

Combining Search Engine Optimization and Human-Computer Interaction on an eCommerce Site: A Mini Longitudinal Study

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Abstract

The rapid development of technology in industrial revolution 4.0 made the business competition even tighter, especially for primary needs, one of which is the local industry is engaged in fashion. Many fashion industries use eCommerce (EC) but have not increased their sales because the primary key to sales is useful marketing techniques. Many scientists who research one EC development with SEO but only pay attention to rankings do not increase sales. In this study, we implement the SEO method with indexing, crawling, and meta tags techniques collaborated with the user interface using the silo structure technique and spoke and hub structure. The purpose of doing so is to make customers feel more comfortable browsing the EC web. This research investigates the possibility of applying those techniques to the sales in a 6-month mini longitudinal study. We found out that this combination has increased the EC monthly income by 4 to 10% each month. It can be concluded that the SEO method will be more optimal in collaboration with other techniques such as the silo structure technique and spoke and hub structure. Suggestions for further research are collaborating SEO with other social media integration methods and location-based services to benefit an EC establishment.

Keywords: *Search Engine Optimization, Human-Computer Interaction, eCommerce, mini longitudinal study*

1. Introduction

In the era of the industrial revolution 4.0, where competition in the digital world cannot be avoided (Dean and Spoehr 2018), companies must have a strategy capable of transformation and innovation to face fierce competition. One industry that needs more of this deals with primary needs, such as fashion ((UTCC) 2017). The digital world means the internet; hence, one business establishment should own an eCommerce (EC) website, which has been the case for Steigen Store, a local clothing company in Indonesia. As a new EC site, they have not implemented any techniques to boost their presence on the internet. A digital presence can be known using Search Engine Optimization (SEO). A search engine is a computer program specially created to help users search for files or services stored on the internet (Beveridge et al. 2020). As a result, search engines can be beneficial to EC sites as internet users can find sites using search engines. Many EC webs are scattered on the internet but are challenging to find because they do not use SEO. SEO is an effort to optimize a website to get top rankings in search engines (Wicaksono and Muhtarom 2020). The benefits of implementing SEO by a company that has EC can increase brand awareness, get targeted visitors and make the EC website in the top position on the search engine, making it easier for buyers to find the website (Özkan et al. 2020).

Nevertheless, it is not easy to implement SEO on an EC. The biggest problem is to determine our targeted visitors. Choosing the wrong segment will make the business is less known and makes competitiveness weak. The implementation of SEO will be more optimal when combined with an excellent Human-Computer Interaction (HCI) (Kong 2019). When SEO is collaborated with HCI, it can make consumers feel more comfortable lingering on the EC site, allowing consumers to shop more on the EC. According to Nielsen, five conditions must be fulfilled for an information system to achieve the ideal usability level (Handiwidjojo and Ernawati 2016)(Issa and Turk 2012)(Dahar et al. 2020), which one of them is learnability. It is a human habit of learning and understanding an object. The easier it is for humans to understand the item, the easier it is for humans to remember, so it creates comfort when using an object (Garaialde et al. 2020). The HCI technique makes it easier for users to adapt to the environment (Oudah, Al-Naji, and Chahl 2020) because it is structured to make users feel like they are returning to the same place.

Creating an EC that is easy to find cannot increase a product's sales because online promotion must also use the right techniques (Markov and Veselinovic 2020). The target market should be clearly defined (Castro 2020). Many studies discuss the use of SEO but only used so that search engines can easily recognize the website to increase traffic (Akram et al. 2010). Besides that, the use of SEO in previous studies does not pay attention to customer loyalty. This research was conducted in a Mini Longitudinal Study (MLS) for six months. It measures the commitment of members who have registered for a difference in the previous six months using the techniques mentioned. We apply various methods, such as indexing, crawling, and meta tag techniques. We also implemented HCI using the silo structure technique and spoke and hub structure. Silo structure is a technique for internal linking between articles on one website (Ema et al. 2017), by way of a group based on the same topic, while spoke and hub structure is a navigation model that contains all the pages that are related to the main menu.

2. Research Method

We construct this research by implementing SEO and HCI together and then manage the impact by using a mini longitudinal study and improving website rankings and increasing loyalty by implementing SEO and improving HCI on existing websites. We use an EC site of Steigen Store, a local clothing company located in Bandung, Indonesia. This research was conducted using the agile method, carried out for six months, from February to August 2020, as seen in Figure 1. We began our series of activities by analyzing existing systems. It was carried out using Alexa and Small SEO tools to analyze Steigen's EC site. To assess the existing HCI, we use HCI principles to measure their current User Interface and User Experience (UI/UX). We plan and design the SEO techniques and HCI principles to fix the UI/UX using the Silo Structure, Hub, and Spoke Structure technique in the next stage. Finally, we monitor the impact and make some adjustments on the meta tag of the SEO for six months to create a proper analysis of the implications for this research. The research steps can be seen in Figure 1.



Figure 1 Research Flow

2.1 System Analysis

The interaction model between humans and computers involves four components: users in the sense that they are humans, interactions, computer systems, and activities. The primary key of HCI is usability. Usability is a quality attribute that assesses the user interface is easy to use or not; the user interface is used to achieve the goal of being useful, efficient, and satisfying when used by users. According to Nielsen, usability is a quality attribute that assesses the use of an interface that allows users to complete tasks transparently, agile, and useful (Marcus, Eds, and Goos 2020). Matters related to interaction include the interface, the language used, adjustments to the device, flexibility, system compatibility with other systems, and communication. One of the essential topics in HCI is the user interface, which is part of a system controlled by the user (Human) to achieve and carry out a system's functions. The user deals directly with the system through the user interface. The role of the user interface in the usability of a system is crucial. Therefore, the interface's form and development need to be seen as one of the main processes in the whole system, as depicted in Figure 2 (Prihati 2012).

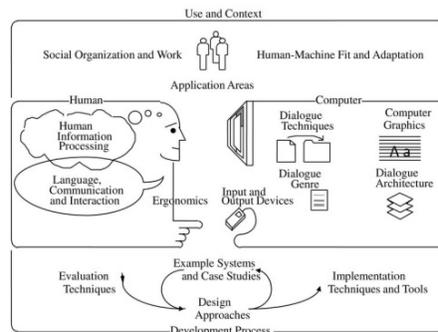


Figure 2 Map Of HCI (Prihati 2012)

System analysis needs to be done to determine how far the system has been running because, in this study, We will make some changes to Steigen's EC store. Before analyzing the system that has been built, SEO also needs a plan before We start optimizing the website. At the initial stage in optimizing Steigen's SEO, we perform a competitor analysis by investigating strategies that competitors use, their keywords, and targeting. Furthermore, we use tools to score the current Steigen's EC site and get the result of an SEO score of 45% and is ranked at 9,796,342, as seen in Figure 3.

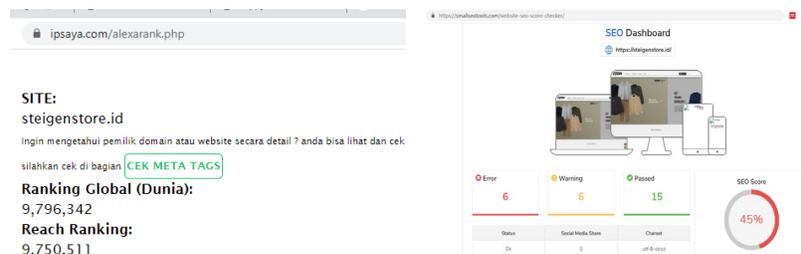


Figure 3 Analysis Results Using Alexa and Small SEO tools

The next step is to do keywords analysis, which we will use to implement it on Steigen's EC site. This keyword analysis is fundamental to help the website be easily found in search engines, and keywords also significantly affect SEO quality. We analyze them by using Google Trends. Google Trends is a tool for displaying a statistical graph of keyword search results that shows the popularity of search topics at a specific time. We use this tool to search for the right keywords and search for several keywords based on the average number of searches each month for a keyword and find any topic related to the keyword that We analyze. The following is the keyword that We analyze using Google Trends tools. Table 1 shows our list keyword analyzer, which we used as the first foundation of the research.

Table 1 Keyword Analyzer

Keyword	Search Result	Related Topics
Sweater	2276	Shirt, Jacket, Korean Style
Couple	2480	Viu Media Streaming, Korean Drama, Korean Fashion Couple
Discount	1888	Electricity, Purchasing, Goods, Trade
Promo	1221	Internet, Product Catalog, Weekday
Import	2074	Clothes, Pajamas, Knitting
Hitz	1620	Bali, Cafe, 2000s style
Not disappointed	1082	Brother, Character, Independence
So Young	-	-
Fashionable	1013	Clothing, Accessories, Textiles
Best Material	-	Textiles, Bridges, Industrial Revolution
Casual	1247	Denim, Chino, Studio
Original	2482	Shoes, clothes, sweaters
Juragan	2639	Content, Chickens, Series
Fashion	2139	Street Style, Jackets, Pants
Bandung	335	Lokawisata, Food, Fashion
Elegant	2349	Watches, Jewelry, Accessories
Luxury	1945	Lifestyle, Motorbikes, Cars
Super Wow	-	-
Top Brand	432	Indofood, Online Shopping, Marketing
Number One	2046	World, Culture, Games

In the analysis results above, we can see the results of research with several keyboards, which, according to We, can increase the website's score and ranking. Popular keywords include a sweater, import, fashionable, original, and discount keywords. This keyword is a keyword related to the topic that the Steigen Store post on the online store, and total searches with the keyword found around 1.000 searches per month. Another keyword may not increase the number of visits, even though the topic is not directly related to the online store's product; it can be optimized by adding the right meta description.

2.2 Design

The design optimizes the website's position to be on the first page by using SEO techniques. The things that are done in SEO techniques are :

- A. Meta title
Provide insert keywords in the website page title.
- B. Meta Description and Meta Keyword
Provide predetermined keywords so that the website is easily searched for by search engines and explains its content.
- C. Crawling and Indexing
We perform a web registration process for search engines to store and organize the crawling process's content. After a page has been indexed, this page will be considered when there is a relevant search(Drivas et al. 2020)(Yakoob and Arora 2020).
- D. HCI Repair
The Steigen Store website already has a pretty good appearance, but there are still some principles that need to be considered, such as :
 - In a web application that has been built, the principle of visibility is a note that when the web is opened, the mobile navigation menu is not visible so that it is easier to use. We will make the menu navigation fixed so that it doesn't change.

- In a web application that has been built, no feedback principle involves sending back information about what actions have been taken and completed. For example, in the delete basket function, the application does not provide any feedback, and the data will be deleted immediately.
- - Applying the silo structure technique by linking products that are still in one category. For example, when a customer selects a sweater product with a jacket category, the system will display the jacket category's contents as a material for customer recommendations to choose the same type. Simultaneously, the Hub technique and Spoke are used to make menu navigation changes by grouping menus according to service categories.

3. Result And Discussion

This study has succeeded in improving the web Steigen store's user interface to be easier to understand and responsive. Easy to understand here, the meaning is that We enhance the user interface that is difficult for most users to understand. It does not use standard components used by famous online stores to make a UI that is easy to use. The most significant change is in the menu navigation section. Before repairing the menu, the navigation still looks messy. When opened via a smartphone, the menu navigation on the web disappears and makes it difficult for the user to move from one menu to another. Each product is not categorized according to its type, while responsive means making the user interface more adaptable to various devices and speeding the website faster. Before repairing this website, it could not adjust to several tools such as mobile and tablet, and the interface load speed is quite long. The longer the interface is displayed, the more visitors will feel bored or even go straight from the website. The fast-loading process will automatically affect the visitor's user experience. The faster the website, the more comfortable visitors will be there. Besides, responsiveness here means that the interface that We changed provides some form of feedback. The interface must communicate with the user to let them know what's going on. The following is the interface that we have fixed. Figure 4 showed the implementation of the system after the revamp.

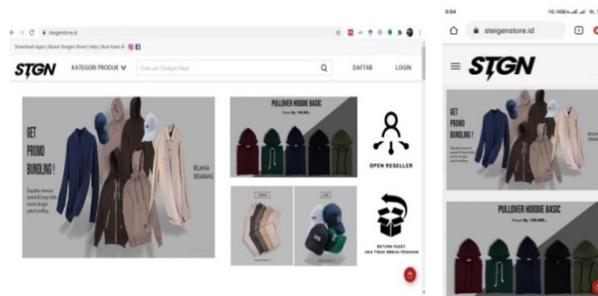


Figure 4 User Interface on Web And Mobile Apps After Revamp

The research, which was carried out for six months, was divided into eight sprints. These eight sprints were used to implement SEO at the EC Steigen store because they had not used SEO, so the website was difficult to find. The implementation of SEO that we have done includes optimization of the title. The title is optimized by inserting a keyword in the first character in the title so that search engines do not cut it off. We optimize the URL by inserting the primary keyword in the URL. The keyword we use is "Imported Hoodie Sweater." Meta Description serves to carry out a clear description of what content the visitor is looking for. These meta tags help web spiders or search engine robots describe products on the web, while meta keywords help determine keywords in the content to find it easy to find on search engines. The keywords must match the range of content on the web. Meta Keywords also function to make content indexed by search engines faster based on the specified keywords. For HCI implementation, we apply the Silo Structure technique that is useful for better product post relevance. Products that the admin posts will only provide internal links to other articles that are still in the same category as the product they have. Spoke and Hub is useful for modeling the navigation menu, which contains all the main menu pages. It makes it easier for visitors to navigate the menu and color changes to its appearance and website structure. Here are the activities We did in implementing the SEO web Steigen store for eight sprints shown in Table 2.

Table 2 Sprint 1

Sprint	Activity	Condition Before Repair	Result After Repair
1 (February 1st Week - 3rd Week of February)	<ul style="list-style-type: none"> - Creating a keyword: Sweeter Hoodie Import - Make 3 Meta Description consisting of the adult sweater, couple sweater, discount sweater - Create Meta Keywords 3 consisting of sweater, couple, discount 	<ul style="list-style-type: none"> - The number of web visits on average is ten visits - SEO score 45% 	<ul style="list-style-type: none"> - The number of web visits increased by an average of 15 visits - SEO score is still 45%

In the first sprint, we applied the meta tags, especially the meta description and meta keywords. In three sentences, adding this meta key and meta description was to increase the number of visits. This sprint resulted in an increase in visits by fifteen visits because We used meta keys and descriptions with general sentences and were related to one another. After a keyword analysis is carried out, our input has a large enough search result above two thousand searches (analyzed using google trends) per month. It has topics that are relevant to the product so that it can make the browser more comfortable to find the website. We continue to the second sprint shown in Table 3.

Table 3 Sprint 2

Sprint	Activity	Condition Before Repair	Result After Repair
2 (4th Week of Feb - 2nd Week of Mar)	<ul style="list-style-type: none"> - Creating a keyword: Sweeter Hoodie Import - Make 4 Meta Description consisting of the adult sweater, couple sweater, discount sweater, promo sweater - Create 4 Meta Keywords consisting of sweater, couple, discount, promo 	<ul style="list-style-type: none"> - The number of web visits on average is 15 visits - SEO score is still 45% 	<ul style="list-style-type: none"> - The number of fixed web visits. - SEO score increased to 48% - Starting with the same IP address and returning to the website, 23 IP addresses have been recorded

In the second sprint, twenty-three unique visitors have appeared, proving that there has been consumer loyalty to a product. This loyalty can occur because visitors feel comfortable with the Steigen store application. In this sprint, We added a new keyword, a promo, but it does not affect the number of visits. This situation can happen because search engines still have difficulty finding websites. After all, the techniques we use are still the same, only relying on the keywords. We start changing the method in the next sprint, as shown in Table 4.

Table 4 Sprint 3

Sprint	Activity	Condition Before Repair	Result After Repair
3 (March Week 3 - Week April 1)	<ul style="list-style-type: none"> - Creating a keyword: Sweeter Hoodie Import - Make 5 Meta Description consisting of adult sweaters, couple sweaters, discount sweaters, promo sweaters, 	<ul style="list-style-type: none"> - The number of web visits on average is 15 visits - SEO score is still 48% - Recorded 23 IP address of the last visit with the same IP address 	<ul style="list-style-type: none"> - The number of visits increased by an average of 28 trips. - SEO score increased to 53% - Starting with the same IP

imported sweaters	address and returning to visit the website, 33 IP addresses
- Creating Meta Keywords: as many as five consisting of the shirt, couple, discount, promo, import	
- Create a sitemap	

In the third sprint, we add a sitemap containing the URL's information on the site used as a search engine map. A sitemap is also a way website owners can tell search engines, including Google, about their website pages and add. The number of meta key sentences and description is six sentences, the addition of this SEO technique increases the SEO score to 53%, which previously was 45%, and visits increased to 28. It happens because we add SEO techniques and adds sentences to the meta tag. The third sprint produces the result of the second sprint. This difference is the increase in the sitemap technique in the third sprint, which increases the number of visits. Next, we continue to fine-tune our efforts, as shown in Table 5.

Table 5 Sprint 4

Sprint	Activity	Condition Before Repair	Result After Repair
4 (April Week 2 – May Week 1)	- Creating a keyword: Sweeter Hoodie Import - Make 6 Meta Description consisting of adult sweaters, couple sweaters, discount sweaters, promo sweaters, imported sweaters, today's sweaters hitz - Create 6 Meta Keywords consisting of the sweater, couple, discount, promo, import, hitz	- The number of visits averaged 28 visits. - SEO score 53% - The last data visit with the same IP was recorded as many as 33 IP addresses	- The number of visits on average increased to 42 visits. - SEO score 53% - It is recorded that starting from the same IP address and returning to visit the website, as many as 35 IP addresses

In the fourth sprint, We added six sentences to the meta key and description and resulted in the addition of visits by 42 people. This situation happened because of the addition of sentences to the meta tags. In the meta keyword meta, there were several meta that we input, and the topic did not match Steigen store. We can still optimize the keyword by adding a meta description to complement the meta keyword whose case is unrelated. One of the keywords that are not so related to the topic is "hitz." We removed the keyword and moved on to the next sprint, as shown in Table 6.

Table 6 Sprint 5

Sprint	Activity	Condition Before Repair	Result After Repair
5 (June 1 Week - 3rd week June)	- Creating a keyword: Sweeter Hoodie Import - Creating 2 Meta Description consisting of cool sweater suitable for young people, the originally imported sweater doesn't disappoint - Create 4 Meta Keywords consisting of: not disappointed, very young, fashionable, the best materials	- The average number of visits is 42 visits. - SEO score 53% - The last data visit was recorded with the same IP address as many as 33 IP addresses	- The number of visits decreased by an average of 20 visits - SEO score 53% - Recorded starting from the same IP address and returning to visit the website as many as 12 IP addresses

We try to reduce the sentence on the meta keyword and meta tags to 2 sentences in the fifth sprint. It results in a decrease in visits but does not lower the SEO score. It happens because we reduce the number of sentences. The keyword that we write is a keyword that is not directly related to the Steigen store's topic. For example, this keyword is the keyword of very young people. When analysis does not produce any results, young people's keyword issues do not deliver a value even on google trends. We then intensify the keyword and meta description as shown in Table 7.

Table 7 Sprint 6

Sprint	Activity	Condition Before Repair	Result After Repair
6 (June 4th week to July 2)	<ul style="list-style-type: none"> - Creating a keyword: Sweeter Hoodie Import - Make 8 Meta Description consisting of the adult sweater, couple sweater, discount sweater, promo sweater, import sweater, current sweater, casual sweater, hitz sweater - Create 8 Meta Keywords consisting of : sweater, couple, discount, promo, import, hitz, everyday, original 	<ul style="list-style-type: none"> - The number of visits on average is 20 visits - SEO score 53% - Recorded the last visit data with the same IP address as many as 12 IP addresses 	<ul style="list-style-type: none"> - The number of visits increased by an average of 77 visits - SEO score 53% - Recorded starting from the same IP address and revisiting the website as many as 30 IP addresses

In the sixth sprint, we tried to increase the meta key and description back to 8 sentences and resulted in the visitors going back up from 20 visits to 77 visits. We did not find many differences from the previous sprints to be analyzed here; hence, we quickly moved to the next sprint in Table 8.

Table 8 Sprint 7

Sprint	Activity	Condition Before Repair	Result After Repair
7 (July 3rd week - August 1)	<ul style="list-style-type: none"> - Creating a keyword: Sweeter Hoodie Import - Creating 9 Meta Description consisting of adult sweaters, couple sweaters, discount sweaters, promo sweaters, imported sweaters, modern sweaters, casual sweaters, hitz sweaters - Create 9 Meta Keywords consisting of Skipper, fashion, Bandung, elegant, luxurious, super wow, best, top brand, number one 	<ul style="list-style-type: none"> - The number of visits on average is 77 visits - SEO score 53% - Recorded the last visit data with the same IP address as many as 30 IP addresses 	<ul style="list-style-type: none"> - The number of visits decreased by an average of 43 visits - SEO score 53% - Starting with the same IP address and revisiting the website as many as 31 IP addresses

We add back meta keywords and descriptions in the seventh sprint, but the sentences between them are not related. The result is a decrease in visits because search engines have difficulty finding products. After all, the keyword and description are not related. We added significant steps on our last sprint, as depicted in Table 9.

Table 9 Sprint 8

Sprint	Activity	Condition Before Repair	Result After Repair
8 (August Week 2 - Week August 4)	<ul style="list-style-type: none"> - Creating a keyword: Sweeter Hoodie Import - Make 10 Meta Description consisting of adult sweaters, couple sweaters, discount sweaters, promo sweaters, imported sweaters, modern sweaters, casual sweaters, hitz sweaters, sultan children's sweaters, Steigen store sweaters - Make 10 Meta Keywords consisting of the sweater, couple, discount, promo, import, hitz, casual, original, sultan, Steigen store - Create Robots.txt, which functions to notify search engines about which pages need to be indexed and which pages do not need to be indexed 	<ul style="list-style-type: none"> - The number of visits on average is 43 visits - SEO score 53% - Recorded the last visit data with the same IP address as many as 30 IP addresses 	<ul style="list-style-type: none"> - The number of visits increased by an average of 90 visits - SEO score increased to 60% - Starting with the same IP address and returning to visit the website as many as 41 IP addresses

In the last sprint, sprint 8, we added robot.txt. We fixed the sentences in the meta key and description related and increased visitors' number to 90. The SEO score increased to 60%, and every sprint, there were always the same visitors returning to the website. From this sprint activity, we get the result that the more SEO techniques used, the higher the SEO score that will be obtained. Next, the more meta keys and descriptions used, the more visits will be made with the terms meta key and description made must-have. The relationship with each other and the change in HCI can change holidays to unique visits because every sprint, there is always the same visitor returning to the website.

From the results of a longitudinal study conducted for six months starting from February 2020 - August 2020, We found that the SEO and HCI that I applied were more effective in increasing visits and loyalty than similar studies with different EC objects in previous research. We were unable to increase EC ranking because it cannot show comparisons before and after using SEO. Before implementing SEO, the web, the research object, was being blocked by the hosting manager. Previous studies stated that it could not convert visitors into regular customers (Saefullah, Himawan, and Arisantoso 2015). This study can increase more than 2 million ranks and convert some visitors into regular customers. It means that customer loyalty has appeared on a website. It happens because We combine SEO techniques with HCI. The following indicators have increased, including :

- A. The website's position, which was previously in the place of 9,796,342, has increased to 7,411,965 in the global score position obtained from analysis using Alexa tools. The Steigen store has been found on the search engine on the first page in the third position, as seen in Figure 5.

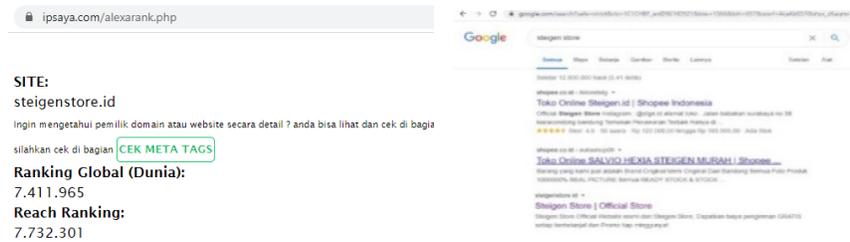


Figure 5 Analysis Results and Web Position in Search Engines

- B. The SEO score increased from 45% to 60%. The results of this analysis were obtained from the analysis using small SEO tools showed in Figure 6.

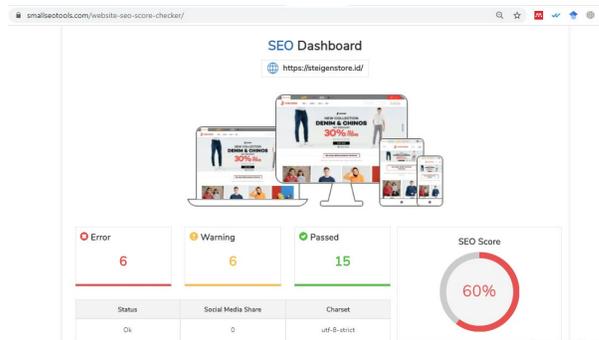


Figure 6 Score results with a small SEO tool

- C. Customers who returned to the Steigen store website were 41 people from the last observation results and proved that customer loyalty had emerged towards the EC Steigen store, as shown in Figure 7.

No	Ip Address	Lokasi
1	[REDACTED]	Bandung
2	[REDACTED]	Bandung
3	[REDACTED]	Jakarta
4	[REDACTED]	Bandung
5	[REDACTED]	Surabaya

Figure 7 List of Customers Returning to the Store

4. Conclusion

This study, which was carried out for six months, resulted in a relatively good increase in visits, unique visits, and scores, even though sprints five and seven experienced a decrease in the number of visits because we experimented with the meta keys and descriptions to not correlate to one another. The more SEO techniques used, the higher the SEO score obtained, and the more meta keys and definitions used, the more visits that will visit with the terms meta key and description made must have a relationship with each other. HCI improvement can convert visits to unique visits because, in every sprint, there are always the same visitors returning to the website, and the most massive increase in visits occurred on the 8th sprint in August 2020. This increase in visits can occur because We have implemented several SEO techniques such as indexing, crawling, and meta tags to optimize crawling. We create a file called robots.txt; this file is designed to control or control user agents as google bot in crawling web pages. Although the case study was carried out at a clothing shop, this technique can be applied to other cases. For example, we can apply this technique to the tourism sector using E-Tourism as a medium to support programs that have been determined by the government to attract more tourists.

HCI is imperative as it plays a significant role in helping the applications we make to stand out more and make users feel comfortable and create impressions for users who use them. In this longitudinal study, We have also improved the existing HCI by promoting the usability principle. Good HCI has the criteria for user-friendly and high usability(Haryoko 2012). User friendly is the ability that software or application programs have that are easy to operate and have many other skills to feel at home in managing the program, even for a novice user. At the same time, usability is the system's ability to meet user needs (Handiwidjojo and Ernawati 2016). From the results observed by We, it can be concluded that the Steigen store system that has been improved by SEO and HCI can help increase the score and ranking of the previously created web. Finally, there is an increase in the number of customer loyalty. The increase in customers can be seen from the number of unique visits on each sprint.

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