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Original Article

Search Engine Optimization Metric

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Abstract *- Search engine optimization SEO is one of the most important topics today. Search Engine Optimization is considered an essential part of e-marketing or digital marketing techniques. All companies and foundations compete to make their websites get a high rank in the search engine. Getting a high rank means getting more visitors, subscriptions, and interactions. Subsequently, SEO helps companies to achieve more success and money. Therefore, measuring the SEO rank of a website is a critical issue. In previous work, authors propose some metrics to measure the SEO rank. However, these metrics didn't cover the most critical factors that help assess the rank accurately. This paper proposes a novel metric called Total-Rank (TR) by adding more critical factors. This metric not only depends on on-page factors but also considers off-page factors. In addition, some novel factors have been added. The results ensure that the proposed TR outperforms the previous metric.*

Keywords *- SEO, Search engine optimization, Ranking factors, Digital marketing, E-business.*

1. Introduction

There are Countless data on the internet. Every day millions of people use search engines to make a query with specific keywords to find information that they need. Search engines show their results in an arranged list called Search Engine Result Pages (SERPs) according to given keywords. The search engine has two main functions crawling and indexing. A search engine crawls to the website to index it in its dictionary. When you use a search engine to search for something, it returns the indexed page according to this index. It is called Search Engine Result Pages (SERPs). The page on the top usually gets more visits and helps companies earn more money.

Search engine optimization (SEO) is the practice of what the website should look like and contains to get a higher rank in SERP using specific keywords. Users prefer to visit websites that are at the top. Only 20% to 25% of users check the second page of SERP, and 3% to 4% of users check the remaining pages [1]. SEO is different from SEM (Search Engine Marketing) as SEO increases website visibility in an organic way for the long term. It can be achieved through having good content and introducing good service for the visitors. But, SEM is Search Engine Marketing that increases the website visibility for a short time. Since it is a paid search engine campaign, getting a higher rank in the search engine (SEO) saves more money than achieving success. Hence, companies or organizations get more traffic from the search engine in an organic way.

There are many ranking algorithms, and some search engines stated these in this research [1, 2]. However, search engines do not explicitly mention what algorithms they use. They just mention factors that web designers and digital marketers should use to get ranking [13].

Many factors can affect website rank. These factors are divided into two types On-page SEO factors and Off-page SEO factors. On-page factors tell what we should do on the website to improve our ranking in search engines. Not all web developers know exactly what they should do on a website to get a higher rank. So, SEO metrics help developers to measure page rank.

Additionally, Off-page SEO factors tell what we should do outside the website to improve our ranking in search engines. In [5], the authors state some of the website success factors. Many factors are related to keywords that the user searches in. Keep in mind that keyword List is one of the most important criteria. A critical issue has an accurate metric that can rank the websites according to SEO factors such that it gives ranks that agree with the ranks from the most common and popular search engines.

In a previous job, the authors proposed a K-rank metric [3]. K rank depends only on On-page factors to measure the website's performance. In this paper, the formula of the K-rank is updated. More important factors in On-page have been involved (NK-Rank). Since both On-page and off-page factors are very important to know the right rank of a website, they help web designers or digital marketers to improve the SEO (On-page and Off-page) of a website. Therefore, a novel metric is proposed for measuring not only On-page rank but also Off-page rank.

This paper is organized as follows:

Section 2 discusses the SEO factors previously defined. In section 3, the related work is investigated. Section 4 presents the proposed NK rank. Section 5 introduces a novel Off-page SEO called Total-Rank.

Finally, conclusions and future work are driven in section 6.

This paper will use the most common Search Engine (Google) for Results. We first start by investigating the common SEO factors.

2. SEO Factors

The search engine startup guide [13] introduces most On-page SEO factors that developers should take into account. Authors in [5] also introduced SEO success factors for On-page and Off-page.

Here, we redefine the important factors used earlier besides defining some newly proposed factors that help have more accurate SEO metrics; some of these factors had been studied before in other papers like Tile tag, URL, Header Tag, and meta Tag. Other factors will be defined here for the first time, like (the average backlink domain authority). Some other added metrics for the first time here, like content quality, fresh content, and domain age.

Fig. 1 proposes a taxonomy for the common SEO factors. Some factors are On-page, and others are Off-page. Some factors depend on Keywords, and others don't depend on keywords. Then, Table 1 presents the factors that depend and do not depend on keywords.

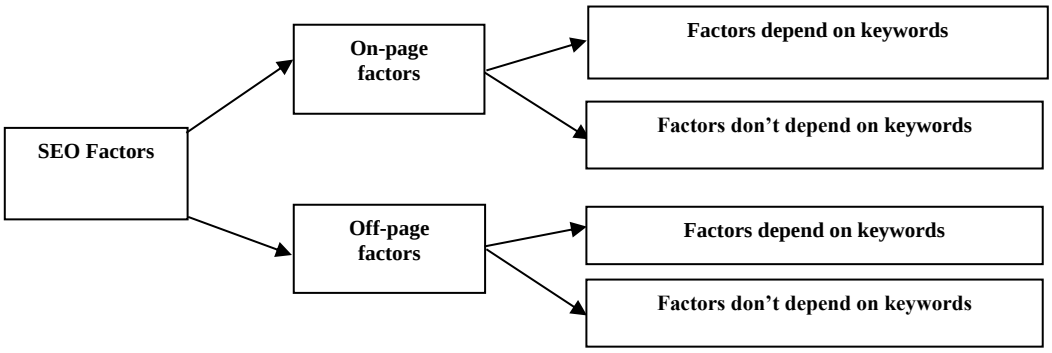

Fig. 1 proposed taxonomy of SEO metric

Table 1. On-page SEO factors

Factors that depend on keywords							
Title tag	Meta tag	URL	Alt tag	Header tag	Content quality	Fresh content	Internal anchor text
Factors do not depend on keywords							
Web design		Domain age			HTTPS		

2.1. On-page SEO factors

In the following, a set of the most important On-page SEO factor is defined:

2.1.1. Title Tag

It should have the main keywords of the website topic. It appears to users in search engines (e.g., the University of Cambridge in figure (2)). Every page on the website should have a different title tag that describes the page's content. The title tag length recommended being is 50-60 characters.

Fig. 2 The search result for the University of Cambridge (Title tag)

2.1.2. Meta Tag

It is the description of the page. Every page on the website should have a unique description that describes the content and has keywords from the keyword list to spur users to access the page. Meta tag length should be 50-160 characters, and search engines appear to be 155-160 characters of Meta tag figure (3). Note: if there wasn't a Meta tag, the search engine auto generates it from the page's content. So it's recommended to write a special Meta tag for every page. It helps every page on the website to get ranked in the search engine for its content.

Fig. 3 The search result for the University of Cambridge (Meta tag)

2.1.3. URL

URL should be short and easy to understand. This helps users to remember the URL. Also, it is recommended that the URL should have the main keyword of the website topic.

2.1.4. Header Tag

Header tag using keywords in the header tag make the web page easier to index the page in search engine and easier for users to understand.

2.1.5. Alt Tag

Crawler can't see but can understand the content. Therefore, the Alt tag should be used to explain the image's content. Alt tag helps search engine to index the image according to the content.

2.1.6. Content Quality

Content plays the main role in search engine algorithms. Search Engine Artificial Intelligence can understand the content. Thus, websites that have high content quality get a higher rank. While websites that have low or copied content get a lower rank. Content should have targeted keywords. If webpages have rich content, they will attract more users. They will also stay more on websites that have high content quality.

2.1.7. Fresh Content

Fresh content is one of the most important On-page factors. Search engines can recognize fresh content and see when a website is actively updated. It is recommended to add a blog to a website to help you always add blog posts, and the length of a blog post is suggested at 350 – 650 characters and has targeted keywords.

2.1.8. Internal Anchor Text

It is one of the keywords from the keyword list that has hyperlinks to the web page inside the website.

2.1.9. Web Design

Web Design website must be mobile-friendly (responsive). Website speed is important. User doesn't prefer to wait a lot to see the content of the page [5].

2.1.10. HTTPS

HTTPS is an HTTPS protocol that requires purchasing SSL certification and considers the On-page factor. HTTPS makes users feel safe while browsing the website.

2.2. Off-page SEO

Off-page SEO is a very important part of SEO and represents more than 50% of the influence on website ranking. Off-page factors affect the final ranking results. There are Off-page factors that depend on keywords and factors that don't depend on keywords.

Off-page factors that depend on keywords:

- Social media
- External anchor text

Off-page factors that don't depend on keywords:

- Number of backlinks
- Average of domain authority of backlinks

2.2.1. Social Media

Social media joining the website with social media, writing keywords, and uploading posts with the website domain are important things that should happen. Linking, commenting, and sharing posts with a website domain means the domain has good content.

2.2.2. External Anchor Text

External Anchor Text using keywords from the targeted keyword list to create external hyperlinks.

2.2.3. Backlinks

Do follow backlinks are important because they play a major role in the total webpage ranking score. It is very important to take backlinks from a website in the same field of your website. For example, if you have a website about Digital Marketing, you should take backlinks from a website or a blog about Digital Marketing. Also, remember that you have to take backlinks from a website with high domain authority. Since using backlinks has the same domain and high domain authority, your website is also in the same domain and has high authority, like the website you take backlinks from. Keep in mind prohibiting using robots to get backlinks because search engines can feel it.

In the experience, getting more backlinks is based on having good content on your website or blog since other websites will complete or discuss your website content and will put your website URL on their websites because you have rich content.

3. Related work

In [3] authors explain the significance of SEO to get a higher rank in SERP; they also clarify On-page factors and Off-page factors. The authors produced K-rank as a measure for Assessing the On-page SEO of a website. It focused on other factors related to keywords (the words we use to search for something using a search engine). The paper tested the k-rank metric on educational domains, and the results proved that K-rank is a good metric for optimizing On-page rank. In [4], the authors introduced common techniques for getting higher rankings in search engines. It also eluded the results of a study of 50 web pages after implementing search engine optimization on them. The authors in [9] summarize some search engine ranking algorithms, some SEO terminology, and the difference between black hat SEO and white hat SEO. In [7], the authors eluded the importance of SEO for better user interaction. In [5], the authors talked about all SEO factors (On-page and Off-page) influencing ranking. However, the authors in [10] studied the impact of On-page and Off-page factors on a website. It took results using SEERP metrics and tools from Google. The study presented in [10] states that content and backlink are the most relevant SEO factors. To learn more about SEO factors and the use of factors, refer to [13] as a search engine optimization guide.

To summarize, in [3], the metric doesn't cover all factors. There are very important factors that can affect the ranking result. Here, the body factor in [3] will be replaced with content quality for its importance. Some other factors will be added, like fresh content, internal anchor text, web design, domain age, and HTTPS, to make k-rank more efficient. Another critical issue taken into consideration here is that One of the most important factors we should take care of before checking On-page SEO is rebot.txt. A rebot.txt file tells the search engine which part should crawl. In the next section, an updated version of the K-rank is proposed called NK-rank.

4. Proposed NK-rank metric

K-rank is an amendment of K-rank to measure On-page ranking. The first thing you have to do for SEO is to prepare a keyword list. This list has the most important keywords related to your website topic. In this paper, we test only on keywords (we chose the most important keywords in our topic). The most critical On-page factors have been used as follows:

4.1. Title Tag

It is the title of the website. The number of keywords in each title tag is calculated (noted as f_1).

4.2. Meta Tag

The discretion of a website written with an HTML tag. We also calculate the number of every keyword in the meta tag. (noted as f_2).

4.3. URL

Check if the URL uses any keyword from the targeted keywords. (noted as f_3).

4.4. Header Tag

Checks the number of every keyword in the header tag. (noted as f_4).

4.5. Alt Tag

Number of keywords that describe the image. (noted as f_5).

4.6. Content quality

One of the most important factors in On-page factors. It contains the most important keywords from the keyword list. (noted as f_6).

4.7. Fresh Content

To make sure that most blog posts have targeted keywords. It also helps the website rank (noted as f_7).

4.8. Internal Anchor Text

It is recommended to have internal hyperlinks with targeted keywords. (noted as f_8).

4.9. Webdesign

In this paper, we will give the number to this factor from 0 to 0.2 for every website after we test it. (noted as f_9).

4.10. Domain Age

It is another affecting factor that wasn't considered in the search engine guidelines. However, SEO experts in this article [4] mention that search engines prefer an old domain because it is more trusted. Keep in mind that this paper tests on university domains, and here, domain age is old in all tested websites, so all websites here take 0.2 as a maximum value because it is already trusted. (noted as f_{10}).

4.11. HTTPS

Using an SSL certificate is very important because some browsers today give a red alarm for websites that don't haven't HTTPS protocols, which worries users. This factor takes 0.1 as a weight. (noted as f_{11}).

These factors are aggregated to calculate a newly proposed metric called NK-rank. The formula of KN-rank is as follows:

$$KN\text{-}rank=\Sigma_{x=kn,kl,ti,t2,t3}[(_{y=1}\Sigma^{8}fytwy)kwx+f_9tw_9+f_{10}tw_{10}+f_{11}tw_{11}] \quad (1)$$

Eq.1 represents KN-rank, the improvement of k-rank.(f1 …f8) Onpage SEO factors. (tw1 ….tw8) tag weights. SEO professionals determined tag weights. This paper uses five keywords (kn, kl, t1, t2,t3) and (twn, twl, tw1, tw2, tw3) to represent keyword weights. We determined keyword weights beside [3]. (f9tw9 , f10 tw10 , f11tw11) those factors don't depend on keywords, so we didn't multiply it in keyword weights(kw).tag weights for Nk-rank.Tables (2, 3, and 4) include all the weights and threshold values for the parameters used in our experiments.

Table 2. Factors weight and threshold

Parameter	f1	f2	f3	f4	f5	f6	f7	f8
weight	1.0	0.8	0.6	0.7	0.5	0.7	0.4	0.1
threshold	2	4	2	3	4	15	5	2

Table 3. Factors weight

Parameter	f9	F10	F11
Weight	From 0 to 0.2	From 0 to 0.2	0.1

In this article, f_6 (body factor in [3]) was replaced with f6, representing content quality and body. Fresh content and internal anchor text with factors that depend on keywords have been added. Additionally, On-page SEO factors (f_9,f_{10}, f_{11}) that don't depend on keywords have been used. A threshold value has been defined to avoid more repetition of keywords. Search engines consider repetition as black hat SEO. The threshold values are assumed according to the most common values of them. A test is done on the universities' domains in the UK, Australia, and Egypt. The most 5 common keywords (university, college, study, research, and city of university) are used as test pages. These keywords are most common in the universities' domain (See Table 4).

The Keywords used for the test in the article

Symbol	Keyword
kn	university
t1	collage
t2	study
t3	research
kl	City of the university

These measures enable us to estimate how much the proposed SEO rank agrees with the real ranks obtained by the search engine (i.e., Google search engine results are used along the article).

Considering Euclidean distance, lower values are better. Lower distances mean more similarity between the rank results and the real search engine results. Euclidean Distance between 2 vectors X (x1,x2,…,xn) and Y (y1,y2,…,yn) can be calculated according to equation 2. We use X as a proposed metric and y as a real search result (i.e., Google results).

$$d = \sqrt{[(x_1 - y_1)^2 + (x_2 - y_2)^2 + \ldots + (x_n - y_n)^2]} \quad (2)$$

However, greater values of cosine similarity are better. Cosine similarity is calculated between X and Y as follows:

$$\text{Cos}(x, y) = x \cdot y / \|x\| * \|y\| \quad (3)$$

Table (4, 5, 6) presents the results of K-rank, NK-rank, Total Rank, and Real Result obtained from the search engine. For evaluating the proposed SEO metric, Euclidean distance, and cosine similarity.

Table 4. Parameter setting

Kwn	Kwl	$kwt_1..kwt_3$
0.8	0.5	1

In tables 5, 6, and 7, we calculated NK-rank for websites from the UK, Australia, and Egypt (respectively) universities websites. On the way of K-rank, we have to calculate the maximum of NK-rank by using tables (2, 3, 4). Wherefore the result is 100.26. Then, use this result to normalize NK rank. Tables 8, 9, and 10 K-rank results were recalculated since the dataset in [3] changed nowadays, wherefore website content changed.

NK-rank results and K-rank results are used to rank the website. The comparison between K-rank, NK-rank, real results, and famous SEO tools is shown in tables (11, 13, and 15). Tables (12 and 14) show clearly that KN-rank is better than K-rank. We can see which ranking metric (On-page) is closer to the real result and SEO tool. Keep in mind that the real result (we used here Google search results) and the result from SEO tools are the total results.

The Total Result means On-page and off-page factors. In comparison to SEO tools, we will use domain authority score (DA) because the domain authority this metric shows how your website appears on search engine result pages.

Domain authority score takes a number from 1 to 100 according to the mathematical equation, which uses SEO factors. In the table (11), cam.ac.uk and ox.ac.uk have the same domain authority score, and this may consider a blemish in DA. We give cam. ac number 1 and ox. ac number 2 because cam. ac has a larger number of backlinks and, in real result, has a higher rank. We can note that DA has a range from 1 to 100. If DA is used for comparison between websites, we may find 2 websites have the same DA (like table 11), but in real results, one of them will appear higher in (SERPs). We can note that the result of NK-rank in tables (11 and 13) is closer to the real results and SEO tools. Also, tables (12, 14) show Euclidean distance and Cosine similarity for K-rank and NK-rank with the real result; they show NK-rank is closer to the real result, which means NK-rank is better.

But note: in table (16), the results are not what was expected. The reason is that some domains don't care about SEO rules, especially non-commercial ones. There are copied contents sometimes. Search engines punish copied content.

To summarize, the contributions involved in the NK rank enable for better ranking that is more similar to the real one. In the next section, an Off-page SEO metric is proposed. Then, it is integrated with NK-rank for better SEO ranking.

Table 11. comparing results between K-rank, NK-rank, SEO tools and real result (the result in the search engine)

Website	K-rank	NK-rank	real	Tools
cam.ac.uk	5	3	1	1(92)
ox.ac.uk	4	4	2	2(92)
ucl.ac.uk	6	5	3	3(91)
nottingham.ac.uk	2	2	6	5(79)
gla.ac.uk	1	1	4	4(87)
southampton.ac.uk	3	6	5	6(74)

Table 12. Cosine Similarity K-rank, NK-rank and TR with the real result for universities websites.

Website	K-rank	NK-rank	Real
.cam.ac.uk	4	2	1
ox.ac.uk	2	2	2
ucl.ac.uk	3	2	3
nottingham.ac.uk	4	4	6
gla.ac.uk	3	3	4
southampton.ac.uk	2	1	5
Similarity	0.681	**0.791**	
Total distance	18	**14**	

Table 13. comparing results between K-rank, NK-rank, SEO tools and real result for Australia.

Website	K-rank	NK-rank	Real	Tools
sydney.edu.au	2	2	1	1(86)
newcastle.edu.au	1	1	3	3(79)
utas.edu.au	3	4	4	4(71)
uq.edu.au	6	5	2	2(83)
usc.edu.au	5	6	6	6(61)
cqu.edu.au	4	3	5	5(64)

Table 14. Cosine Similarity K-rank, NK-rank and TR with the real result for Australian universities websites

Website	K-rank	NK-rank	Real
sydney.edu.au	1	1	1
newcastle.edu.au	2	2	3
utas.edu.au	1	0	4
uq.edu.au	4	3	2
usc.edu.au	1	0	6
cqu.edu.au	1	2	5
Similarity	0.868	0.901	
Total distance	10	8	

Table 15. Comparing results between K-rank, NK-rank, SEO tools and real result for Egypt

Website	K-rank	NK-rank	Real	Tools
tanta.edu.eg	4	3	5	5(34)
mans.edu.eg	2	2	2	2(49)
cu.edu.eg	1	1	1	1(59)
kfs.edu.eg	5	5	4	4(40)
helwan.edu.eg	3	4	3	3(44)

Table 16. Cosine Similarity K-rank, NK-rank and TR with the real result for Egypt universities website.

Website	K-rank	NK-rank	Real
tanta.edu.eg	1	2	5
mans.edu.eg	0	0	2
cu.edu.eg	0	0	1
kfs.edu.eg	1	1	4
helwan.edu.eg	0	1	3
Similarity	0.982	0.945	
Total distance	2	4	

5. Proposed Total Rank Metric

In this section, a novel Off-page rank metric is proposed. It is then integrated with the previously proposed On-page NK-rank and is noted as Total-Rank TR. It allows for better SEO ranking metrics as follows:

5.1. Off-page Ranking Function

In this section, we discuss the influence of NK-rank rank score after adding Off-page factors. Backlinks and other factors play an important role in the Off-page part. Thus, incorporating Off-page factors with On-page factors allows for better ranking. The total result (TR) is expected to be closer to the real result from search engines or SEO tools (Domain Authority score).

Not only backlinks should be considered, but also the quality of these backlinks. Every backlink should have high domain authority (good rank in search engines) and be on the page's same topic. Therefore, the domain authority for every backlink should be considered. Subsequently, adding another factor (average of backlinks domain authority) is important. This factor helps judge the quality of backlinks or how these backlinks ranking in SERPs influence total rank. Also, using more Dofollow backlinks is a good way to get a high rank.

5.2. Domain Authority Average (DAA)

This factor is new and introduced here for the first. Because the domain authority of backlinks influences the website, high domain authority of backlinks leads to high domain authority.

Note that we use normalization in our result. So f_{14} and f_{15} will be variable in every country's domains. We choose the max of f_{14} and the max of f_{15} for every country. In table (20), the average of backlink domain authority is assumed (f_{15}) because they are equal in every domain (all high).

The Off-page rank is calculated as follows :

$$KN\text{-}rank_f = \Sigma_{x=kn,kl,ti,t2,t3} \left[\sum_{y=12}^{13} f_y \, tw_y \right) kw_x + f_{14} + f_{15} \right] \quad (4)$$

5.3. Social Media Factor

(f_{12}) represents joining your social media to your website. Using keywords in posts and Bio or About is good for page ranking. It is also recommended to use your website URL (or your blog) in posts on social media. We used several keywords in social media posts and About as keyword weights (kw).

5.4. External Anchor Text

(f_{13}) represents keywords linked with external websites. It is important to use keywords when you are building your backlinks.

5.5. Number of Backlinks

(f_{14}) this factor represents the number of backlinks in every website in our dataset but using the same method of k-rank [3], we use the normalization. Hence, f_{14} in tables (17, 18, 19) is the max number of backlinks in the UK, Australia, and Egypt, respectively, and we use that number to normalize the result.

5.6. Average of Backlink Domain

Authority (f_{15}); it is important to add this factor to our formula because the domain authority or ranking of backlinks in SERPs influences Total rank, so it is better to choose to get backlinks from websites that have high domain authority, Note that f_{15} didn't add to table 17

because all websites have the same domain authority (all of them is high). In tables (18 and 19) we added f_{15} because all domains' authorities are variable. Also, we use the maximum value of f_{15} to normalize the result. Note that values of factors f_{14} and f_{15} are variable as we use the max value for every group to normalize the total result.

Table 17. Factors weight and threshold of UK websites

Parameter	f_{12}	f_{13}	f_{14}
Weight	0.4	0.1	48.3
Threshold	5	7	

Table 18. Factors weight and threshold of Australian websites

Parameter	f_{12}	f_{13}	f_{14}	f_{15}
Weight	0.4	0.1	12.67	29.56
Threshold	5	7		

Table 19. Factors weight and threshold of Egypt websites

Parameter	f_{12}	f_{13}	f_{14}	f_{15}
Weight	0.4	0.1	64.91	92
Threshold	5	7		

5.7. Total Ranking score

The total rank score (TR) is the final metric that produces a total ranking score using On-page and Off-page factors. The result of TR is expected to be closer to results in SERPs and from SEO tools. Formula (5) is formula (1) + formula (4).

$$TR = KN\text{-}rank + KN\text{-}rank_f$$

$$TR = \Sigma_{x=kn,kl,ti,t2,t3} [(_{y=1}\Sigma^{8} f_y tw_y)kw_x + f_9 tw_9 + f_{10}\ tw_{10} + f_{11}\ tw_{11}] + \Sigma_{x=kn,kl,ti,t2,t3} [(_{y=12}\Sigma^{13}\ f_y tw_y)kw_x + f_{14} + f_{15}] \quad (5)$$

Innovative SEO factors are defined here. These factors are critical from the point of view of all experienced researchers in SEO. Domain age and Domain Authority Average (DAA) are defined here for the first time. Tables (20, 21, and 22) show the results of NK-rankf, NK-rank, and TR. NK-rankf was calculated using tables (17, 18, 19), and TR was calculated by summation of NK-rank and NK-rankf (formula 4). In tables (23 and 25), it is noted that NK-rank is closer to the real result than k-rank, and TR is more closely to the real result and SEO tool than NK-rank. It means that Off-page factors used here strongly affect the website's rank in SERPs. It is evident that the NK rank introduced here enhanced the rank, and TR enhanced the rank more because we added off-page factors to the formula. The comparisons are depicted in tables (23, 25, and 27). Tables (24, 26, and 28) show Euclidean distance and Cosine similarity for K-rank, NK-rank, and TR with the real result. It is clear that the proposed TR SEO metric has almost the smallest distance and a higher similarity with the real results from the google search engine. It indicates the superiority of the proposed TR rank over the existing SEO metric. Figures 4 and 5 summarize the results of our proposed metric according to similarity and distance evaluation metrics, respectively.

6. Conclusion

Search Engine Optimization is a vital area of research today. All companies try to get a high rank on search engines. A high rank means more visitors and, therefore, more income. This paper proposes NK-rank that measures On-page SEO. NK-rank outperforms the previously proposed SEO metrics since it incorporates some additional critical On-page factors.

Moreover, the Total-Rank TR metric is proposed. TR aggregates some Off-page SEO factors to make ranking more efficient. The results show that TR ranking is closer to the real result and SEO tools. Thus, TR is efficient in measuring the quality of SEO in general (On-page and Off-page). The TR ranks almost agree with the ranking from the real search engine (i.e., Google). In future work, another influencing factor that is not included (e.g., keywords number) will be considered. Additionally, NK-rank and TR are going to be tested on a large number of domains to investigate the merits and drawbacks of each deeply

Table 23. comparing results between K-rank, NK-rank, SEO tools, Total Rank and real result (the result in the search engine)

Website	K-rank	NK-rank	TR	real	Tools
.cam.ac.uk	5	3	1	1	1(92)
ox.ac.uk	4	4	2	2	2(92)
ucl.ac.uk	6	5	3	3	3(91)
nottingham.ac.uk	2	2	6	6	5(79)
gla.ac.uk	1	1	4	4	4(87)
southampton.ac.uk	3	6	5	5	6(74)

Table 24. Distance and Cosine Similarity K-rank, NK-rank, and TR with the real result for UK websites

Website	K-rank	NK-rank	TR	Real
.cam.ac.uk	4	2	0	1
ox.ac.uk	2	2	0	2
ucl.ac.uk	3	2	0	3
nottingham.ac.uk	4	4	0	6
gla.ac.uk	3	3	0	4
southampton.ac.uk	2	1	0	5
Similarity	0.681	**0.791**	**1**	
Total distance	18	**14**	**0**	

Table 25. Comparing results between K-rank, NK-rank, Total Rank, SEO tools and real result for Australia

Website	K-rank	NK-rank	TR	Real	Tools
sydney.edu.au	2	2	1	1	1(86)
newcastle.edu.au	1	1	2	3	3(79)
utas.edu.au	3	4	4	4	4(71)
uq.edu.au	6	5	3	2	2(83)
usc.edu.au	5	6	6	6	6(61)
cqu.edu.au	4	3	5	5	5(64)

Table 26. Cosine Similarity K-rank, NK-rank and TR with the real result for Australia websites

website	K-rank	NK-rank	TR	Real
sydney.edu.au	1	1	0	1
newcastle.edu.au	2	2	1	3
utas.edu.au	1	0	0	4
uq.edu.au	4	3	1	2
usc.edu.au	1	0	0	6
cqu.edu.au	1	2	0	5
Similarity	0.868	**0.901**	**0.989**	
Total distance	10	**8**	**2**	

Table 27. Comparing results between K-rank, NK-rank, Total Rank, SEO tools and real result for Egypt

website	K-rank	NK-rank	TR	real	Tools
tanta.edu.eg	4	3	5	5	5(34)
mans.edu.eg	2	2	1	2	2(49)
cu.edu.eg	1	1	2	1	1(59)
kfs.edu.eg	5	5	4	4	4(40)
helwan.edu.eg	3	4	3	3	3(44)

Table 28. Cosine Similarity K-rank, NK-rank and TR with the real result for Egypt websites.

website	K-rank	NK-rank	TR	Real
tanta.edu.eg	1	2	0	5
mans.edu.eg	0	0	1	2
cu.edu.eg	0	0	1	1
kfs.edu.eg	1	1	0	4
helwan.edu.eg	0	1	0	3
Similarity	0.981	0.945	**0.982**	
Total distance	**2**	4	**2**	

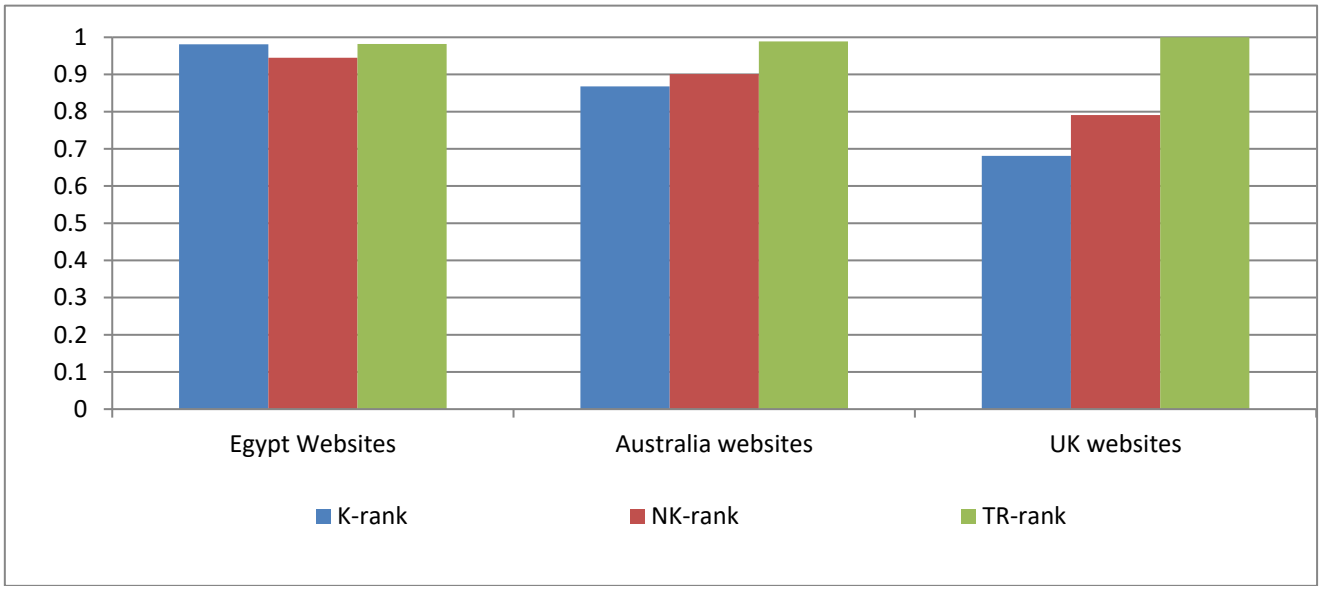

Fig. 4 Similarity of SEO metric with Google search results

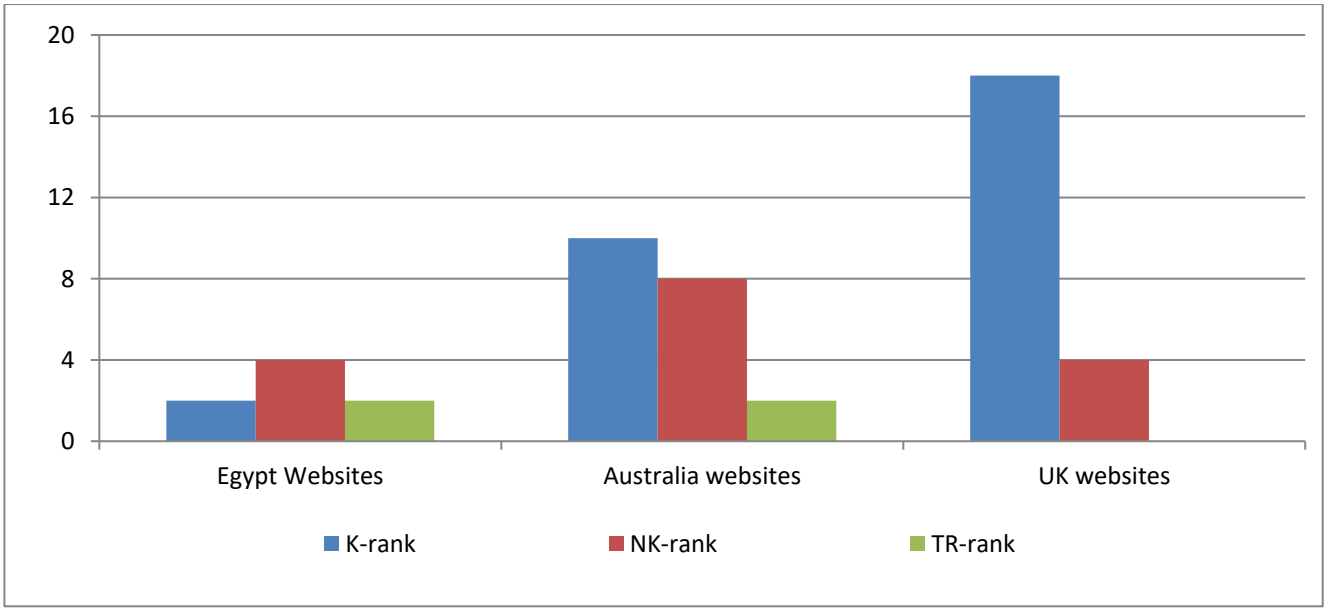

Fig. 5 Distance of SEO metrics with the results of Google search results

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Appendix 1:

Table 8. On-page K-rank result for some UK universities' website

Website	Keywords	f_1	f_2	f_3	f_4	f_5	f_6	K-rank
cam.ac.uk	University	1	1			1	7	0.123
	College					1		
	Study						2	
	Research		1				5	
	Cambridge	1	1		1	1	8	
ox.ac.uk	University	1	2		1	1	5	0.144
	College							
	Study						1	
	Research						4	
	Oxford	1	1		1	3	15	
ucl.ac.uk	University	1	1		1		6	0.109
	College						1	
	Study				1		3	
	Research		1		1		4	
	London	1	1		1		6	
nottingham.ac.uk	University	1	2		1	4	11	0.194
	College							
	Study						2	
	Research		1				13	
	Nottingham	1	1	1	1	6	6	
gla.ac.uk	University	1	4		1	5	10	0.296
	College							
	Study				1		7	
	Research		2			1	10	
	Glasgow	1	2		3	4	8	
southampton.ac.uk	University	2	1		2		3	0.175
	College							
	Study		1				1	
	Research		1		2		2	
	Southampton	1	1	1			5	

Table 9. On-page K-rank result for some Australian universities' website

Website	Keywords	f_1	f_2	f_3	f_4	f_5	f_6	K-rank
sydney.edu.au	University	1	1			6	8	0.158
	College							
	Study						3	
	Research						2	
	Sydney	1	1	1	1	7	5	
newcastle.edu.au	University	1	2		1	2	8	0.225
	College							
	Study				1	2	3	
	Research		1		1	2	4	
	Newcastle	1	1	1	1	2	7	
utas.edu.au	University	2			1	3	8	0.149
	College							
	Study						2	
	Research						6	
	Tasmania	2			1	3	3	
uq.edu.au	University		1		1	1	2	0.0916
	College							
	Study	1			1		1	
	Research		1				2	
	Queensland		1				1	
usc.edu.au	University	1	1			1	1	0.092
	College							
	Study		1				2	
	Research		1				1	
	Sunshine	1	1			1		
cqu.edu.au	University		2				2	0.107
	College							
	Study					1	7	
	Research					1	7	
	CQUniversity		1				4	

Table 10. On-page K-rank result for some Egypt universities' website

Website	Keywords	f_1	f_2	f_3	f_4	f_5	f_6	K-rank
tanta.edu.eg	جامعة	1	1		1	3	17	0.157
	كلية							
	طالب							
	بحث						1	
	طنطا	1	1	1	1	3	10	
mans.edu.eg	جامعة	2	1		8	1	7	0.195
	كلية						35	
	طالب							
	بحث							
	المنصورة	2	1	1	1	1	6	
cu.edu.eg	جامعة	1	1		10	7	18	0.278
	كلية						25	
	طالب						2	
	بحث				1		4	
	القاهرة	1	1		7	9	25	
kfs.edu.eg	جامعة	2			3		16	0.127
	كلية						1	
	طالب						1	
	بحث						1	
	كفر الشيخ	1					6	
helwan.edu.eg	جامعة	1	1		2	3	19	0.183
	كلية							
	طالب							
	بحث						2	
	حلوان	1	1	1	1	9	16	

Table 20. shows NK-rankf (using off-page factors), NK-rank, and Total Rank (TR) for UK websites.

website	Keywords	F_{12}	F_{13}	F_{14}	NK-rank$_f$	NK-rank	Total Rank
cam.ac.uk	university	5	1	48.3	0.908	0.212	1.12
	college						
	study	2	1				
	research	1					
	cambridge	5	1				
ox.ac.uk	university	5		37.1	0.684	0.197	0.881
	college	1	37				
	study						
	research		2				
	oxford	5					
ucl.ac.uk	university	4		33	0.594	0.194	0.788
	college	1					
	study		1				
	research		2				
	london	3					
nottingham.ac.uk	university	5		4.8	0.124	0.243	0.367
	college						
	study						
	research						
	nottingham	5					
gla.ac.uk	university	5		13.54	0.269	0.356	0.625
	college						
	study						
	research						
	glasgow	5					
southampton.ac.uk	university	4		8.63	0.189	0.179	0.368
	college						
	study						
	research	1					
	southampton	5					

Table 21. Shows NK-rankf (using off-page factors), NK-rank and Total Rank (TR) for Australian websites

Website	Keywords	F_{12}	F_{13}	F_{14}	F_{15}	NK-rank$_f$	NK-rank	Total Rank
sydney.edu.au	University	5		64.91	92	0.998	0.179	1.177
	College							
	Study							
	Research							
	Sydney	5	1					
newcastle.edu.au	University	5		0.62	90	0.583	0.221	0.804
	College							
	Study							
	Research	1						
	Newcastle	3						
utas.edu.au	University	3		5.55	90.2	0.609	0.147	0.756
	College							
	Study							
	Research							
	Tasmania	3						
uq.edu.au	University	5		10	92	0.655	0.112	0.767
	College							
	Study							
	Research							
	queensland	5						
usc.edu.au	University	5		0.11	80.95	0.521	0.089	0.61
	College							
	Study							
	Research							
	Sunshine	3						
cqu.edu.au	University	3		1.7	85.5	0.560	0.173	0.733
	College							
	Study							
	Research	1						
	CQUniversity	5						

Table 22. Shows NK-rankf (using off-page factors), NK-rank and Total Rank (TR) for Australian websites

website	Keywords	F_{12}	F_{13}	F_{14}	F_{15}	NK-$rank_f$	NK-rank	Total Rank
tanta.edu.eg	جامعة	5		5.54	20	0.525	0.207	0.732
	كلية							
	طالب							
	بحث		1					
	طنطا	5						
mans.edu.eg	جامعة	5	2	12.67	28	0.843	0.255	1.09
	كلية	3	33					
	طالب							
	بحث							
	المنصورة	5	1					
cu.edu.eg	جامعة	5	3	2.8	29.56	0.720	0.369	1.089
	كلية	3	25					
	طالب	1						
	بحث	2	1					
	القاهرة	5	2					
kfs.edu.eg	جامعة	5		11	23.52	0.704	0.187	0.891
	كلية	3						
	طالب							
	بحث							
	كفر الشيخ	3						
helwan.edu.eg	جامعة	5	2	11	23.5	0.694	0.198	0.892
	كلية							
	طالب							
	بحث		1					
	حلوان	5						

Table 5. On-page NK-rank result for some UK universities' website

website	Keywords	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	f_9	f_{10}	f_{11}	NK-rank
cam.ac.uk	University	1	1			1	7	10		0.2	0.2	0.1	0.212
	College					1		2					
	Study						3	4					
	Research		1				4		1				
	Cambridge	1	1			1	7	16	1				
ox.ac.uk	University	1	2		1	1	5	6		0.2	0.2	0.1	0.197
	College												

	Study						1						
	Research						4						
	Oxford	1	1		1	3	15	9	1				
ucl.ac.uk	University	1	1		1		6			0.1	0.2	0.1	0.194
	College		1				1						
	Study				1		3						
	Research				1		5	4	2				
	London	1	1		1		6						
nottingham.ac.uk	University	1	2		1	4	6	10	3	0.2	0.2	0.1	0.243
	College							1					
	Study						2	1					
	Research		1				10	8	2				
	Nottingham	1	1	1		6	3	15	1				
gla.ac.uk	University	1	4		1	5	12		1	0.2	0.2	0.1	0.356
	College												
	Study				1		2		5				
	Research		2			1	10	22	1				
	Glasgow	1	2			4	16	10	3				
southampton.ac.uk	University	2	1		2		3	3		0.2	0.2	0.1	0.179
	College												
	Study		1				1	3					
	Research		1		2		1	5	1				
	Southampton	1	1	1			4	5	1				

Table 6. On-page NK-rank result for some Australian universities' website

website	**Keywords**	**f_1**	**f_2**	**f_3**	**f_4**	**f_5**	**f_6**	**f_7**	**f_8**	**f_9**	**f_{10}**	**f_{11}**	**NK-rank**
sydney.edu.au	University	1	1			6	4	8	1	0.17	0.2	0.1	0.179
	College												
	Study						3						
	Research						1	11					
	Sydney	1	1	1	1	7	4	4					
newcastle.edu.	University	1	2		1	2	4	7		0.17	0.2	0.1	0.221

au	College						1	3					
	Study				1	2	3						
	Research		1		1	2	2	4	1				
	Newcastle	1	1	1	1	2	1	13					
utas.edu.au	University	2			1	3	1	6	4	0.2	0.2	0.1	0.147
	College							6					
	Study						1	1	1				
	Research						3	8	1				
	Tasmania	2				3	3	3					
uq.edu.au	University		1		1	1	2	4		0.2	0.2	0.1	0.112
	College												
	Study	1			1		1	1					
	Research		1				1	3	1				
	Queensland		1				1	2					
usc.edu.au	University	1	1			1	1	1		0.17	0.2	0.1	0.089
	College							1					
	Study		1				2						
	Research		1					1					
	Sunshine	1	1			1		4					
cqu.edu.au	University		2				2	5		0.18	0.2	0.1	0.173
	College												
	Study					1	4	5	3				
	Research					1	4	5	2				
	CQUniversity		1				2	4					

Table 7. On-page NK-rank result for some Egypt universities' website

website	Keywords	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	f_9	f_{10}	f_{11}	NK-rank
tanta.edu.eg	جامعة	1	1		1	3	13	6	6	0.18	0.2	0.1	0.207
	كلية												
	طالب												
	بحث								1				
	طنطا	1	1	1	1	3	6	3	1				
mans.edu.eg	جامعة	2	1		8	1	5	11	6	0.15	0.2	0.1	0.255
	كلية						34	1					
	طالب												
	بحث							5					
	المنصورة	2	1	1	1	1	1	3	2				
cu.edu.eg	جامعة	1	1		10	7	22	6	1	0.17	0.2	0.1	0.369
	كلية						24	1					
	طالب						2	1					
	بحث				1		4						
	القاهرة	1	1		7	9	11	5					
kfs.edu.eg	جامعة	2			3		11	8	6	0.17	0.2	0.1	0.187
	كلية							2					
	طالب						1	1	1				
	بحث							6	1				
	كفر الشيخ	1					6						
helwan.edu.eg	جامعة	1	1		2	3	9	5	1	0.17	0.2		0.198
	كلية							1					
	طالب												
	بحث						2						
	حلوان	1	1	1	1	9	10	5	1				