An Empirical Evaluation of Information Sharing's Impact on Profitability; Evidence from the Solar Sector

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Abstract

The role of online marketing is significant. Businesses strive to maximize their profit, and there are low-budget but efficient digital solutions for this aim. Social media sites are not just a connection point but also a great surface to collect information regarding products and/or companies. Even though these free opportunities are often used, websites are the „classical" standalone digital surfaces used for marketing purposes. SEO (Search Engine Optimization) provides various techniques to improve the companies' websites' SERP (Search Engine Result Page). In addition, it could provide even statistically proven financial benefits. The current study analyzes the SEO's influence on the financial performance of SMEs in the solar sector. The nationwide study based on the Kruskal-Wallis test revealed the importance of connecting social media sites to the company's website. The proper Social SEO results in significantly higher after-tax profit. Regarding the first contentful paints (first feedback to the browser about the website loading), the Pearson correlation coefficients showed up moderately strong, positive, significant relationships with many financial indicators.

Keywords

Introduction

The internet has been playing a crucial role in many aspects of life. The various social media sites offer plentiful opportunities for private people, communities, companies, and even governments. If businesses do not want to lose competitiveness, they must be widely and properly presented online. Free and easy-to-use social media sites are often used as a browser. Therefore, businesses should strive to have a complete and interesting profile on each site. However, these platforms do not provide free customization and direct selling for companies. In addition, the curious but not registered enquirers cannot access (totally) these contact points. The pandemic and the lockdowns increased internet traffic. Not only do the home office-related platforms and streaming providers enhance their positions, but the online stores could also multiply their sales and profit. Many factors could considerably influence the customers' purchasing decisions. The search engines, based on their secret algorithms, look for the demanded information on the web. Since the users trust them – they think the higher ranked website, the better result – they regularly choose the first few sites (they even do not look for the next pages). Because of this phenomenon, many online tools and experts deal with Search Engine Optimization (SEO). The companies' ranking could be increased by presenting preferred content for the search engines. Considering the higher ranking, the higher click, the better-optimized companies' websites could receive more orders and, through these, generate higher revenues. The limited resources, uncertain circumstances, and the pressure of sustainable development lead more and more people to use renewable energy. Recently, electricity prices in Hungary have increased significantly due to the growing military threat and inflation. Many households found implementing solar panels a favorable solution to reduce utility fees, dependency, and carbon footprint. This study aims to analyze the SEO's impact on firms' business performance in the solar energy sector.

Digital marketing is a technology-based process established by interacting with businesses, partners, and consumers to create, share, and maintain value for all stakeholders (Kannan, 2017). Various forms could be found within the applied techniques to satisfy consumer needs (Gao and Zhang,

2020). Nowadays, not just mobile marketing and social media marketing are involved, but also continuously developing tools, like data mining (Langan et al., 2019). The studied SEO is one of the most cost-effective tools dedicated to improving a website's popularity and traffic (Malaga, 2007). Even though it could be used as a "standalone" solution, it belongs to a wider phenomenon, the so-called Search Engine Marketing (SEM). SEM involves the paid (Search Engine Advertising, SEA) approach and organic ("free") aspect, which is represented by SEO (Chopra and Tandon, 2022). SEO could be interpreted as a web writing skill that engages customers (Sheffield, 2020). The quality content could be stolen and used (duplication), which was earlier just like keyword stuffing, link spamming, or the application of light affiliate forms of grey or black-hat SEO practices (Zhang and Cabage, 2017). Various works (Evans, 2007; Malaga, 2008; O'Neill and Curran, 2011) identified content, link building, and social sharing as crucial parts of SEO strategies, although diverse SEO guides name more main aspects (Google, 2013; SEO MOZ, 2016). According to (Google, 2013), the SEO basics start with accurate page titles and the application of "description" meta tags. The improved site structure should be implemented through the proper structure of URLs and more straightforward navigation. The optimization of the content is also advisable by quality content, anchor text, appropriate heading text, and the proper application of images. The crawlers (these read and analyze the websites) should be treated well through the effective usage of robots.txt and the proper application of nofollow links. Important the persistently application of the (right) SEO, because it can help increasing the online brand positioning too (Ahmad et al., 2022). Even if the business page appears in an adequate position (first page) on the Search Engine Results Page (SERP) – it contains the most relevant results for a given query – there is no guarantee for business. Since purchasing is a series of choices (Indumathi, 2018), before the decision is made, information must be collected, and the alternatives must be identified. These options need to be weighted according to different sets of criteria and then evaluated. If these steps are done, the last one is selecting the best alternative (Rezaei, 2015). The needed information could be collected through the search's results. Therefore the content could be the king, but it is not necessarily (Desai et al., 2013). Many factors can influence online shopping. Within the demographical variables,

gender (Clemes et al., 2014), level of internet usage (Saprikis, 2013), purchase experience (El-Ansary and Roushdy, 2013) and age (Lian and Yen, 2014) are the most often studied factors (Akar and Nasir, 2015) that have an impact on online purchasing. From the general variables, the same could be said about; trust (Al-Nasser et al., 2014), perceived risk (Adnan, 2014), and attitude (Mazaheri et al., 2012). While related to the product characteristics; the product type (Chen et al., 2022) and its price (Lestari et al., 2022) are the most often studied and some of the relevant factors. However, the latest studies (Ansari et al., 2019; Athapaththu and Kulathunga, 2018; Dabbous and Barakat, 2020) reveal a positive and significant relationship between the (website's or social media site's) content and online purchase intention.

Material and methods

To get a proper dataset for the analyses of SEO, the countrywide database of the Hungarian Solar Panel, Solar Collector Association was used. They aim to promote the application of solar energy and spread it widely. There are various types of memberships available. However, at least two recommendations of (previous) members and the acceptance of the presidency are needed for successful admission. The organization is open to Hungarian investors, manufacturers, traders, constructors, designers, and users. However, some international companies also could be found on the list of members. All in all, three hundred-sixty-two companies, sixty-two members, and two honorary members were registered on 30.10.2022. on the website. The number of contractors among the members was relatively low, only one hundred nineteen provided this service. This amount of companies created the base of the analyses. However, during the in-depth review, some self-employed and businesses without websites were identified and excluded from the next stages. In fifty cases, the websites did not work or could not be scanned by the SEO analyzer. So seventy-five contractors were called in the last section. Since the Hungarian regulation provides free access to the registered businesses' financial reports, this information was also involved. But this extra data resulted in six more companies being excluded because their reports were unavailable. Despite this information must be updated after six months of the latest financial year. This regulation reduces the data quality because the reports are from 2021. However, SMEs do not regularly modify their websites (even the aware businesses change

it approximately every two to three years, but proper study related to this question has not been published). So the final number of the analysed contractors was sixty-nine. The potential customers can search on the associations' website by region. Previously the companies' results were shown like business cards, where the primary purpose (electricity, hot water, heating) and the activity (design, construction, repair) of the solar panels' installations were indicated. Their business websites were analyzed using the six main SEO factors in Table 1.

TOTAL	It makes the website more relevant and popular within the user search queries. It helps to rank the webpage higher in search engines.
ON PAGE	It helps search engines understand the website's content and rank it based on the keywords.
LINKS	Search engines treat links as „citations". Each citation represents the content more valuable and credible.
USABILITY	It maximizes the available audience and minimizes their bounce rates.
PERFORMANCE	It provides a good user experience and decreases bounce rates.
SOCIAL	It is crucial for customer communication and brand awareness. It can be considered as a marketing channel that brings visitors to the website.

Source: based on (SEOptimer, 2022), own elaboration

Table 1: The main SEO dimensions of the current analyses.

Considering the available dataset and the type of variables Kruskal-Wallis test was applied. This nonparametric method is the extended version of the Mann-Whitney U test (Bugała et al., 2017). This statistic could identify whether the data comes from the same distribution. The Kruskal-Wallis test is used to study more than two groups. Since it requires independent random samples, a one-way ANOVA test was used (Xia, 2020). It is a well-known tool that determines whether there are any statistically significant differences between the groups' means (Kim, 2017). If two groups were tested, an independent samples t-test would be ideal. If three or more groups need to be analyzed, one-way ANOVA has to be used. This method requires regarding the variables; the independency of observations, normality of the populations, and homogeneity of the variances (Mishra et al., 2019). The nonparametric Kolmogorov-Smirnov test is ideal for testing distributions with a reference probability distribution or comparing two samples (Aslam, 2019). The Shapiro–Wilk test has the same function. It analyses whether the random sample

comes from a normal distribution (Aslam, 2021). In the current study, the Pearson correlation was also applied. It is a bivariate correlation that analyses the linear correlation between two data sets. The relationship between the studied variables can be positive, neutral, or negative, and its strength is between -1 and 1 (Ly et al., 2018).

Results and discussion

The companies with various focuses (electricity, hot water, heating) activities (design, construction, repair) and the number of regions (where they provide their services) were studied with ANOVA to highlight the differences within the groups. Since the test's assumptions were filled out, it was ideal for this approach. However, no similarities or differences regarding any of the SEO indicators could be identified at a reliable significance level. The correlation analysis of scale variables showed up a lot of relationships between many financial indicators and some technical-related SEO variables. Outliers and pairless variables were not within the dataset. In addition, the normality of the scale variables and the linear relationships between them were proved (Figure 1).
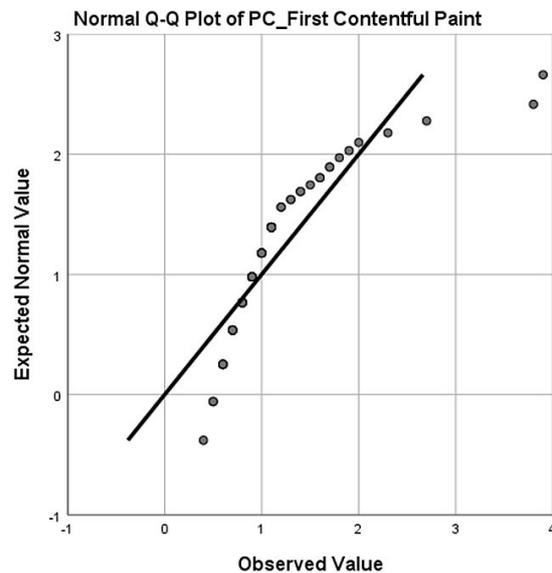
Source: own elaboration

Figure 1: Normal distribution of PC First Contentful Paint.

Therefore, the Pearson correlation coefficient could be used to identify their hidden relations. A robust (0.918) correlation was highlighted at a 0.05 significance level between the first contentful paint on mobile and the first on PC. This variable represents the first feedback the user receives when the opened webpage is

loading. It could be interpreted as a fast answer from the business website, and the strong connection means both interfaces have the same importance for the studied companies. If a quick "response" is provided for mobile users, the same will be valid for desktop users. Because these variables moved together, similar correlation coefficients were expected, demonstrated by the Figure 2.

The correlation coefficients showed moderately strong (from 0.4 to 0.62) relationships with various financial indicators at a high (0.05) significance level. However, the Mobile first contentful paint always revealed higher values. Naturally, the financial indicators are connected, so the results could be slightly distorted. Despite all that, these findings suggest the higher effect of mobile devices, which could also be measured in the financial results.

The ideal statistical tests were sought to analyze the relations between the diverse SEOs and financial indicators. For the ordinal (social SEO) and the scale (after-tax profit) variable, the Kruskal-Wallis test seemed to be ideal. To test the parameters' suitability to the assumptions, the independency of the observations was studied. For this purpose, an independent sample t-test should be used, but with it, only two groups could be compared.

Therefore, the one-way ANOVA was used, which rejected the similarity of the studied groups. After that, the distributions and the variances were studied. The Kolmogorov-Smirnov and even the Shapiro-Wilk tests identified the normal distribution of the studied variables (Table 2).

From the descriptives of these tests, the ideal variances were highlighted. The last requirement regarding the Kruskal-Wallis test was the random sampling of the observations, which was already fulfilled during the data collection. After all the assumptions were checked, the dissimilarities within the groups could be analyzed. Applying the Kruskal-Wallis test revealed a significant difference in the distribution of after-tax profit regarding social SEO. The statistic value was 8,524 at a 0.036 significance level. The pairwise comparisons highlighted the distinct levels of after-tax profit in the case of 1-3 and 2-3 social SEO groups (Table 3).

The measured difference meant those companies whose websites' had an "average" (3) social SEO realized significantly higher after-tax profit than those that had "poor" (1) or "slight" (2) social SEO.

The studied enterprises' customers (individuals or companies) can not be identified based
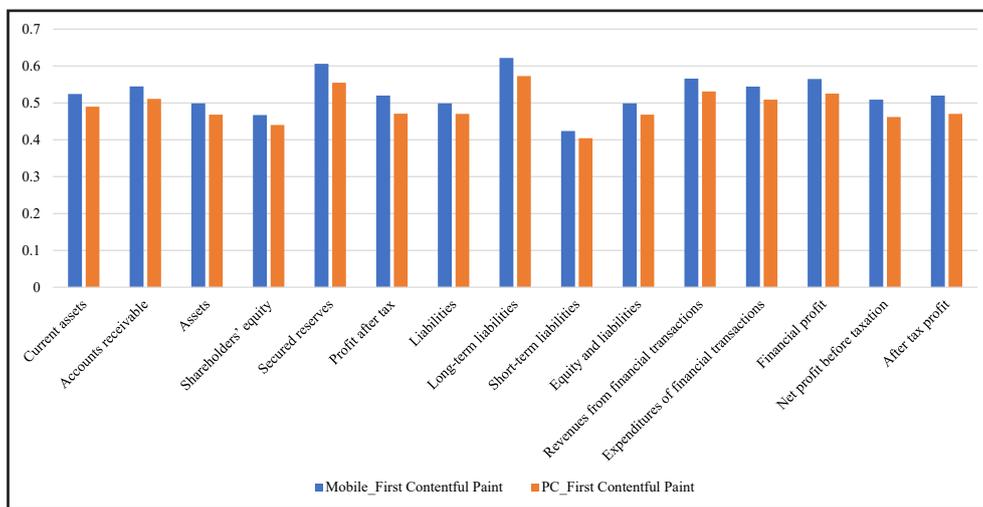
Source: own elaboration

Figure 2: Pearson correlation coefficients of financial indicators.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SOCIAL SEO	0.437	68	0.001	0.590	68	0.001
After-tax profit	0.358	68	0.001	0.336	68	0.001

Source: own elaboration

Table 2: Test of normal distribution.

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.a
1-2	-1.260	6.850	-0.184	0.854	1.000
1-4	-20.760	14.259	-1.456	0.145	0.872
1-3	-22.260	8.543	-2.606	0.009	0.055
2-4	-19.500	15.317	-1.273	0.203	0.000
2-3	-21.000	10.211	-2.057	0.040	0.238
4-3	1.500	16.145	0.093	0.926	1.000

Note: The adjusted significance levels were not significant in any of the cases.
Source: own elaboration

Table 3: The pairwise comparisons of the Kruskal-Wallis test.

on the information provided on the websites. Furthermore, the sites studied do not emphasize the contribution of solar energy to the Sustainable Development Goals (SDGs) and its enormous potential to support rural development. But these issues are of particular importance today. Energy independence is also a frequently discussed topic, where the role of solar panels is often mentioned (Abhyankar et al., 2023; Sattich et al., 2022). Solar energy is clean, renewable, and abundant, and it also reduces the reliance on fossil fuels and all the disadvantages of their application (Al-Shahri et al., 2021; Kuşkaya et al., 2023). Some settlements are difficult to reach (typically with a low population) and/or too expensive to connect to the grid. Therefore, they are not connected to the electricity network. The so-called off-grid solutions can provide power in these cases. By applying solar panels, batteries, and inverters, their needs can be satisfied sustainably (Baurzhan and Jenkins, 2016; Brunet et al., 2022; Pal and Mukherjee, 2021). The tremendous economic opportunities provided by solar panels have to be stressed too. It can reduce the energy cost, create new jobs and through higher employment, economic growth and tax revenues could be increased (Guo and Xiang, 2022; Madsen and Hansen, 2019; Tănasie et al., 2022; Yasmeen et al., 2022). These advantages could powerfully support the development of rural regions (Ibrik, 2019; Palit, 2013). The operation of agriculture's efficiency can be enhanced through cost-saving, automatization, and remote monitoring opportunities supported by solar energy. In addition, the widespread of various greenhouses could also enhance the quality of life in these areas (Hu, 2023; Pascaris et al., 2021; Sharma et al., 2019). The benefits of this form of renewable energy are probably not known to everyone. Due this reason, a form of advertising should be pursued by the companies studied, which should present not only the benefits of their given product but also the benefits of the sustainable operation itself

in an educational way. So they could address more potential customers and increase their profit further.

SEO has been playing an essential role in business life, and the pandemic showed how important the SERP for companies could be. Digital marketing is strongly correlated with online presence, and the proper management of digital surfaces could further increase the efficiency of digital marketing even without ads. Mostly the influence of SEO on SERP has been studied (Iqbal et al., 2022; Sellamuthu et al., 2022; Wahba and Barhoom, 2019), but there are a few studies related to SEO's financial impact too. The work of (Poturak et al., 2022) studied a private university, where SEO influence on business performance was analysed. The implementation of SEO tactics resulted in a better position on the SERP, and through this development, the number of visitors, the spent time on the website, and the user engagement increased. These also affect the student enrollment, which causes higher annual sales revenue. The study of (Tomasi and Li, 2015) analyzed three SMEs regarding the SEO impact on their performances. The applied SEO techniques resulted in the same effects; increased SERPs ranking, a higher number of visitors, longer average time on site, better user engagement, and increased annual sales revenue. The research of (Zhang and Cabage, 2017) implemented three different aspects of SEO tactics (content-based, content-based and proactive link building, content-based and, social media campaigns) for various websites. The authors found link-building results in better ROI in long term, while social media builds traffic fast. However, both of them increase website traffic and revenue. Like the previous studies, the current work highlights SEO's positive impact on financial indicators. However, this work reveals the importance of Social SEO on the higher after-tax profit in the solar sector. Even though the social media campaign's influence was studied, the recent findings show that the connected and on the website

presented social media links'/appereances' a significant role. This could be explained by the extended content of the website. May these platforms be crawled by search engines. However, it would bring back the question of "Is content king?". The technical side of the work stressed the relevance of the first contentful paints (both on PC and mobile) and their moderately strong correlations with many financial indicators. The fast answer provided to the user could be crucial since everybody looks for fast interactions nowadays. The consumers' attitudes towards fast replies have not been studied. The SERP-related works reveal the preference for organic (search) results (Lewandowski et al., 2018; Lewandowski and Schultheiß, 2022), and higher rank (Alanazi et al., 2020; Wu et al., 2014), but the other preferences are just seldom analyzed (Agichtein et al., 2006).

Conclusion

The current work studied the information-sharing's impact on the profitability of SMEs in the solar sector. Since, nowadays next to the support of sustainable development, the growing military threat and inflation also highly increased the demand for solar panel-based solutions. The potential consumers' information-collecting habits changed too through the strengthening of social media platforms. The Hungarian solar sector was studied to see how the proper online presence and linkage of various sites could affect the financial performance. In line with previous works, the current study found a significant and positive relationship between the application of SEO and profit. The higher rank of Social SEO was connected with a higher profit after-tax too. The research's technical aspect showed the importance of first contentful paints. In both cases of PCs and mobiles, they showed moderately strong correlations with various financial indicators. The correlation between the PC's and mobile's first contentful paints was nearly linear. So, the studied businesses found both or none of these aspects important. Based on the current findings, the more content obligatory involves the connection of social media platforms to the website, and the fast reply of the website could positively influence the financial performance of the business too. Specializing the content/ad could further increase the visibility and profit of the contractors. Informative material focusing on the features of solar panels (e.g., upfront cost, payback period, relevance of weather) could increase the knowledge of potential customers while improving the SMEs' brand and reputation.

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Appendix

ON PAGE	Title Tag	USABILITY	Use of Mobile Viewports
	Meta Description Tag		Google's PageSpeed Insights - Mobile
	Language		Mobile_First Contentful Paint
	H1 Header Tag Usage		Mobile_Speed Index
	Keyword Consistency		Mobile_Largest Contentful Paint
	Amount of Content		Mobile_Time to Interactive
	Image Alt Attributes		Mobile_Total Blocking Time
	Canonical Tag		Mobile_Cumulative Layout Shift
	Noindex Tag Test		Google's PageSpeed Insights - Desktop
	Noindex Header Test		PC_First Contentful Paint
	SSL Enabled		PC_Speed Index
	HTTPS Redirect		PC_Largest Contentful Paint
	Robots.txt		PC_Time to Interactive
	Blocked by Robots.txt		PC_Total Blocking Time
	XML Sitemaps		PC_Cumulative Layout Shift
	Analytics		Flash Used
	Schema.org Structured Data		iFrames Used
LINKS	Total Traffic From Search		Favicon
	Friendly Links		Email Privacy
PERFORMANCE	JavaScript Errors	SOCIAL	Facebook Connected
	HTTP2 Usage		Twitter Connected
	Optimize Images		Instagram Connected
	Minification		YouTube Connected
	Deprecated HTML		LinkedIn Connected
	Inline Styles		Used_Tech

Source: own elaboration

Table A1: The used variables of SEO analyses.

Invested assets	Net sales revenues
Intangible assets	Capitalised value of own performance
Tangible assets	Other revenues
Investments and funds	Material type expenditure
Current assets	Payments to personnel
Inventory	Depreciation charge
Accounts receivable	Other expenses
Securities	Trading profit
Liquid assets	Revenues from financial transactions
Accrued and deferred assets	Expenditures of financial transactions
Assets	Financial profit
Shareholders' equity	Net profit before taxation
Issued capital	Tax liability
Issued, unpaid capital	After tax profit
Capital reserve	
Accumulated profit reserve	
Secured reserves	
Valuation reserves	
Profit after tax	
Provisions	
Liabilities	
Subordinated liabilities	
Long-term liabilities	
Short-term liabilities	
Accrued expenses and deferred income	
Equity and liabilities	

Source: own elaboration

Table A2: Balance sheet, profit and loss.