

Testing Quality Web-Application E-commerce BookCorner Using ISO 9126

Kevin Christianto, Devi Yurisca Bernanda, Francka Sakti Lee, Johannes Fernandes Andry, Nadia Natalia Karepowan

Abstract—Currently, e-commerce is one of the promising businesses that the public often engages in. E-commerce is the activity of the process of buying and selling products electronically. In e-commerce, the entire trading process, starting from the process of ordering products, exchanging data, to transferring funds is done electronically. E-commerce is included in the part of e-business, where the scope of e-business is broader, not only for commerce, but also collaboration between business partners, job vacancies, customer service, and so on. E-commerce is also included in Web Based Applications (WBA). By using e-commerce, of course, transactions in e-commerce are not affected by time and place, and can be done at any time. Therefore, e-commerce must be checked in terms of quality first to become a reference in developing Web-Based Applications (WBA), and its quality is guaranteed. In this study, a quality test was conducted using the ISO 9126 model, because ISO 9126 is an international standard for evaluating software quality. In the ISO 9126 standard, there are 6 aspects of testing, namely function, usability, efficiency, maintenance, and portability. By using ISO 9126 we can measure the aspects of function, usability, efficiency, maintenance, and portability so as to ensure the quality of e-commerce runs well or not. In addition, this study uses black-box testing to test whether the application runs well or not.

Keywords—Web-Based Application; E-Commerce; ISO 9126.

I. INTRODUCTION

The Web has had a significant on all aspects of our society, from business, education, government, entertainment sectors, industry, to our personal lives. The advantages of using the Web to develop software products are (1) no application installation costs, (2) automatic application upgrade with new features for all users, (3) universal access from any machine connected to the Internet, and (4) independent of client operating systems. [1].

Web Services technology is based on service-oriented computing concepts. Web services are integrating web-based applications through connected and shared business processes across a network where applications from

different vendors, languages, and platforms communicate with each other and with clients. Web applications refer to web-based applications that can be accessed via a Web browser via an internet network and are developed using a browser-supported language (e.g., HTML, JavaScript). To be executable, web applications depend on the Web browser and include many applications. The adoption of an application-based web infrastructure can provide important processes such as money transfer and updating of product price information data. In Web engineering, the need for a methodology is demonstrated for developing Web services. In this case, Web Services has provided useful tools for developing and implementing business processes, for example, the Web Service Description Language (WSDL) and Business Process Execution Language (BPEL) [2].

Web applications allow information functions to be started from a great distance from the browser and run partly on web servers, server applications, and / or server-based data. Web applications are applications that are created and designed from the start to be operated or run in a web-based environment. This apparently trivial definition reveals two very important aspects of such an application [3]:

1. Web-based application is designed to run in a Web-based environment. Which means that in the aspects of hypermedia, hypertext and multimedia combined with traditional application logic must consider the application life cycle, which makes it different from conventional applications.
2. A Web application is an application-based web programming, not just a collection of Web pages. Even Web services that dynamically generate pages cannot be considered Web applications. Try think for example of a timetabled service that, given desired departure and destination times and places, returns a set of pages containing the available trains and connections. In this case, there is no need for the service to maintain the notion of the session which means that this is not a Web application, but just a Web-based service.

Electronic commerce is a business in information technology is used to increase sales, business efficiency, and provide a basis for new products and services [4]. In order to understand the concept of e-commerce, it is important to be able to identify the different terms used and to access the origin and usage of e-commerce [5].

There are many different types of electronic commerce and many different methods to characterize this group. The main different classification of electronic commerce is [6]:

1. B2B e-commerce refers to business selling goods and

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services to other businesses. Type of this e-commerce based on market volume. It is ten times larger than the size of B2C e-commerce [7].

2. B2C e-commerce uses the Internet as a retail market channel and in the case of information, as a .product or service delivery channel [8] .
3. C2C e-commerce permits individuals to come together to buy and sell goods/services through the use of information technology. C2C e-commerce is becoming more commonplace [9].
4. Mobile Commerce is used to buy and sell goods by using wireless devices like mobile phones and other handheld devices have Internet access [10]

Several categories of web applications can be seen in table 1.

Table 1 Categories of Web Applications [11]

Category	Example
Information	Electronic newspapers, catalog, newsletter, guide service manuals, classified, e-books.
Interactive	Registration form, customized information, games.
Transaction	E-shopping, ordering goods and services, banking.
Workflow	scheduling and planning system, inventory system, system monitoring.
Collaborative work environments	Distributed writing system, collaborative design tools.
The online community, Marketplace	Group chat, recommended products, markets, auctions.
Web portals	Electronic shopping malls, intermediaries.
Web services	Enterprise applications, information, and business intermediaries.

With the turmoil and the large increase in the development of Web-Based Applications (WBA), it is not surprising that the interest in developing high-quality Web-Based Applications (WBA) is increasing. Develop Web-Based Application (WBA) is more complicated than simple HTML web pages and consider different views through developing them [12].

Web-Based Application Quality (WBA) is a difficult property to define and capture in an organized manner. Of course, it is very clear that Web Based Application (WBA) is more important. What is not clear is: what factors reflect the quality of a Web-Based Application (WBA)? And how can we deal with high-quality Web Based Application (WBA) development? [13].

Testing is the process of running or executing a program with the main objective of detecting bugs or errors in the application. The right testing technique is not only clever at errors, it also supports us to uncover all the errors that have never happened before [14].

Testing in this study was conducted using ISO 9126 to evaluate the quality for e-commerce websites. ISO 9126 standards are used to evaluate software quality. This standard focuses on six factors namely efficiency, maintenance, reliability, portable, functional and usability. and all of them have their own specifications that can

evaluate the quality of any website for best performance [15].

This paper is structured as follows. In part 2 of the literature review, the theory presented is information about Software Quality, ISO 9126 definition, ISO 9126 model, and ISO 9126 characteristics. In Part 3 of the methodology, ISO 9126 is used as a method for evaluating the quality of software that will be tested to obtain quality results. software using iso 9126. In Section 4 the results and discussion are a report of the results of research using ISO 9126 against the BookCorner website that was tested. In Section 5 the conclusions are the results of the research.

II. RELATED LITERATURE AND STUDIES

The literature review section provides information on Software Quality, ISO 9126 definitions, ISO 9126 models, and ISO 9126 characteristics.

A. Software Quality

Quality consists of several important factors and features of a product related to the requirements given. The totality of features and factors of software products that support the ability to meet certain needs [16]. Quality in software products can be defined as 1) the extent to which systems, components, or processes meet certain requirements and 2) the extent to which systems, components, or processes meet the needs or expectations of users [17]. Software Quality can be categorized into functional and nonfunctional SQ. Functional Software Quality includes software features and specifications identified at each early stage, while non-functional Software Quality involves features that support functional requirements (FR) in software, namely software services [18]. The quality of the software can be seen through a certain size and size, as well as the software. One of the benchmarks for software quality is ISO / IEC 9126 [19].

Quality in software products can be defined as 1) the extent to which systems, components, or processes meet certain requirements and 2) the extent to which systems, components, or processes meet the needs or expectations of users [17].

So, we chose the ISO / IEC-9126 model as a reference frame for measuring the quality of our software products, namely the e-commerce BookCorner [20].

B. The ISO 9126

ISO stands for International Standard Organization is a world international standardization organization that functions to regulate standardization [21]. ISO (The International Organization for Standardisation) was founded in 1946, London, Britania Raya in order to facilitate international trade, international coordination, and unification of industrial standards by providing standards that would be recognized (Praxiom Research Group) [22]. The standard ISO 9126 developed by ISO JTC1 SC7 is divided into four parts[23]:

1. ISO / IEC 9126-1: Quality models. This section recommends a quality model that contains important characteristics for the final product. Quality sub

characteristics and attributes enhance the quality model and can be internal or external quality attributes.

2. ISO / IEC 9126-2: External metrics. This section recommends external quality metrics that are useful for measuring software quality characteristics applicable to software that can be executed during testing or operation at a later stage of development and after entering the operating process.
3. ISO / IEC 9126-3: Internal metrics. This section recommends internal quality metrics that are useful for measuring software quality characteristics applicable to non-executable software during design and coding in the early stages of the development process.
4. ISO / IEC 9126-4: Quality used metrics. This section recommends quality metrics for use measuring software quality characteristics that apply to software that can be executed after entering an operating process.

Other ISO standards related to or that can be used or used in connection with ISO / IEC 9126 and ISO / IEC 14598, are [24]:

- ISO / IEC 12119 - Requirements for quality in software packages
- ISO / IEC 12207 - Process life cycle for software
- ISO / IEC 14143 - Software measurement
- ISO / IEC 15271 - Guide to ISO / IEC 12207
- ISO / IEC 15504 - Process assessment for software (also known as Spice)
- ISO / IEC 15939 - Process measurement software

For internal quality and external quality models, ISO / IEC 9126 describes the same model for internal quality and external quality. This generic quality model can then be used as a model for internal or external quality quality by using a series of different metrics. ISO 9126 Model itself has six basic characteristics are functionality, reliability, usability, efficiency, maintainability, and portability [25].

ISO 9126 has specifies 6 characteristics that are divided into 21 sub-characteristics. sub-characteristic is manifested externally when software is used in part of the computer system, and results from internal attributes. The main advantage of this ISO 9126 model is that each defined characteristic can be applied to any type of software and can also be performed while providing consistent terminology for software product quality. [26].

Quality is defined by ISO / IEC 9126 as 'the totality of the characteristics of an entity that bears its ability to meet expressed and implied needs. ISO / IEC 9126 has defined several quality models with the characteristics of six factors, namely functionality, function, management, maintenance, and portability which are then divided into 22 factors. [27].

Table 2 Characteristics of the ISO 9126 [28]

Characteristic	Description
Functionality	To provide functions which meet the stated needs of users (what the software does to meet needs)
Reliability	To maintain its performance level within a certain period of time
Usability	So that the software can be easily understood, learned, used, and provide visual appeal
Efficiency	To provide desired performance, relative to the number of resources use of the software
Maintainability	To be modifiable (improvement, or adaptation of software to changing environments and in functional requirements and specifications)
Portability	To make it easier for software to be transferred from one environment to another. The environment may include organization, hardware, or software

Several usability attributes have been variously proposed to guide measurement. With respect to associated standards, ISO 9126-1 specifies understandability, learnability, operability, and attractiveness (and extending to usability compliance) [29].

ISO / IEC 9126 contributes to advancing consensus and enhances prospects for future universal acceptance and certification under 9126 [30].

The ISO 9126 quality characteristics are developed in order to address sustainability and longer operational life (of software products). Since software quality is measured and refers to the ISO / IEC 9126 quality attributes and attributes, this method uses quality depending on the objectives and performance goals of the software system. The six software quality characteristics prescribed in ISO 9126 are the standardized quality characteristics namely, functionality, reliability, usability, efficiency, maintainability, and portability which are extremely helpful in assessing the performance of the operational software systems for sustainability. These six characteristics are further divided into sub-characteristics that help the developers, the users, and the organizations to develop suitable metrics to assess the performance of the software within the given attributes and parameters important for them and suitable for the performance assessment of the software system [31].

III. METHODS

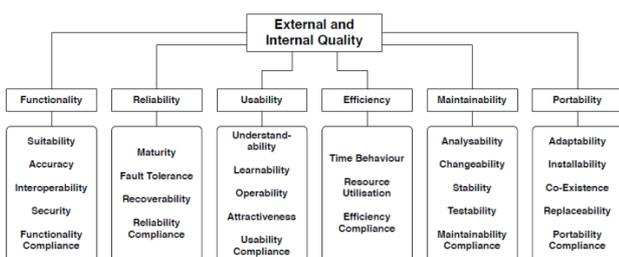


Figure 1. ISO 9126 Model [25].

IV. RESULT AND ANALYSIS

In developing the BookCorner e-commerce website, this web-based application was tested using the ISO 9126 model to measure the quality level of the software to be applied. The BookCorner e-commerce information system has implementation limitations, namely the application of the technology used. In this case, the limitation in question is a system limitation that is implemented only in the form of an application-based website. This study will examine aspects of functionality which include functionality, reliability, usability, efficiency, maintainability, and portability.

This test is done to test the ISO 9126 quality of a system whether the quality of the system is good or not. The results of the aspects tested are as follows:

A. *Functionality*

From the results of black-box testing that has been carried out by researchers. In this case, the function of the BookCorner e-commerce information system can be said to be running well in accordance with the stated needs.

Sub Characteristics:

- Suitability: Can the software perform the required tasks??
- Accuracy: Can the software produce the expected results?
- Security: Can the software interact with other systems?

Table 3 Step Testing

Name	Trial Steps
Home	From the tests carried out, the home page that functions to display the main page can run and look well.
Login	On the login screen, you are asked to enter your email and password correctly to enter the home menu. If you enter the wrong email and password, you will not be able to enter the home menu.
Button Reset	This button can function if the input that is written already has input.
Register	On the registration screen, you need to enter your email and password to be able to register.
Category	Filters are provided based on each specific category owned by a product, to display a particular product there must be product data in the database.
Cart	In this menu cart, there are buttons that function to increase product quantity, delete a product or product quantity.
Checkout	On this checkout menu, you will get the data record that we have registered and enter the address so you can click the checkout button to make a product purchase.
Upload Product	On this menu upload product, you are required to fill in product data to be uploaded by clicking the save button.
Edit Product	In this menu edit product, the admin can edit (update) product details and save the data.
Data user admin	In this menu you can add users who can update and delete data.
Dashboard admin	This menu Dashboard admin contains the administrator page.

Quality Metrics:

- The extent to BookStore: Provides an appropriate set of functions and purposes
- The extent to BookStore: Provide the expected results for the specified tasks and goals.
- Security measures in BookStore: Maintain confidentiality of information including authentication, login procedures, data display and password protection.

B. *Reliability*

The results of tests carried out on the BookCorner e-commerce information system are based on the URL page that has been clicked. The test results can be seen in Table 3.

From the results of testing the functions that exist in the BookCorner e-commerce information system, it can be said that it runs very well in accordance with predetermined needs.

Sub Characteristics:

- Maturity: Can some errors be removed from time to time?
- Fault Tolerance: Can the software has an error?

Quality Metrics:

- Reliability of BookStore: In terms of software failure frequency and function there is no error.
- Fault tolerance of BookStore: Handling invalid input and ability to maintain performance in case of software errors.

C. *Usability*

The results of usability can be seen in table 3 of the test steps, where the test results show that the usability of the application is very good in accordance with the needs that have been determined for the user in order to feel comfortable in using the application.

Sub Characteristics:

- Understandability: Software can be understood easily?
- Operability: Can the software be operated by minimal effort?
- Learnability: Can it be learned easily?
- Attractiveness: Does the software have an attractive interface?

Quality Metrics:

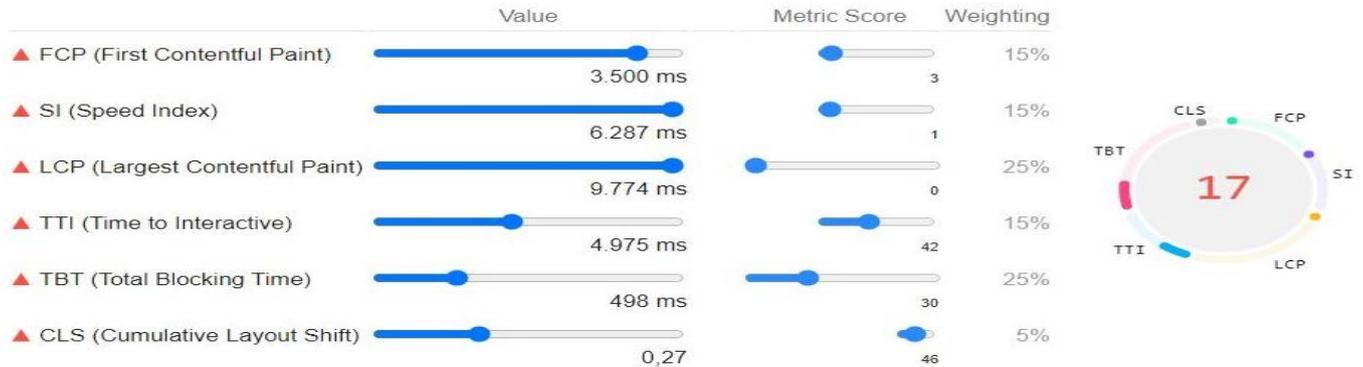
- The capability of BookStore is providing Button works fine, consistent layout and easy to understand.
- Operating BookStore: Find the required information from the table of contents.
- Learnability BookStore regarding: Learn to use the software, explore new features and functions, navigation tools, try trial and clear instructions.
- Attractiveness of BookStore: From a user interface point of view, templates and multimedia software products.

D. *Efficiency*

The test results based on this efficiency aspect are obtained from the performance metrics tested on e-commerce BookCorner using the Lighthouse Scoring Calculator found on google chrome in the inspection

section. The results of testing these metrics can be seen in Figure 2 as follows.

From the test results based on the image above, the efficiency of FCP (First Contentful Paint) gets a value of 3,500 MS with a Metric Score 3, SI (Speed Index) gets a value of 6,287 MS with a Metric Score 1, LCP (Large Contentful Paint) gets a value of 9,774 MS with Metric Score 0, TTI (Time to Interactive) got a value of 4,975 MS with a



Metric Score of 42, TBT (Total Blocking Time) got a value of 498 MS with a Metric Score of 30 and CLS (Cumulative

Layout Shift) got a value of 0.27 MS with a Metric Score 46, for a total of 17%.

Sub Characteristics:

- Does the software behave on time?

Quality Metrics:

- Provides appropriate responsive time (from

navigation, search, next and previous buttons), provides appropriate processing time and performs a sequence of operations.

Figure 2 Lighthouse Scoring Calculator

E. Maintainability

Maintainability test results based on aspects of Correct Faults, Consistency, and Simplicity. The BookCorner e-commerce information system has met all of these aspects to be modifiable (correction, enhancement, or adaptation of software to changing environments and in functional requirements and specifications).

F. Portability

The results of portability testing carried out on the e-commerce Book Corner information system are based on the assessment aspects of the results obtained from testing using the ISO 9126 model. To make the system run well on various desktop browsers such as Mozilla Firefox, Google Chrome and Internet Explorer.

Sub Characteristics:

- Adaptability: Can the software be adapted easily?
- Installability: Can it be installed easily?

Quality Metrics:

- Ability BookStore in term of: Adapt to hardware without additional effort
- Ability BookStore in term of: Effort is required to install software products in the specified environment.

V. CONCLUSION

BookCorner is an e-commerce system aimed at selling books. The results of the tests that have been carried out are as follows: (1) Functionality: In this case the function in the bookstore information system can run well. (2) Reliability: The functions in the bookstore information system can run very well. (3) Usability: The test results show that the usability of the application is very good. (4) Efficiency: The efficiency obtained in FCP (First Contentful Paint), SI (Speed Index), LCP (Large Contentful Paint), TTI (Time to Interactive), TBT (Total Blocking Time) and CLS

(Cumulative Layout Shift) has a total of 17%. (4) Maintainability: Based on aspects of Correct Faults, Consistency and Simplicity. The online bookstore information system has fulfilled all these aspects. (6) Portability: Based on the evaluation aspect, the results obtained from testing using the ISO 9126 model. That the system can run on various desktop browsers such as Mozilla Firefox, Google Chrome and Internet Explorer.

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