a stick person to the left or right of your diagram (and just in case you're wondering, some people draw prettier stick people than others). Use simple lines to depict relationships between actors and use cases, as shown in Figure 2.2 below. [13]
2.6.2 Class Diagram

The class diagram shows how the different entities (people, things, and data) relate to each other; in other words, it shows the static structures of the system. A class diagram can be used to display logical classes, which are typically the kinds of things the business people in an organization talk about -- rock bands, CDs, radio play; or loans, home mortgages, car loans, and interest rates. Class diagrams can also be used to show implementation classes, which are the things that programmers typically deal with. An implementation class diagram will probably show some of the same classes as the logical classes diagram. The implementation class diagram won't be drawn with the same attributes, however, because it will most likely have references to things like Vectors and Hash Maps. A class is depicted on the class diagram as a rectangle with three horizontal sections. The upper section shows the class's name; the middle section contains the class's attributes; and the lower section contains the class's operations (or "methods"). [13]
2.6.3 Sequence Diagram

Sequence diagrams show a detailed flow for a specific use case or even just part of a specific use case. They are almost self-explanatory; they show the calls between the different objects in their sequence and can show, at a detailed level, different calls to different objects. A sequence diagram has two dimensions: The vertical dimension shows the sequence of messages/calls in the time order that they occur; the horizontal dimension shows the object instances to which the messages are sent. A sequence diagram is very simple to draw. Across the top of your diagram, identify the class instances (objects) by putting each class instance inside a box (see Figure 2.3). In the box, put the class instance name and class name separated by a space/colon/space " : " (e.g., myReportGenerator : ReportGenerator). If a class instance sends a message to another class instance, draw a line with an open arrowhead pointing to the receiving class instance; place the name of the message/method above the line. Optionally, for important messages, you can draw a dotted line with an arrowhead pointing back to the originating class instance; label the return value above the dotted line. Personally, I always like to include the return value lines because I find the extra details make it easier to read. Reading a sequence diagram is very simple. Start at the top left corner with the "driver" class instance that starts the sequence. Then follow each message down the diagram. Remember: Even though the example sequence diagram in Figure 4 shows a return message for each sent message, this is optional. [13]
2.7 Black Box Testing

Black Box Testing, also known as Behavioral Testing, is a software testing method in which the internal structure/designimplemetation of the item being tested is not known to the tester. These tests can be functional or non-functional, though usually functional.

This method is named so because the software program, in the eyes of the tester, is like a black box; inside which one cannot see. This method attempts to find errors in the following categories: [14]
• Incorrect or missing functions
• Interface errors
• Errors in data structures or external database access
• Behavior or performance errors
• Initialization and termination errors

**Definition by ISTQB**

- **black box testing:** Testing, either functional or non-functional, without reference to the internal structure of the component or system.
- **black box test design technique:** Procedure to derive and/or select test cases based on an analysis of the specification, either functional or non-functional, of a component or system without reference to its internal structure.

**EXAMPLE**

A tester, without knowledge of the internal structures of a website, tests the web pages by using a browser; providing inputs (clicks, keystrokes) and verifying the outputs against the expected outcome.

**LEVELS APPLICABLE TO**

Black Box Testing method is applicable to the following levels of software testing:

- Integration Testing
- System Testing
- Acceptance Testing

The higher the level, and hence the bigger and more complex the box, the more black box testing method comes into use.

**BLACK BOX TESTING TECHNIQUES**
Following are some techniques that can be used for designing black box tests.

- *Equivalence partitioning*: It is a software test design technique that involves dividing input values into valid and invalid partitions and selecting representative values from each partition as test data.
- *Boundary Value Analysis*: It is a software test design technique that involves determination of boundaries for input values and selecting values that are at the boundaries and just inside/ outside of the boundaries as test data.
- *Cause Effect Graphing*: It is a software test design technique that involves identifying the cases (input conditions) and effects (output conditions), producing a Cause-Effect Graph, and generating test cases accordingly.

**BLACK BOX TESTING ADVANTAGES**

1) Tests are done from a user’s point of view and will help in exposing discrepancies in the specifications.
2) Tester need not know programming languages or how the software has been implemented.
3) Tests can be conducted by a body independent from the developers, allowing for an objective perspective and the avoidance of developer-bias.
4) Test cases can be designed as soon as the specifications are complete.

**BLACK BOX TESTING DISADVANTAGES**

- Only a small number of possible inputs can be tested and many program paths will be left untested.
- Without clear specifications, which is the situation in many projects, test cases will be difficult to design.
- Tests can be redundant if the software designer/ developer has already run a test case.
- Ever wondered why a soothsayer closes the eyes when foretelling events? So is almost the case in Black Box Testing. [14]