

*A Study on
Search Engine Optimization and Search
Engine Marketing*

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FOREWORD

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This project aims to deliver a report on SEO and SEM strategies in this field with the applied samples (e.g., Google, Bing, etc.) and compares them with each other, explain the benefits of SEO on digital marketing and SEM Intelligent Online Marketing System, and express the Role of search engine optimization in search marketing.

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INTRODUCTION

Search engine marketing (SEM) is a form of Internet marketing that involves the promotion of websites by increasing their visibility in search engine results pages (SERPs). SEM may involve novel search engine optimization (SEO), which adjusts website content and site architecture such that a higher ranking in search engine results pages is achieved as a way to increase pay-per-click (PPC).

Search engine optimization (SEO) is the process of increasing the quality and quantity of website traffic by increasing the visibility and presence of a website or a web page to users of a web search engine. SEO refers to the improvement of unpaid results (known as "natural" or "organic" results) and excludes direct traffic and the purchase of paid placement. Furthermore, it may aim for different types of searches, including image search, video search, academic search, news search, etc. Another SEO tactic is promoting a site to increase the number of backlinks, or inbound links.

1.1 Background

As the number of sites on the Web increased in the mid-to-late 1990s, search engines started appearing to help people find information efficiently and quickly. Search engines developed business models to help finance their products and service, such as pay-per-click programs offered by OpenText in 1996 [5] and then Goto.com in 1998 [14]. Google also began to offer advertisements on search results pages in 2000 through the Google AdWords program. [8] By 2007, pay-per-click programs proved to be primary

moneymakers for search engines. In a market ruled and dominated by Google, in 2009 Yahoo! and Microsoft announced the intention to make a cooperative program. The Yahoo! & Microsoft Search contract eventually acquired approval from regulators in the US and Europe in 2010.

Search engine optimization experts expanded their offerings to help businesses learn about and use the advertising opportunities offered by search engines and to increase awareness, and new agencies focusing primarily upon marketing and advertising through search engines emerged. The term "Search Engine Marketing" was popularized by Danny Sullivan in 2001 [15] to cover the spectrum of activities involved in performing SEO, managing paid listings at the search engines, submitting sites to directories, and developing online marketing strategies for businesses, organizations, and individuals.

SEM STRATEGIES

2.1 SEO vs. PPC

There are two key differences when considering SEO or PPC. The first is that paid ads appear at the top of the page, above the organic listings influenced by SEO. The second is that traffic from organic via SEO is free, whereas traffic from PPC has a cost for each click. In many cases, SEO and PPC work best when integrated and strategically aligned.

2.1.1 Improve your organic traffic

What are the pros and cons of organic traffic from search engines? Let's begin with the pros:[4]

- **Awareness** Visibility in search engines for your targeted keywords puts your business in front of potential customers in the same way as if you were to advertise leading to eventual brand awareness.
- **Branding** Visibility around commercial search terms and informational queries related to your business area has a proved branding effect, the effect known for exponentially increasing the number of customers.
- **Credibility** Having your site return in the organic results can influence your perceived credibility with an audience looking for your services. This is as appose

to the PPC method for the reason that people trust organic results much better.

- **Traffic** Increasing website traffic provides you with more opportunities to drive awareness of your business and educate a prospect as to why they would buy from you. This appears as entangled benefit with more awareness, much you increase it, the outcome favours other aspects of one's business more than expected.
- **Cost per click** Traffic from organic search is free. Developing that visibility will take time and effort (money), but there is not a direct charge for each impression or click. This can cost you a rather high initial investment, but a lasting result.
- **Return on investment** Organic search engine traffic can provide an improved ROI over traditional forms of paid media and certainly improve upon PPC. That is the reward for gaining trust and credibility.
- **Cost** While SEO is neither cheap nor easy, it will generally be more cost-effective than all other marketing tactics for delivering brand awareness and relevant traffic to your website. Even the highest-paid SEO experts cost one fifth of the amount of investment needed for PPC annually.
- **Sustainability** Unlike paid search marketing, organic traffic does not vanish the moment you stop paying. As such, efforts to develop organic traffic can keep a business alive when marketing expenses is cut back.
- **click-through rate** A higher percentage of users click on the organic results. While there are exceptions to this rule, you will generate more clicks from a highly placed organic listing than from a highly placed paid ad. That is the effect known as Ad Blindness.[2]

In many cases, organic traffic can be slow to reach high, and you may be utterly out-of-round. If you are just starting out, and the keywords you are targeting show results dominated by giants like Amazon, then you may need a huge change of strategy.

You may also need to develop content assets to create and maintain strong natural visibility. Not all businesses have the enough resources to excel content development, and this appears as a problem. Tactics such as safe, sustainable link building can be difficult to sustain, and often, a strategy is needed, along with expert support.

Organic traffic may also largely come in via pre-purchase research queries. This is valuable traffic, but a more staged approach may be required to pursue those users to a

purchase. This is a rather godly activity in digital marketing; however, it is not a good fit for all businesses.

2.1.2 Laser-targeted visibility

How does paid search differ from organic search? With click-through rates and trust heavily stacked in favor of organic search, why would a business look at paid search? Here are some of the benefits PPC offers: [3]

- **Position on the page** Paid search dominates above-the-fold content. With typically four ads on desktop and three on mobile, a user will always see the paid search ads, even if they choose to scroll past them.
- **Improved ads** PPC ads are just that: advertisements. Thus, you have far more control and more space for promoting your marketing messages.
- **Budget** PPC allows for a tight control of budget. Determine how much you are willing to spend per day, and set that fixed limit.
- **Speed** While developing good organic visibility can take time, a PPC campaign can be created in days and build up in weeks. There is no faster way to get in front of potentials at the moment they are prepared to buy than paid search engine advertising.
- **Marketing intelligence** Where organic largely hides keyword data in the name of for the sake of privacy, there is no such restriction with paid search marketing. With conversion tracking and a solid integration with an analytic software (like Google Analytic), we can determine what keywords convert and at what percentage and cost. This intelligence can be fed directly into organic search (SEO) marketing and can inform all other advertising to improve results across the board.

As with organic search, there are many benefits to paid search advertising or PPC. However, there are also some drawbacks for advertisers to be wary of.

PPC can be expensive. It is not always the case, but costs can quickly add up. If you are targeting entire countries or running international campaigns, those costs as rather astronomical.

Paid search advertising is, as the name suggests, paid - so it requires constant investment. Stop paying and your ads go away and your lead army melt away. So long as you have a solid acquisition cost, then this should not be a problem, but in contrast to

SEO, it seems less of a logically financed deal. Of course, SEO should be ongoing to keep the opposition away from the gates, but organic traffic can be a little more robust.

Successful PPC needs skilled management and optimization - from monitoring bids, scores, positions and click-through rates. Some of this can be done with scripts, some require an always-awake expert team, depending how vital is SEM to your business.

2.2 The Competition between Paid Search Marketing and Search Engine Optimization

PSM and SEO are two standard promoting procedures available to promoters in search engine advertising. This assessment utilizes two numerical models, one out of a micro-economic procedure and another in a game-theoretical system, to sever down the trade off among PSM and SEO.

Existing literature on search engine marketing is inadequate in clarifying the impact of SEO on the market on the grounds that natural and organic results quality has been only connected with client fulfillment. Up until this point, concentrates in search engine advertise have consistently embraced the client based way to deal with model quality and its effects.

This dimension of quality is a major domain expertise of search engines in satisfying the information need of searchers, reflecting „Crawling and indexing algorithms, the database index, and search and retrieval algorithms,“. we call this quality dimension "algorithm effectiveness".

In the search engine advertising market, Internet search engines attempts to make their page ranking unbiased with regard to their own relevancy standards. They form the foundation of the market, and the businesses of SEO solely reply on their performance.

The involvement of SEO distinguishes the difference between search engines in their ability to exclude these „noises,“; the greater this ability is, the less likely the noises SEO make deteriorate the search engine service quality. We call this ability "algorithm robustness".

To a certain extent, while algorithm robustness can be improved over time primarily through learning on the search engine's side, algorithm effectiveness is highly sensitive to initial investment and less flexible. For example, Google's core ranking algorithm is based on PageRank, a patent of information retrieval filed when Google was founded.

Algorithm robustness is dynamically affected by the competition between search engines and SEO firms, because both parties engage in constant learning and improvement.

2.2. THE COMPETITION BETWEEN PAID SEARCH MARKETING AND SEARCH ENGINE OPTIMIZATION

Lower algorithm robustness, therefore, reflects a lack of learning and investment on the search engine's side, or a lack of accumulated experience on the SEO firms' side, or both.

Although algorithm robustness secures algorithm effectiveness, once a search engine service provider has chosen the effort levels in each of them, we can assume that these two components are stable with regard to the equilibrium status of advertisers and searchers. This definition of organic search quality expands former works in the literature of search engine.

Striving to examine the manageability of SEO firms, and explore the effect of SEO and different factors on SEP's worth, Several interesting experiences emerge from the transformation of the SEO companies' maintainability.

To begin with, the maintainability of SEO companies depends, in any case, on the publicists' ability to-pay for online commercial. Furthermore, calculation strength has a monotonic negative impact on the supportability of SEO on the grounds that it legitimately restrains the act of SEO. The handy consequence is that SEP could improve its benefit through non-stop learning and "outfox" SEO companies with the goal that its outcomes are less helpless against SEO practice, all in all. Thirdly, calculation adequacy certainly influences the maintainability of SEO firms. To make sure about a profit by venture, SEP has the inclination to improve its calculation vigor simultaneously.[10]

From an online promoter's perspective, he is tested with two decisions: PSM versus SEO. Studies have demonstrated that in harmony, SEO isn't an ideal decision, regardless of whether SEO charges are not more costly than a paid advertisement battle. Likewise, it has been demonstrated that posting may hurt the search engine's income. Thus, SEO which holders on to organic search will completely influence search engines' take. For a low-quality web search tool, SEO companies may really propel the positioning. For an excellent web crawler, then again, SEO is regularly viewed as spam. In any case, the effect of SEO from the business point of view is as yet not very much tended to in the published research, and the effect of SEO on search clients' fulfillment is unclear. Along these lines, this examination centers around the promoters' result from PSM benefits within the sight of SEO to research the outcome of SEO and the opposition among SEPs and SEO in the SEM advertise.

[10]

2.3 Optimal search engine marketing strategy

On-line searching is an integral activity of most on-line buyers, and search engines are the most popular tools for this purpose. As a result, search listings have become a non-invasive, "pull marketing" strategy that works in the background. Sellers are keen to advertise and promote themselves on search engines. Initial attempts like banner ads, pop-ups, and e-mail marketing promotions use a frustrating push marketing strategy that interrupts the user's self-directed search. The effectiveness of these methods in terms of click through has gone down from about 2 percent to less than 0.5 percent in recent years, and on-line sellers now realize that banner advertisements do not bring the traffic volume they want.

Conversely, paid placements on search engine results pages are unobtrusive, more effective than banner ads and popups, and a cost-effective way to reach buyers. The main argument against paid placement is that most buyers do not trust paid placements and prefer to follow links displayed in the editorial section of the search-results pages. Given the bias toward editorial content in buyers' on-line search behavior, one could argue that, instead of investing in paid placements, on-line sellers should undertake search engine optimizations (SEOs) to improve their rank in the search-result listings. This paper shows that even if the total cost of implementing SEO and implementing paid placement was the same, and SEO always resulted in a high ranking on the search results page, paid placement would still prevail as the SEM strategy of choice for most on-line sellers.

This result can help advertising professionals who have to justify investments in paid placements even when there is overwhelming evidence that most buyers ignore paid placements and follow links displayed in the editorial section of the search-results page. The analysis will provide search engine vendors with insights about the attractiveness of various SEM strategies for on-line sellers, and will help on line sellers to identify their optimal SEM strategy and recognize the conditions under which one strategy is better than the other.

Potential buyers who search using these keywords will end up with only a few search-result pages and can search through most of the search results. In such a case, the sellers are always discovered by the buyers. A buyer's search intensity depends on several factors, such as the opportunity cost of time, the perception of price dispersion, the expected savings from search activity, and the importance/value of the product the buyer intends to buy. Thus potential buyers are likely to have high search intensity if they have low opportunity cost of time, or perceive high price dispersion, or are buying an

expensive product. These buyers are more likely to discover on-line sellers even if they are listed in the back pages of the search results. There is a relatively high probability that these sellers will be part of a buyer's consideration set.

To summarize, in the case of electronic markets characterized by buyers with high search intensity or by products that have relatively few relevant Web sites, on-line sellers would be better off not investing in SEM strategies.

2.4 SEO vs PPC: A Model To Determine The Most Effective Digital Marketing Budget Division

The Internet started devising an influence on the business world during the mid-ninety nineties, and has since grown dramatically in the number of users. User access to product information, services, their pricing and other important information has get a lot easier.

Most novel search engines (including Google, Bing and Yahoo!) display two types of results: paid results at the top (resulting from a pay-per-click PPC plot), and natural (or organic) results lower down on the screen. Each set of results is graded according to its own algorithm - ideally a given website should rank highly in both. Doing effective search engine optimization (SEO) on a website should amend the ranking in the natural section, and running an expert PPC campaign should revel a website's ranking in the paid section of search engine results.

It has been established many times that an online presence, especially for an e-commerce concern, is not negotiable. More than a decade ago the estimated spending on online transactions globally was already noted as being \$102 million. Search engines drive a large amount of traffic to websites - mostly through either SEO, PPC or both. Most business websites should strive towards ranking highly in either natural, or paid, but preferably in both types of listings.

Other authors have claimed that spending on these two digital marketing platforms can be split as being 82% on PPC, 12% on SEO and 4% on other platforms. However, it is generally accepted that spending SEO decreases after an initial peak, while PPC spending continues as long as the campaign remains active. This points to a contradiction, which is one of the motivations behind this research. There appears to be contradicting results from previous research, whether natural or paid results are more popular in terms of clicks harvested. A claim has been made that 60 - 68% of users prefer clicking on organic results, while only 14 - 40% prefer PPC results This trend seems to be confirmed by other authors. However, the same author claims that if one of the two marketing

platforms is ignored, potential clients will be lost. Hence the research problem can be stated as that website traffic maximization (and therefore the return on investment ROI) is at risk without clear guidance as to the budget split between SEO and PPC marketing.

This research project was done in three phases, involving three separate empirical experiments.

1. **SEO & PPC simultaneously** Firstly, an experiment was done on websites which did invest in PPC, to determine if they also invested in SEO. One of Google's directories was used to identify 13 common item categories, like: Computers, Family & Community, Finance, Food, Gifts & Occasions, Real Estate, etc. Many experimental searches were then done for each category, using first a fat head search phrase - a short, wider and less focused search query. Another search query was also constructed for each category - this time a long tail query, which is longer, more focused and specific.
2. **PPC only then SEO only** Secondly, another experiment was done in a case study on one e-commerce website, using first only PPC, then switching over to only SEO, with the purpose of determining which one produced more website traffic, sales and ROI in the long run.
3. **PPC versus SEO** - Thirdly, a final comparative experiment was done on three different e-commerce websites, in an attempt to determine how the CPA compares between SEO and PPC.

As could be expected, this experiment proved that the implementation of a PPC system can produce favourable results, if it is acceptable that there will be a fixed monthly expense. Once the campaign was terminated, website traffic dropped to virtually zero. On the other hand, the implementation of an SEO campaign requires a relatively large investment at the start, but very little after that. After the initial dramatic drop in traffic, SEO started producing a gradual increase in traffic, bypassing the figures produced by PPC only after about three months. The expenses for the two systems crossed over after about six months, with the monthly expense of SEO decreasing consistently into the future. As expected, the PPC traffic was fairly stable while the campaign was running (blue line), then dropped to zero when it was terminated. Shortly after that, SEO traffic started picking up (red line), eventually bypassing the average PPC level. Expenditure wise, there was a consistent cost per month during the PPC period (green line), which dropped to zero after termination of the campaign, then peaked sharply as the invoice

2.4. SEO VS PPC: A MODEL TO DETERMINE THE MOST EFFECTIVE DIGITAL MARKETING BUDGET DIVISION

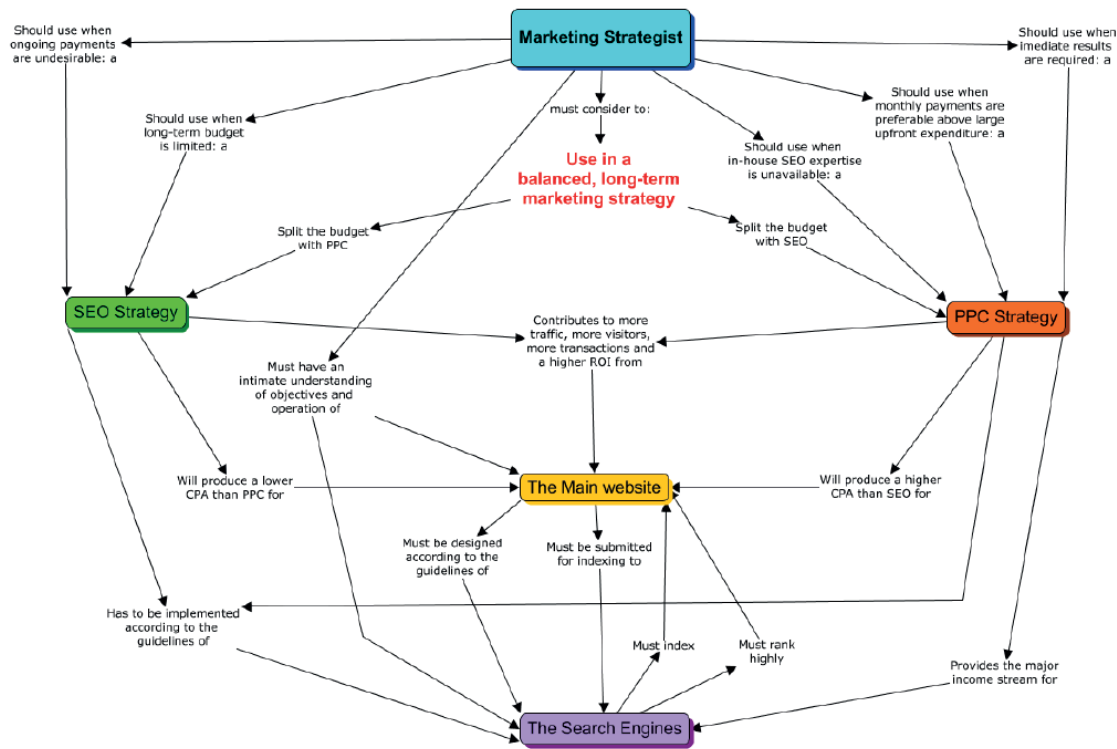


Figure 2.1: Model to determine budget split across SEO and PPC

for the SEO was paid. However, after the peak, it dropped to zero. This high initial cost was then spread over the remaining months in all calculations.[11]

2.4.1 Development of a Search Engine Marketing Model using the application of a dual strategy

This research set out to determine how the results of the implementation of a PPC campaign compared to those of a SEO campaign, given the same websites and environments. At the same time, the expenses incurred through both these marketing methods were recorded and compared.

Methods

The first article in this paper was based on an empirical field experimental approach. The authors considered the implementation of both SEO and PPC, and compared the results. Data was gathered from Google search results after performing both fat head and long tail key phrase searches based in various categories.

The websites that were listed in the top 10 of the sponsored section of the search

results were recorded. These websites were then checked to see if they also had an SEO ranking within the top 100 for both the fat head and long tail key-phrases.

From Article One, results showed that few of the websites that invested in PPC had organic listings within the top 100 for both fat head and long tail key-phrases. It therefore confirms that online marketers seldom use SEO as part of a SEM campaign. Even when assuming that the implementation of SEO costs the same as investing in PPC, and the benefits include the assurance of always being part of a user's consideration set, SEO was still not the optimal SEM strategy for website marketers. One of the major reasons for the quick adoption of the PPC strategy is that it is very similar to traditional paid advertising strategies and business owners or Marketing Managers can manage such campaigns on their own. Many of the companies that invest in PPC do not have the skills/training to implement SEO on their own. They will have to outsource this to SEM companies to do this on their behalf.

The second article's data was gathered from a real-life website where first the one (PPC) and then the other (SEO) of the marketing approaches were followed exclusively. Usage behaviour and statistics were recorded and analysed in an attempt to compare the expenditure with the gain from each approach. A company in Cape Town, South Africa, manufactures PVC, polypropylene and leather promotional and stationery products. The company's name is not listed; for clarity they will be named XYZ. The company invested in PPC from May 2010 to May 2011 in an attempt to drive traffic to the website.

During that time no SEO implementation was done on the website. Each month XYZ spent, on average, R3000 on PPC. However, after the PPC campaign was terminated, they paid a once-off fee of R19 000 for the SEO project. Article two's results indicated that the PPC system did produce favourable results, but on the condition that a monthly fee must be set aside to guarantee consistent traffic. The implementation of SEO required a relatively large investment at the outset, but it was once-off. After a drop in traffic due to crawler visitation delays, the website traffic bypassed the average figure achieved during the PPC period after a little over three months, while the expenditure crossed over after just over six months.

In conclusion of Article Two, it can be claimed that, in this specific case, SEO provides a better investment than PPC. It is also predictable that this advantage will increase as time goes by. It should also be noted that traffic to a website on its own is not the only indicator of success. A high conversion rate, leading to more revenue generated, and eventually leading to increased profit would be the final indicator of the success of an e-commerce website.

2.4. SEO VS PPC: A MODEL TO DETERMINE THE MOST EFFECTIVE DIGITAL MARKETING BUDGET DIVISION

For the last article, the authors examined the analytics and other statistical usage results of three real-life websites where both PPC and SEO were applied in tandem. The three websites were from three distinct industries. It was found in Article Three that the CPA for SEO, for each of the e-commerce websites, was significantly lower than that of the CPA for the PPC campaigns.

Based on the results obtained from Article One, Article Two and Article Three, it can be claimed that running PPC alone, like many Online Marketers do, the company will most likely miss out a large portion of the market share. PPC has huge short-term benefits, however, on the condition that a monthly budget must be set aside to guarantee consistent traffic. If the budget runs out, the traffic stops.

SEO, on the other hand, is very much a long-term strategy and it does require a high initial investment. However, unlike PPC, it does not necessarily require an ongoing budget to keep sending traffic to the website.

This thesis contributes to the existing body of knowledge in the field of SEM by proving that SEM expenditure in an unbalanced way seems to be the norm. It then confirmed that both SEO and PPC are required for maximum website exposure. [9]

2.4.2 Application Marketing Strategy Search Engine Optimization (SEO)

The purpose of this research is to improve product marketing using Search Engine Optimization (SEO) strategy. This research used the descriptive method to analyze market strategy by utilizing Search Engine Optimization. For data collection used interview method of observation and literature study. The results of this study indicate that the implementation of SEO strategy is very useful in improving product marketing.

This research used the descriptive method to analyze marketing strategies by leveraging Search Engine Optimization. For data collection used observation and interview method study of the literature. The observation was made samples of research on Mountain Grounds Coffee & Eatery.

From the figure below can be explained that there are several levels of cycles that can be seen before finally getting the benefit. From the table above, researchers concluded that all cycle or sequence must be traversed with success if it wants to get the benefit.

Interview results From the interview result of the researcher to the owner and about 14 consumers, the result is 40% of the consumers who live in Ciwidey area know Mountain Grounds Coffee & Eatery from word of mouth, while almost 60% of the rest

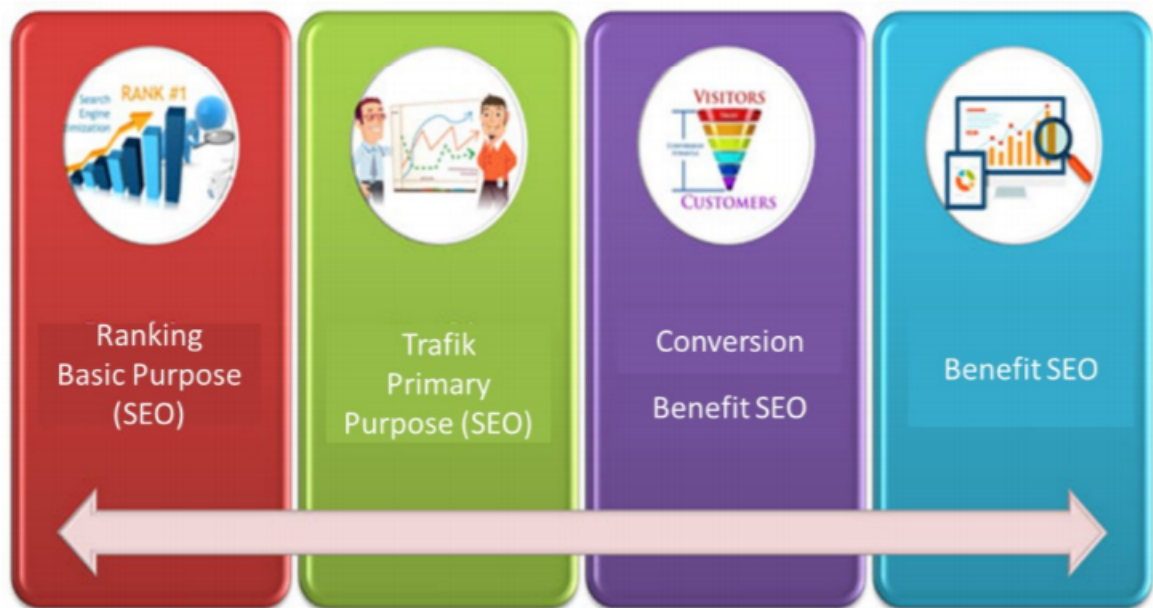


Figure 2.2: Cycle Achievement SEO

know Mountain Grounds Coffee & Eatery from social media like Instagram and Facebook.

The conclusion obtained is that the average consumer knows Mountain Grounds Coffee & Eatery from social media, this proves that the application of the SEO marketing strategy will be very beneficial for the Mountain and also Grounds Coffee and Eatery & also for consumers who live outside the domicile Ciwidey village.[7]

HOW DO SEARCH ENGINES WORK?

Search engines are your portal to the internet. They take masses of information on a website, break it down, and make decisions on how well it answers a specific query. But with so much data to sift through, how do search engines actually work?

To discover, categorize, and rank the billions of websites that make up the internet, search engines make use of sophisticated algorithms that make decisions on the quality and relevancy of any page. It's a complex process involving significant amounts of data, all of which needs to be presented in a way that's easy for end users to digest.

Search engines parse all of this information by looking at numerous different ranking factors based on a user's query. This includes relevancy to the question a user typed in, quality of the content, site speed, metadata, and more. Each data point is combined to help search engines calculate the overall quality of any page. The website is then ranked based on their calculations and presented to the user.

3.1 How?

To be effective, search engines need to understand exactly what kind of information is available and present it to users logically. The way they accomplish this is through three fundamental actions: crawling, indexing, and ranking. Through these actions, they discover newly published content, store the information on their servers, and organize it for your consumption. Let's break down what happens during each of these actions:

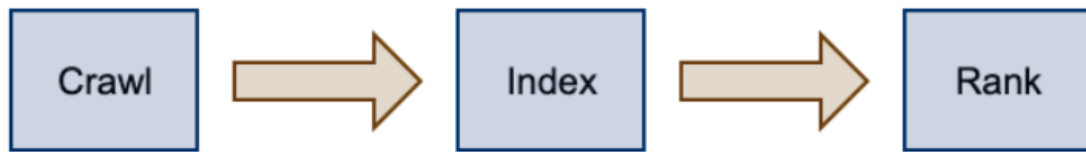


Figure 3.1: Search engine process flow

- **Crawl** Search engines send out web crawlers, also known as bots or spiders, to review website content. Paying close attention to new websites and to existing content that has recently been changed, web crawlers look at data such as URLs, sitemaps, and code to discover the types of content being displayed.
- **Index** Once a website has been crawled, the search engines need to decide how to organize the information. The indexing process is when they review website data for positive or negative ranking signals and store it in the correct location on their servers.
- **Rank** During the indexing process, search engines start making decisions on where to display specific content on the search engine results page (SERP). Ranking is accomplished by assessing a number of different factors based on an end user's query for quality and relevancy.

Decisions are made during this process to determine the value any website can potentially provide to the end user. These decisions are guided by an algorithm. Understanding how an algorithm works helps you create content that ranks better for each platform.

Whether it's RankBrain for Google and YouTube or Space Partition Tree And Graph (SPTAG) for Bing, each platform uses a unique series of ranking factors to determine where websites fall in the search results. If you keep these factors in mind as you create content for your website, it's easier to tailor specific pages to rank well.

3.2 Breaking Down Search Engine Algorithms by Platform

Each search engine goes about surfacing search results in a different way. We'll take a look at the top four platforms in today's market and break down how they make decisions about content quality and relevancy.

3.2.1 Google Search Algorithm

Google is the most popular search engine on the planet. Their search engine routinely own above 90% of the market, resulting in approximately 3.5 billion of individual searches on their platform every day. While notoriously tight-lipped about how their algorithm works, Google does provide some high-level context about how they prioritize websites in the results page.

New websites are created every day. Google can find these pages by following links from existing content they've crawled previously, or when a website owner submits their sitemap directly. Any updates to existing content can also be submitted to Google by asking them to re-crawl a specific URL. This is done through Google's Search Console.

While Google doesn't state how often sites are crawled, any new content that is linked to existing content will be found eventually as well.

Once the web crawlers gather enough information, they bring it back to Google for indexing.

Indexing starts by analyzing website data, including written content, images, videos, and technical site structure. Google is looking for positive and negative ranking signals such as keywords and website freshness to try and understand what any page they crawled is all about.

Google's website index contains billions of pages and 100,000,000 gigabytes of data. To organize this information, Google uses a machine-learning algorithm called RankBrain and a knowledge base called Knowledge Graph. This all works together to help Google provide the most relevant content possible for users. Once the indexing is complete, they move on to the ranking action.

Everything that takes place up to this point is done in the background, before a user ever interacts with Google's search functionality. Ranking is the action that occurs based on what a user is searching for. Google looks at five major factors when someone performs a search:

- **Query meaning** This determines the intent of any end user's question. Google uses this to determine exactly what someone is looking for when they perform a search. They parse each query using complex language models built on past searches and usage behavior.
- **Web page relevance** Once Google has determined the intent of a user's search query, they review the content of ranking web pages to figure out which one is the

most relevant. The primary driver for this is keyword analysis. The keywords on a website have to match Google's understanding of the question a user asked.

- **Content quality** With keywords matched, Google takes it a step further and reviews the quality of the content on the requisite web pages. This helps them prioritize which results come first by looking at the authority of a given website as well as its page rank and freshness.
- **Web page usability** Google gives ranking priority to websites that are easy to use. Usability covers everything from site speed to responsiveness.
- **Additional context and settings** This step tailors searches to past user engagement and specific settings within the Google platform.

As the most popular search engine around, Google more or less built the framework for how search engines look at content. Most marketers tailor their content specifically to rank on Google, which means they're potentially missing out on other platforms. [1]

3.2.2 Bing Search Algorithm

Bing, Microsoft's proprietary search engine, uses an open-source vector-search algorithm called Space Partition Tree And Graph (SPTAG) to surface results. This means they're going in a totally different direction from Google's keyword-based search.

Being open source means that anyone can look at the nuts-and-bolts code of what makes up Bing's search results and make comments. This open model is antithetical to Google's tight control of their algorithms. The code itself is separated into two separate modules-index builder and searcher:

- **Index Builder** The code that works to categorize website information into vectors.
- **Searcher** The way that Bing makes connections between search queries and vectors in their index

The second big difference between Bing and Google is at the core of how the information is stored and indexed. Instead of a keyword-first model, like Google, Bing breaks down information into individual data points called vectors. A vector is a numerical representation of concept; this concept is the basis for Bing's search structure.

Search queries for Bing are based on an algorithmic principle called Approximate Nearest Neighbor, which uses deep learning and natural-language models to provide faster results based on the proximity of certain vectors to one another.

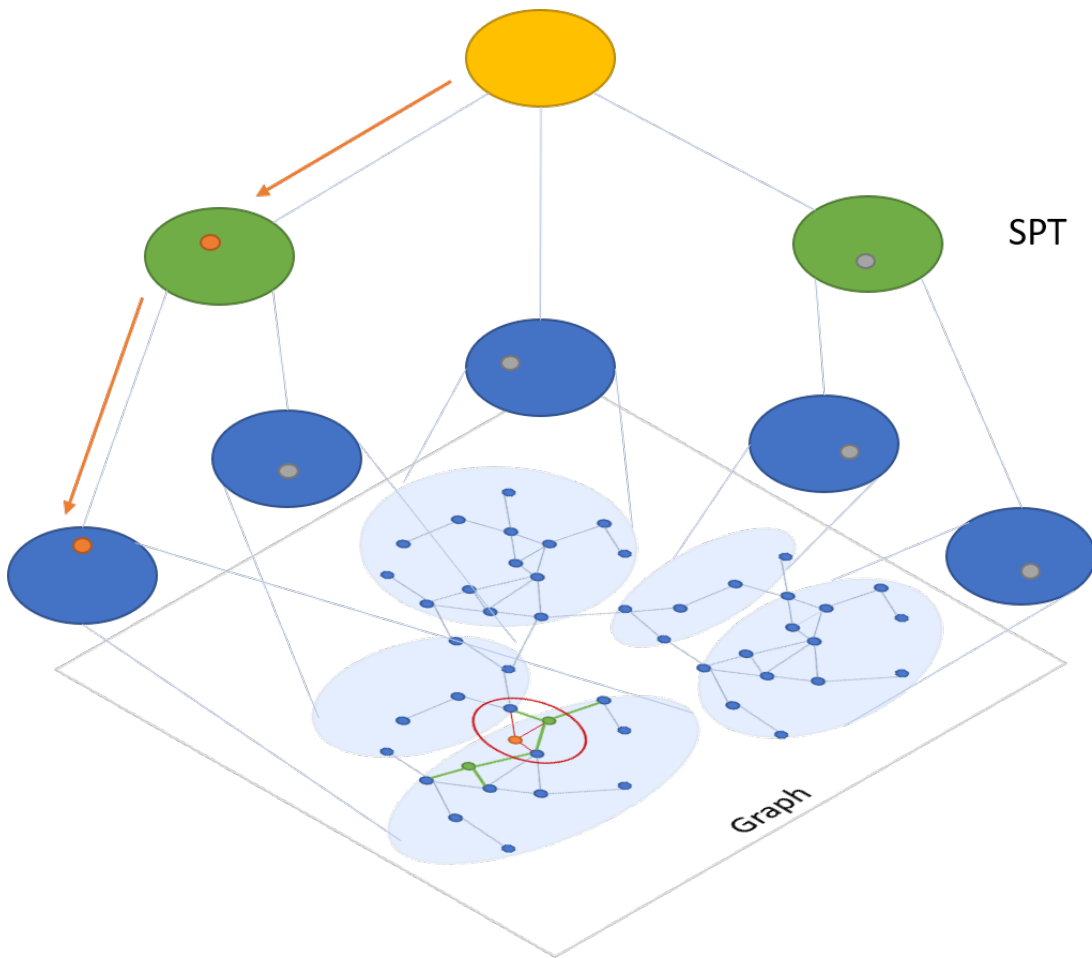


Figure 3.2: Graphical representation of Bing's Approximate Nearest Neighbor algorithm SPTAG

If we look at the yellow dot as a user query, the green dots are the first closest neighbors, followed by the blue dots. Tracking the orange arrow, we can see how Bing's algorithm decides which information is most relevant to the user's search.

While the underlying principles driving Bing's search structure are fundamentally different, the process of building their database still follows the crawl, index, rank actions.

Bing crawls websites to find new content or updates to existing content. They then create vectors for that information to store in their index. From there, they look at specific ranking factors. The biggest difference in comparison with Google is that Bing does not include pages without ranking authority, meaning that new pages have a more difficult time ranking if they don't have backlinks to an existing page with more authority.[12]

3.3 A brief history

Search engine optimization or SEO is somewhat the most important thing that a website should consider. Every company wants to increase their customers and one of the best ways is by search engines. Most of the people search their needs by a search engine like Google and they will choose one of the first results and the other results are going to get ignored. Imagine whenever someone needs some information that is relevant to your website, they find your website by a simple search. That's why the SEO field is on demand. This section presents what matters the most during this transformation from traditional form of Internet Marketing and the revolution search engines have brought.

In the late 90s, web was getting worldwide and many websites were created each day. The problem was that there was not a proper way to find new websites. As you know, any website can join the web and although it is a major benefit of web the problem was that "How can someone find the website that is good for their need"

So as you maybe have thought about it, the first solution could be to create a list of all websites being categorized by their subjects. Hence, anyone could visit a specific website and explore the categories that he needs to find the appropriate website. But, the problem was that this operation should be performed by humans, and as it is a very time-consuming activity, it would not work for a long time as the web grows larger. Another drawback was that it was weary to find the article or the information needed by just exploring the websites of the same category. It would have been an exhaustive search in the ocean for maybe a little needle.

As mentioned, there should be another way to help users find the website they need. Thus, researchers and experts proposed something rather revolutionary: Search Engines. Although, the first problem was that they just queried the titles of the articles and even that was with Regular Expressions. So, the content did not matter. One that was a little bit better, could crawl web to find new articles to index them. But the issue rose higher when this system visited a website more that hundreds of time to check its update and that could cause many server errors and many more network resource. Another way was that some new engines decided to tell users to inform them when they changed their website. The problem was that many websites' admin did not know that they should have informed these websites manually. These problems were so much that many decided to think of another solution.

One of the first ones was Excit. Google came out later. It is worth mentioning that both was created by Stanford graduates. Long story short, they needed investment but

there was a major hardship. No one thought of web as a business opportunity. All of the internet users believed that internet is just for exploring new ideas and a place to share random stuff with others. Even some people believed that making money from web was a bad thing ethically and they were against it.

At last, founders of Yahoo, Jerry Yang and David Filo, decided to accept investments to grow. Although they thought maybe they would lose some users because of advertisements but they observed the opposite. The number of users increased even with more advertisements. So many people found out about the capability of web and internet; so many others started websites based on online services. The only thing they were thinking of was how they can increase their users so they suggested free services like free email. But focusing on making money produced lots of ads and spam. This was the scene that Google started to work on to fix.

Larry Page and Sergey Brin, the founders of Google looked for the ways to decide if a website is better than other. Thus, one of the first algorithms was the PageRank algorithm named after Larry Page. If I want to explain it very quickly, it was based on the idea that „If a website is better than others, it gets more back-links from other.. This means that they could just search for websites back-links and rank pages by that. It was a good algorithm back then and even it was being used until some past years before the time Google mentioned its deprecation.

After that time, the major problem was that how search engines could decide if the website is better than other based on the query searched by the user. I am going to mention some of the Google big updates for its search engine:

2000: Google announced Internationalization: search is launched in 13 new languages. After that, the updates of Brandy, Austin and Personalized took place. In summary these updates detected the websites with following actions: some websites just repeated a certain keyword lots of times to make their website best for that keyword. Some, placed those repeated keywords on the same color background so users could not recognize the text but it would optimize their website for search engines. Some used spam back-links to increase their page rank. After these updates many website lost lots of their ranks in google search engine and some never could repair. Some other updates like Personalized and Pigeon didn't affect the websites for penalties but they were for better user experience as they personalized search results based on the user history and personal info and considering user's location for search results.

The most important update was Google Panda update as it targeted the content of the websites and their quality. It wasn't just a one-time update as it occurs often. By the way

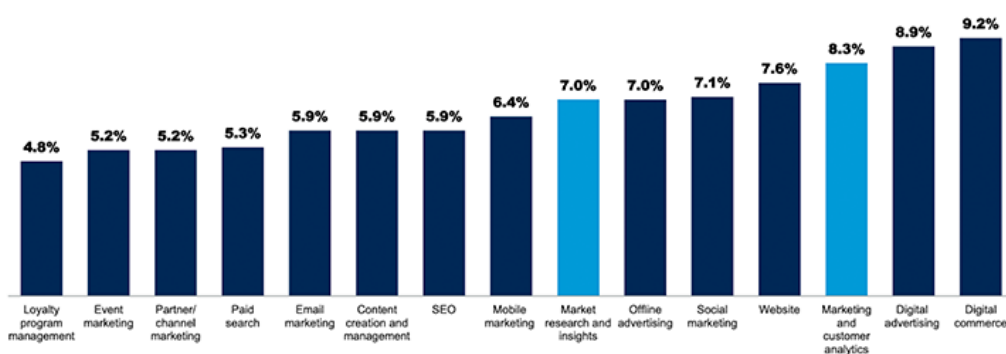
it worth mentioning that google algorithm change about 500 times a year base on their claims. It means one and a half change every day. So, it is very important to follow the best practices for the users and also the search engine instead of trying to manipulate search engines as they are smarter as we think. And you should remember that if some website gets penalized it would be very hard to get it back and fix its reputation.

SEM INTELLIGENT MARKETING

Data is a big investment for all companies nowadays. CMOs are spending a significant portion of their budget on market research, analytic vendors, software, and technologies, as shown in recent research by Gartner.

Data is a Big Investment...

2018 CMO Budget Allocation by Marketing Channels and Marketing Enablers
Mean Percentage of Budget Shown

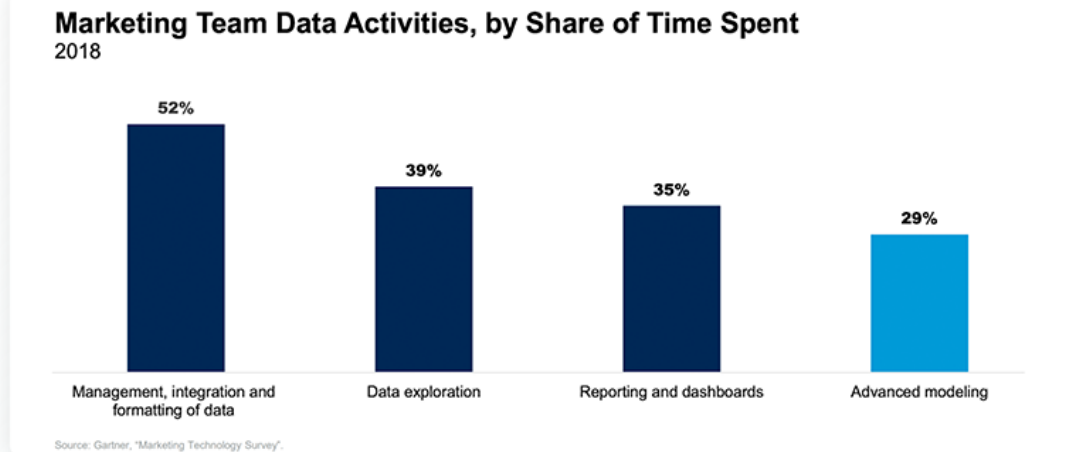


Base: All respondents, excludes "Don't know," n = 610.

Q: Please tell us how your company's fiscal year 2018 total marketing expense budget is being allocated to or spent on each of the following marketing channels and marketing enablers.

This investment has increased YoY and a majority of the decisions coming from business leaders are data-driven based on analytic.

But Marketers are stuck in Data collection and Query




However, marketers are mostly stuck in data collection and queries. Data analysts and scientists are spending their time in the management and formatting of data or even tasks like creating dashboards and reporting. Only 29% of their time is spent on data advanced modelling. If we look at the current state of publisher data, there are obvious challenges ahead of us. Namely;

- Keeping up with publishers' ever-changing algorithms.
- There is no easy way to apply bid optimizations from campaigns running on Google to Bing or even to manage all of these publishers from one platform.
- We have so many data signals that we want to use to optimize our campaigns.
- We want to focus on top terms and keywords and most of the time long-tail keywords are ignored.

If you look at all of the customer-level data that you are processing currently, you will no doubt have some powerful data on repeat purchase value, call surge and capacity, and lifetime value or average order value.

The real question, then, is how do you integrate all of this rich data coming from various sources and channels to enhance your advertising and marketing efforts. A "Customer Data Platform" is the solution. [13]

Current State of Affairs : Publisher Data



Publisher
Ads, Time, Day, Device, Location

- Publishers ever-changing algorithms impact business results
- No easy way to apply learnings from one to another at scale
- Competitors are constantly engaged in “bid-wars” to gain “market-share” for top terms resulting in publisher revenue gains.
- Long tail keywords are often ignored (rarely optimized)
- Day parting is not consistent across publishers, mostly implemented to prevent “budget burn”
- Location targeting is manual and based on sparse CRM data or ‘known’ top markets

4.1 Build an Intelligent Online Marketing System: An Overview

With the rapid growth of internet users, online marketing has become one of the most effective channels to reach new customers. In this report, an intelligent online marketing system architecture is presented to better facilitate online marketing.

We first provide an overview of the customer conversion challenges faced when marketing online. Then, we outline an architectural design of the productionized intelligent marketing system, which consists of tracking, metrics, attribution, bidding, keyword generation and many other core functionalities, and discuss the interaction between these components.

Based on the internal results, this design can help advertisers reduce operational costs, increase operational efficiency, optimize return on investment, and increase customer engagement.

To understand the essential components of a marketing system, it is necessary to review the life of an ad.

Ads are created on online marketing platforms and are displayed to users when certain criteria are satisfied. Users click on the ads and land a landing page tailored to the audience. The landing event is logged. Users with intent to engage in the product

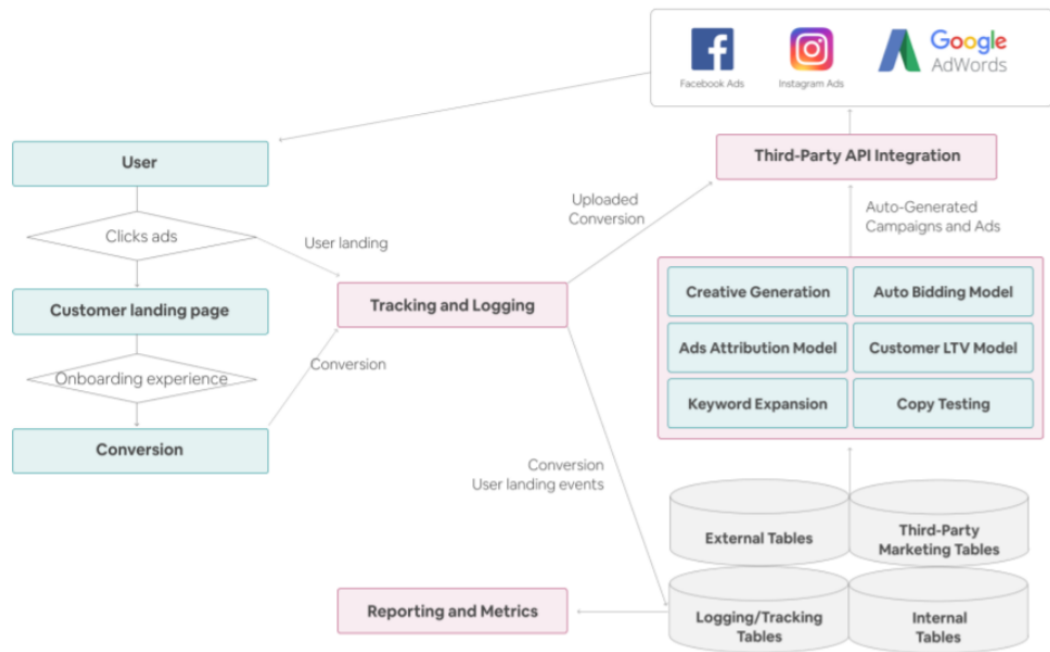


Figure 4.1: life of an Ad

may go through a customer experience. By the time a customer converts, e.g., a purchase happens, the LTV that it can bring to the advertiser is estimated. We then look at the ad click events that precede this conversion. This conversion will be attributed to relevant ads, which will share the LTV.

After collecting data from many conversions, we can infer the value of each ad. All of this information will be used to compute bids and allocate budget for each ad. Finally, bids and budget are set on online marketing platforms. This completes the life cycle of an ad. By looking at the life cycle, we can clearly see several main components of a marketing system: click tracking, attribution, LTV estimation, and bid and budget optimization.

A well-designed marketing system should have reliable data logging and tracking, which is essential for multiple marketing activities. Due to the existence of cannibalization, accurately attributing different channels in a multi-touch environment is key for our measurement system. With our in-house LTV models, designing a exclusiv bidding system is necessary to better track the efficiency and ROI.

Finally, automating the keyword and creative generation as well as ads experimentation setup provides another edge over the competitors. Each of these components

4.1. BUILD AN INTELLIGENT ONLINE MARKETING SYSTEM: AN OVERVIEW

is scheduled using Airflow on a DAG. Based on experience, such a marketing system can reduce operational cost, increase operational efficiency, optimize ROI, and improve customer engagement. [6]

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