Web analytics tools and web metrics tools: An overview and comparative analysis

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Abstract. The aim of the paper is to compare and analyze the impact of web analytics tools for measuring the performance of a business model. Accordingly, an overview of web analytics and web metrics tools is given, including their characteristics, main functionalities and available types. The data acquisition approaches and proper choice of web tools for particular business models are also reviewed. The research is divided in two sections. First, a qualitative focus is placed on reviewing web analytics tools to exploring their functionalities and ability to be integrated into the respective business model. Web analytics tools support the business analyst's efforts in obtaining useful and relevant insights into market dynamics. Thus, generally speaking, selecting a web analytics and web metrics tool should be based on an investigative approach, not a random decision. The second section is a quantitative focus shifting from theory to an empirical approach, and which subsequently presents output data resulting from a study based on perceived user satisfaction of web analytics tools. The empirical study was carried out on employees from 200 Croatian firms from either an either IT or marketing branch. The paper contributes to highlighting the support for management that available web analytics and web metrics tools available on the market have to offer, and based on the growing needs of understanding and predicting global market trends.

Key words: web analytics tools, web metrics, user satisfaction, business models, survey of the IT and marketing sectors in Croatia

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1. Introduction

The world is becoming increasingly aware that the Internet is evolving rapidly and constantly growing as more and more users get online. A presence in the web sphere is necessary for all organizations and businesses. The Internet provides numerous multimedia features enabling and changing the way organizations communicate with their customers, suppliers, competitors and employees [8]. The web sphere has a direct impact on a user's perception of

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business success [4] and the strategic importance of web context for modern business. It also shifts numerous business activities towards the web creating in the same time new context of business models so called web business models. According to [10], a business model is described as a business method used by a particular company to generate revenue and add new value to its product/services. The same author has also distinguished nine basic categories of web business models such as: (1) brokerage model, (2) advertising model, (3) model of information agent, (4) commercial model, (5) manufacturing model, (6) affiliate/collaborative model, (7) virtual community model, (8) subscription model and (9) utility/ancillary services model.

Within these business models five common goals [10] can be identified:

- Selling products or services online and the measuring the outcomes by the number of products sold or services
- Creation of potential client databases and measures of the outcomes based on the number of collected visitor contacts via web sites
- Content publication directed towards attracting as many visitors as possible and thereby increase revenue from advertising
- Providing information to the website visitors
- Company branding

Without proper web metrics applied to a business model on a website, it is almost impossible to measure the effects on visitors, hence proper the proper choice of a web analytics tool is important. On the other hand, gaining insight is also important, as to what tool is apt for unique user needs. Based on what has been said so far, the research task is to investigate the following: *Web analytics tools track and improve a user's satisfaction with web-based business models.*

2. Basic concepts related to web analytics and web metrics

2.1. Web analytics

According to the official definition of [13], web analytics refers to a combination of (a) measuring, (b) acquisition, (c) analyzing and (d) reporting of data collected from the Internet with the aim of understanding and optimizing web experience.

Measuring (a) incorporates different metrics [1] and expressed in the form of numbers, ratios and key performance indicators (KPI's). Data acquisition activity (b) is mainly done through one of the two most widely used methods: (1) using log files that gather data from a server, and (2) using popular methods of tagging websites supported by JavaScript code.

Log files are contain data collected from a company server, regardless of the visitor's type of Internet browser. Data acquisition activities on a server come in the form of a text file containing server-side collected data. These activities are related to requests directed to a web server, such as displaying

pages, images or PDF files [3]. On the client side, site tagging is carried out using JavaScript code inserted into every web page and is run and recorded each time a user opens a tagged webpage. Visitor behavior is then recorded in a separate file [12].

Furthermore, the purpose of analyzing data (c) is to transform data into information useful for a decision-making process [12]. In that sense, special attention should be given to selecting appropriate web analytics tools while taking into account a company's specific characteristics and goals, as well as employing the staff who are competent in "discovering" useful information for supporting decisions that are based on large amounts of acquired data.

Finally, reports are generated (d) based on selected metrics outputs which in turn are useful for company management.

Data originating from the Internet offers relevant information on website traffic, website transactions, server performance and information submitted by users themselves [9]. Understanding of the web and website optimization provides a more adapted approach to a target audience with the goal of increasing conversion rates [12], as well as customer loyalty [4]. Analyzing website traffic provides insight into the number of visitors, their geolocation, visitor locations, time spent on websites and other parameters. Web analytics also provides other advantages such as increasing efficiency and cost reduction [3]. Marketers can also find web analytics data useful for improving products/services and evaluating the success of a marketing campaign. In addition, web designers and web developers use such data for improving website usability and consequently, website user satisfaction. Web analytics provides company management with the insight into how to generate revenue from a website, how to create appropriate user experience and improve its competitive advantage [6], as well as to support continuous improvement and competitiveness [12].

The said author proposes a definition of web analytics as follows: *the analysis of qualitative and quantitative data on the website in order to continuously improve the online experience of visitors, which leads to more efficient and effective realization of the company's planned goals.* Quantitative data provide insight into visitor behavior such as the previous web page prior to reaching the actual website. In addition, the acquisition of qualitative data provides answers as to why visitors behave in a certain way. Continuous improvement of online user based on information obtained in web analytics is a key aspect of the web analytics concept.

Improved business results based on decisions supported by information gained from web analytics certainly justify further expenditure in web analytics.

2.1.1. Web analytics as a process

Web analytics is not a technology for just reporting, but a cyclical process of website optimization which, among other things, measures costs, identifies the

most profitable user behavior and optimizes a website by improving performance and profitability. Waisberg & Kaushik [12] identified the following steps in a web analytics process:

- Objective (goal) determination
- KPIs definition
- Data collection
- Data analysis
- Change implementation

The issue of *"the objectives of a website"* is complex and there is no single answer. It depends on type of business models. As an example and in terms of a commercial business model, the objective of a website is to support product sales by provide all the relevant information to visitors with the intention of transforming them into buyers. Determining these activities is important, as they lead to selecting the appropriate metrics to track the success of a website, especially while keeping in mind that a website should achieve a certain return on investment (ROI). Measuring the success of objectives is accomplished by defining key performance indicators (KPIs) that show the particular progress or detect lagging in achieving goals. Each KPI is expected to correlate with a specific action and match the criteria/attributes of timelessness, simplicity, relevance and usefulness. It is recommended that a defined KPI has to be promptly available (*timelessness*), simple for decision maker to understand (*simple*), as well as relevant (*relevance*) and useful (*usefulness*) to the specific company.

The example [12] of one qualitatively defined KPI that covers all of these attributes is the *bounce rate* defined as the percentage of visitors who leave a website after the first page visit. This metric is simple, i.e. easy to understand and explain. It is *relevant* because it identifies sites with a lower content, technically or in terms of quality. This KPI is also *timely* since is readily available in all web analytics tools. Finally, the observed KPI offers instant *usefulness* given that a decision maker can act immediately and focus on pages with a high bounce rate.

The next activity in the considered process is accurately collecting data and saving it in a database for subsequent data analyses. Data analysis includes observing and transforming previously collected data in order to discover useful information that supports future decisions. During this activity, numerous associations, patterns or trends that exist in the data set are revealed. Finally, implementing change is the last but not least activity in the process. In other words, collected and analyzed data provide new information and support change implementation. Otherwise, all the previous activities are baseless. The scheme of the web analytics process is shown in Figure 1.

Figure 1: *Activities in the web analytics process, Waisberg and Kaushik [12]*

2.1.2. Web analytics tools

A variety of web analytics tools have been developed and are available on the market that aim to obtain quantitative and qualitative data as a basis for the decision-making process, The author [11] has classified web analytics tools into five categories:

1. Traditional web analytics tools that mostly relied on clickstream data obtained by the visitors themselves, competitors and data from the company's internal sources.
   Clickstream data generally corresponds to the question "*what happens on websites" or "visitor behavior while browsing the website" and "how many conversions have been achieved on the website*".
2. Web analytics tools that track performance on social networks
3. Web analytics tools for gathering visitor feedback aim to answer the question "*reasons for the visitor behaving or not behaving in a certain way*".
4. Web analytics tools for mobile websites with a growing importance in line with an increase in website turnover caused by the use of mobile devices. These tools provide insight into visitor behavior on websites accessed via mobile devices similar to traditional web analytics tools, and are necessary for achieving compatibility with mobile devices [5].
5. Web analytics tools for experimenting, testing and find optimal technical or design solutions that should improve visitor satisfaction.

In terms of the process of selecting a web analytics tool, the working team is responsible for the following [7]:

- Distinguishing whether the company needs to implement either reporting or an analyzing process in its business model. Accordingly, certain ineffective tools are eliminated.
- Assessing a company's temporary IT capabilities.
- Taking into consideration web tool features in line with a company's requirements.

Here, the focus is reduced solely to traditional web analytics tools based on clickstream data within can be used to identify two categories based on the form the tool is available: first, the software is installed on an organization's computers and, secondly, as a service (SaaS - Software as a Service) provided by ASP - Application Service Provider [4]. The traditional web metrics tools are available on the market as open source or a commercial package. Each of these has its advantages and disadvantages (Table 1).

	Web analytics tools†	Advantages	Disadvantages
Web log tools	Google Analytics	customizable dashboard, conversion visualization, data export in various formats, advanced segmentation features	-
	Webtrends Analytics	provides detailed information, excellent heat maps feature, access to real time data	(relatively) high price
	FireStats	easy to use, downloadable data raw logs, real time data	not recommend for beginners due to install requirements
	AWStats	reveals how much time visitors spend on site, processes raw log files, open-source	not possible to provide an in-depth analysis, neither to measure user activity
	Webalizer	updates log files throughout the day, easy to understand reports	does not use cookies, possible overestimation of data
	StatCounter	access to real time data, provides two levels of analysis	outdated user interface
	Mint	customizable, friendly interface	needs server configuration
Page tagging tools	Piwik	customizable, data control, real time traffic reports, segmentation	-
	Clicky	real-time data, heat maps, split-testing and A/B testing	interface is not user-friendly.
	Chartbeat	real time data, friendly user interface	no detailed historical data available
	GoSquared	pinging feature that reveals how long visitor stayed on site	monthly page view limit
	FoxMetrics	tracks events like newsletter views	key features available in premium plan
	GoingUp	includes SEO related tools, provides heat maps	-
	eTracker	tracks visitor mouse movement, survey options	(relatively) high price
	IBM Unica NetInsight	very flexible and customizable reports, customizable dashboards	(relatively) high price
	Stuffed Tracker	feature that enables comparing organic and paid traffic	installation could be difficult for beginners
	Crazy Egg	excellent heat map feature	-

Table 1: *Traditional features of web analytics tools analyzed by the authors*

† The online source for each presented web analytics tool is found at the end of this paper.

The wide range of web analytics tools makes the selection process more complex and time consuming. Accordingly, selecting the appropriate tool should take into consideration a company's unique characteristics. In the process of selecting the web tool, the team using the web tool should consider usability, functionalities, technical details and the total cost of the tool. In other words, the market should be studied while focusing on the tool's features such as the possibility of installing and deploying software locally, customer support, costs, data segmentation possibilities, download options, ownership of collected data and the possibilities of integrating data from other sources in the actual web analytics tool.

2.2. Web metrics

The common features of web metrics including collecting specific visitor actions and the exclusion of search engine robots that search content on the website while indexing it. Effective web metrics has to be based on generally accepted terms, definitions and practices [13]. Web analytics incorporate web metrics, thus providing benefits for online businesses [14] such as the ability to analyze and increase sales, ability to track revenue generated by the site, ability to identify exit pages, and consequently improving website content, the monitoring of visitor traffic and detection of website errors. The most common types of web metrics are available as option in web analytics tools as presented in Table 1 [13]:

- Metrics for describing visits – the category refers to dimensions such as the front page (*entry page*), the target page (*landing page*), exit pages (*exit page*) and metrics such as duration of the visit (*visit duration - time on site*), source of traffic (*referrer*) and number of clicks on the link (*click-through rate*).
- Metrics for describing visitors - the metrics in this category present different attributes that characterize website visitors and support the process of visitor segmentation. The metrics are: *new visitors* (the number of unique visitors who created a session for the first time on the site during the reporting period, *returning visitor* (indicates how many unique visitors have interacted with the site during a reporting period, supposing that it is their first visit before observed period, *repeat visitor* (number of unique visitors who have made two or more visits to the site during a reporting period), visits per visitor (number of visits per visitor), *recency* (the time elapsed since the specific action was taken by a unique visitor to the site) and *frequency* (the number of times required by a unique visitor to take a specific action such are visit the site, purchase or download from the site during a reporting period).
- Metrics for describing the visitor engagement – the category includes metrics that describe the degree of visitor interaction. Accordingly, the

related metrics calculate the proportion of those leaving a website with respect to the total number of webpage views (*page exit ratio*), the rate of withdrawal (*bounce rate*) and the number of visited pages per visitor (*page views per visitor*).

- Conversion metrics – the collection of special website activities that provide business value, such as metrics that indicate the number of successfully achieved set goals (*conversion*) and the ratio between the number of realized conversions and other relevant metrics (*conversion rate*).

Examples of conversion rate are the number of conversions in relation to the total number of site visits, or the number of conversions in relation to total number of site visits where products are added to a cart.
These mentioned metrics are often a company's key performance indicators (KPI's) relating to easily understood indicators covering website performance and website changes in an observed period [9].

The choice of metric depends, as mentioned above, on the company and its goals. In spite of this, the most common key performance indicators can be categorized by type of business model. In addition, Peterson [9] distinguishes business models and the respective performance indicators as listed in Table 2.

Business model	KPI's
Commercial model	Ratio of new to returning visitors, percentage of new visitors, referring domains, search keywords/phrases, average order value, key conversion rates.
Advertising model	Overall traffic volume, number of visits, ratio of new to returning visitors, percentage of new visitors, referring domains, average number of visits per visitor, average time on site.
Subscription model	Overall traffic volume, percentage of new visitors, ratio of new to returning visitors, referring domains, search keywords/phrases, key conversion rates.
Utility model	Overall traffic volume, percentage of new visitors, referring domains.
Model of information agent	Ratio of new to returning visitors, percentage of new visitors, referring domains, overall traffic volume, percentage of new visitors, average pages viewed by visitor.
Manufacturing model	Search keywords/phrases, entry pages, referring domains, overall traffic volume, key conversion rates, number of visits.
Affiliate model	Overall traffic volume, referring domains, average time spent on site.
Community model	Overall traffic volume, average time spent on site, referring domains, percentage of new visitors
Brokerage model	Number of returning visitors, frequency of visit, number of visits, search keywords/phrases.

Table 2: *Business models and associated performance indicators [9], modified*

Keeping this in mind, information gathered using these indicators offers a relevant background for different ways of analyzing and generating reports, which is operationally and strategically important for any business system.

3. Empirical research based on perception of the usefulness of web analytics tools

The empirical section of the paper presents the results of a one-month research (March 2015) conducted among the employees from 200 Croatian IT and marketing firms. Employees were asked to assess their satisfaction with web analytics tools used by their company and for the associated business model. Therefore, the questionnaire was created using the Google Form option on Google Drive and was sent out via e-mail. The return rate was almost 54% i.e.107 questionnaire were completed.

The methodology analyzed the use of web analytics tools and user satisfaction, and included descriptive statistics, Friedman test, bivariate correlation and multiple regressions. The software package SPSS Statistics 17.0 software package was used for statistical processing and calculations.

Descriptive analyses revealed that the major part of survey respondents were male (58.9 %), in the age group of 21 to 30 years of age (73%), university educated (85%), introduced as users of web metrics for business purposes (67%). Web analytics tools are used for different purposes by the respondents: marketing (75.7%), management (36.4%), web development (13.1%) and others fields (4.7%). The most frequently used web analytic tool was Google Analytics (93, 5%) with the other tools (6, 5%) being Webtrends Analytics, FireStats, Webalizer, Tableau, Flurry and ARIS Connect.

When comparing the frequency of using web analytics tool for activities such as measuring, collecting, analyzing and reporting data, it was observed that web tools are mostly used for collecting (mean= 3.43) and analyzing data (mean = 3.75). Each activity also involves analyzing the user's satisfaction with using a web tool in regard to proper support for particular activities. The respective mean values are presented in Table 3.

Activity	Mean	
	Frequency	Satisfaction
Measuring	3.07	3.64
Collecting	3.43	3.75
Analyzing	3.35	3.73
Reporting	2.96	3.52

Table 3: *Mean values of frequency and satisfaction with web analytics tools according to activities (N=107)*

Using the Friedman nonparametric test, the differences in frequency of usage for a web analytic tool according to activities have been found significant (p=0.00), as well as the differences in level of user satisfaction (p=0.05).

The results indicate that web analytics tools are most frequently used for advertising (mean=3.93) and commercial business models (mean=3.43) followed by community (mean=3.42), information agent (mean=3.31), affiliate (mean=3.26), subscription (mean=3.20), utility (mean=3.07), manufacturing (mean=3.05) and brokerage (mean=2.92) business model. The users also express the highest level of satisfaction relating to the advertising (mean=3.65) and commercial (mean=3.38) models followed by the community (mean=3.35), affiliate (mean=3.34), information agent (mean=3.27), subscription (mean=3.22), utility (mean=3.18), manufacturing (mean=3.09) and brokerage (mean=3.05) business model. Hereafter, Friedman nonparametric test verified that the differences in frequency of a web analytics tool according to the business model are also significant (p=0.00), as well as differences in the level of satisfaction (p=0.00). A positive correlation has been proved between the usage frequency and user satisfaction of a web analytics tool based on each activity. The associated correlation coefficients and significances (p=0.00 for each activity) are shown in Table 4. The activities such as measuring (correlation=0.588) and data analysis (correlation=0.581) indicate a higher correlation when compared with other activities.

Frequency vs. Satisfaction	Pearson Correlation	p (2-tailed)
Measuring	0.588**	0.000
Collecting	0.470**	0.000
Analyzing	0.581**	0.000
Reporting	0.531**	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: *Bivariate correlations between usage frequency and usage satisfaction of web analytics tools based on each activity (N¬=107)*

Furthermore, a positive correlation has been proven using a bivariate correlation between the usage satisfaction and usage frequency of web tools based on observed business models (p= 0.00 for each model). Business models such as brokerage (correlation = 0.597) and advertising (correlation=0.588) indicate a higher correlation in comparison to other models. These results are presented in Table 5.

Frequency vs. Satisfaction	Pearson Correlation	p (2-tailed)
Brokerage	0.597**	0.000
Advertising	0.588**	0.000
Information agent	0.420**	0.000
Commercial	0.467**	0.000
Manufacturing	0.565**	0.000
Affiliate	0.465**	0.000
Community	0.418**	0.000
Subscription	0.533**	0.000
Utility	0.493**	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: *Bivariate correlations between the usage frequency and usage satisfaction of web analytics tools based on business models (N=107)*

In order to explore which activities that are supported with certain web analytics tool contribute more to the level of satisfaction with the business model integration ability, the multiple regression is applied. It was found that activities such as collecting and reporting activities, significantly contribute the level of satisfaction with a business model. Table 6 indicates that the users are significantly satisfied with the integration of web analytics tools in business models during data collection activities (p=0.035) and the reporting of data (p=0.065).

Coefficients [a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	p
	B	Std. Error	Beta		
(Constant)	1.821	0.282		6.447	0.000
Satisfaction_measuring	-0.009	0.079	-0.013	-0.109	0.913
Satisfaction_collecting	0.188	0.088	0.258	2.133	0.035
Satisfaction _analyzing	0.076	0.083	0.107	0.913	0.363
Satisfaction_ reporting	0.143	0.077	0.220	1.864	0.065

**. [a.] Dependent Variable: Satisfaction of web analytical tools integration/models

Table 6: *Multiple regression, the business model using web analytics tools (N=107)*

In summary, the results indicate a significant presence and use of web analytics in various activities within web business models, the conclusion is that web analytics tools support and improve user satisfaction with these business

models. Nevertheless, there is room for improvement in terms of better integration of web analytics tools in web-based business models.

4. Results interpretation and conclusion

The empirical results based on the analysis of data collected from 107 survey respondents indicate that web analytics tools are well accepted and applied in IT and marketing companies. A descriptive statistic output revealed that acceptance of web analytics tools conforms to any other acceptance of technological innovation. In this survey, younger users dominate the age group of users, possibly implying that the use of web analytic tools is more popular among the younger generation [2]. The use of web analytics tools in business fields, as expected, is most frequent in the marketing industry.

Specifically, a comparison of results points out that web analytics tools are mostly used for data collection and analysis (Table 3), indicating the highest observed correlation corresponds to satisfaction with measuring and analyzing activities (Table 4), and evidently there is some room for improvement in functionalities regarding user satisfaction in collecting data. The recommendation is that software companies developing tools should place additional focus on this particular set of functionalities. The survey has shown that data collection is the most frequent tool activity and any improvement or enhancement in this activity could have a significant impact on user satisfaction.

Moreover, according to the obtained results, web analytics tools are most frequently used in advertising and commercial models where users also expressed satisfaction. Additional results indicated that the highest correlation between the usage frequency of web analytics tools and the satisfaction with such tools is observed in the brokerage model and in the advertising model. The expectation was that more frequent usage of web analytics tools in the advertising model implies a higher user satisfaction. This research has shown that use in the brokerage model is low, and the correlation between usage frequency and usage satisfaction of web analytics tools is the highest. It implies that web analytics tools in the brokerage model are not recognized enough and promotion campaigns for additional use in the model is required. The results providing a correlation between frequency and satisfaction for the mentioned activities (Table 4) and a correlation between frequency and satisfaction in the business models (Table 5) are as expected.

Finally, emphasis should be placed on the fact that user satisfaction with web analytics tools used for the collection of data and reporting of activities improves significantly when such tools are integrated in the business models.

The conclusion that the authors stress, based on the outcome of theoretical research, is that web analytics tools and the associated web metrics as statistical indicators of website activity can potentially improve user satisfaction if a

business model's website. Regardless of the fact that some of analyzed web analytics tools and the associated web metrics are freely available, whereas others are not, it is undisputable that each of the tools can be integrated into the respective business models. Successful implementation of web analytics tools requires proper selection given that each website is unique and determined by the nature of related business model and its supporting technologies. Thus focusing on the proper either tools either metric, form the basis to strengthen management support and, that may imply better business results.

The empirical research results based on the perception of web analytics tools indicate that web analytics tools support user satisfaction on the web of business models although further modifications are evident, at the technical and organizational level.

Future studies in this field should include an assessment of web analytics tools based on clickstream data for web analytics tools featured to track performance on social networks or mobile devices, as well as tools for collecting feedback from visitors, and for conducting different testing and experiments.

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