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Web Site Productivity Measurement Using Single Task Size Measure

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Abstract.

We propose a web site productivity measure using the average time taken by the proficient user takes in carrying out a transaction on a website to the total usage time of a web site. The total usage time of a web site depends on the size of the web site and bandwidth, the total time needed to use the information and other time factors. If productivity measurement of a web site delivers an expected productivity value in-between zero to one, then it indicates poor quality and the website needs to be redesigned, otherwise, if the value is bigger than one, which indicates higher expected productivity, then no need of updating. In this paper, we propose a productivity measurement method for web services. Finally, we demonstrate an example of its role for business to consumer web services using the new productivity measurement method.

Keywords: Website productivity measure; Total usage time of website; Web services.

1. Introduction

Productivity is the measure of creating yield every user input [1]. The output consists of services or products. Traditionally, total productivity measures and partial productivity are two basic categories of productivity measures [8]. Total productivity is the ratio of net output of the sum of all associated inputs. However, it gives a more accurate representation, but it is difficult to sum up and compare directly as types of output and inputs are different. It also does not reflect the interactions between output and each input separately. Partial productivity is the ratio of output to single or one class of input. Labor productivity is a kind of this productivity measure where the ratio is computed from a total output to labor input [5]. Similarly, capital and material productivity are also the useful examples of partial productivity measure. This productivity measure is easy to understand, easy to obtain data and easy to compute the productivity indices. If the required data for partial productivity measures are unavailable, then the indirect productivity measurement can be used. Indirect productivity measure uses particular problem related manifestations. Machine defects, long waiting times, high defect rates, and unused capacity are examples of these symptoms or phenomena [5, 14]. These components of problems are focused in indirect productivity measures. These are linked to productivity and cause the changes in productivity. Labor productivity is might be the most typical measure of this kind and it is chiefly utilized in assessing the effects of IT investments.

According to Misterek et al. [8], have not considered the changes in quality of output or inputs. Especially the quality and productivity cannot be dealt separately in e-commerce business service. Due to business process change and indirect impacts, influences like to improve customer satisfaction, traditional protective measures may be difficult to manage. Particularly in the service business sectors, quality and productivity are inseparable [13]. However, counting the influence of e-commerce services for productivity with the conventional measures may be unmanageable due to these services influencing thereby changing business process [3]. For instance, Brynjolfsson and Hitt [4] observed that an information technology venture might create intangible assets, which may induce a positive influence on the productivity of the organization, but are not evaluated conventionally. Adding non physical aspects may provide an accurate and convincing view of returns because of the investment [11].

Generally, productivity is hard to evaluate because outputs and inputs are usually quite varied and in many cases are themselves hard to measure. Our web-based productivity measurement typically acted as the ratio of task size to the effort with respect to the user perspective. Therefore, if we can appraise the average time taken by the proficient user takes in carrying out a transaction as a measure of task size on a website and the effort needed to locate the necessary information, we have:

$$Productivity = Task\ Size/Effort \qquad (1)$$

In this paper, we show a strategy of creating simple productivity measure when the users relate task size to different time step that is spending the WWW page and actual usage time of a web site. Section 2 describes literature review. Section 3 describes our proposed productivity measurement method on task size. In section 4, we conduct a case study applying the new measurement method. Finally, section 5 summarizes the findings and concludes.

2. Literature Survey

Stensrud and Myrtveit [15], have presented single size measures as the direct size measures of productivity. The direct size, measure consists of a line of code and function point. The alternative size measures include Use Case Points [2, 4], System Meter [9], and "Magnitude" [7].

Moser et al. [9] have pointed out that at the time of measuring the size of object-oriented application reused components should not be included.

Morasca and Russo [10] pointed out that, size must be considered as a good productivity measure which is related to effort.

B.A. Kitchenham et al. [6], proposed a productivity assessment method using new images, reused web page and high function effort and represented it in Adjusted size measures.

Sandeep et al. [12], proposed a route dimension metric through which they can calculate the Cyclomatic complexity of a web site and analyze the result in 10-point scale. They have suggested the necessary updating required for the websites or not.

Mendes et al. [6], proposed that count of distinct elements in a web service are the best measure of size. This includes functions, text, files, images, animations and reused web pages.

3. PMMWS: Our Proposed Productivity Measurement Method on Web Services

Among the list of authors in this paper (Sandeep) gathered to record data on 10 business to consumer web services from the server. The purpose of the data collection is to investigate average time taken by the proficient user takes in carrying out a transaction on a website and effort used in productivity measurement in task size. The measures gathered from the server are based on the result of the survey of the websites of 10 businesses for consumer web services. We have collected the web service factors from the research literatures. Here, we present some common factors are the number of pages, number of images, and number of different types of information.

Thus, we have selected the dimension of web services empirically. When we investigate the data set collected by Sandeep, we found that to obtain productivity, the various issues are needed in web services. We identified one measure, which are directly related to task size that is the average time taken by the proficient user takes in carrying out a transaction on a website. We found three measures directly related to effort. They were the size of the web site/bandwidth, the total time needed to use the information and other factors like typing speed of the user.

3.1. Productivity Measurement Method on Web Services

Our recommendation for calculating productivity with multiple service measure based on the proven fact that any service model relies on the user spend on the web site. Therefore, we can treat the task size at the time taken by the user to spend on the web pages and to calculate the productivity we use the following expression in our proposed approach:

$$PMMWS = \text{Average time taken by the proficient user takes in carrying out a transaction on a website} / Effort \qquad (2)$$

The average time taken by the proficient user takes in carrying out a transaction on a website measure includes the time measures which relate to effort and if necessary, it is also nonlinearity relationship. It has a number of benefits:

If productivity measurement of a web site delivers an expected productivity value in-between zero to one, then it indicates poor quality and the website needs to be redesigned, otherwise, if the value is bigger than one, which indicates higher expected productivity, then no need of updating.

"Estimated effort" and "Expected effort" both are different concepts. The viewpoints of estimated model are required for future project predictions. In our case, our productivity measurement method on web services calculate expected effort after design the websites.

The PMMWS shows in expression 2 can easily be relevant to takes hold on any kind of web services, domain because theirs is an easy relationship between task size measure and effort. On the other hand the actual productivity calculates when employing (9) might use simply to the web services in the present data set; it would not naturally utilize for other web services from the same space unless the sites were a self-assertive specimen of the decently characterized populace.

3.2. Productivity Measurement Method on Web Services Assumptions

The productivity measurement method on web services deduces that an apt measure of task size is validly associated with the effort. For a task size, measure not directly related to the effort, a productivity measure can not be constructed. In this context, our productivity measurement method on web services relies on task size, made by user that the average time that a proficient user takes in carrying out a transaction on a website.

The expression (2) is rewritten as:

$$PMMWS = Task\ Size/Effort \tag{3}$$

The second assumptions embedded in our method are more complicated that is calculating the effort in terms of total actual usage time of a web site. In our approach, total actual usage time of a web site depends on the size of the website, bandwidth, the total time needed to use the information and other factors. The effort is expressed in the expression (4) as:

$$Effort = Total\ \ usage\ time \tag{4}$$

Total actual usability time expressed in the expression (5) as:

$$Total\ \ usage\ time = ((Size\ of\ the\ site/Bandwidth) + Total\ time\ needed\ to\ use\ the\ information + Other\ factors)) \tag{5}$$

Dimension of a website based on the number of web page count, number of media count, number of program count, number of image count, and number of information count. Hence, Dimension of the web site represented as:

$$Size\ of\ the\ site = [(\text{ A number of media files } * \text{size in KB} + \text{ number of program files} * \text{size in KB} + \text{ number of image files } * \text{size in KB } + \text{ number of information files} * \text{size in KB })] * \text{ Pages in site} \tag{6}$$

The total time needed by the user to use the information contained in a web site can be expressed as summation of time need to access each type of information and number of pages linked.

$$Time\ to\ use\ the\ information = \sum_{i=1}^{m} Pi \sum_{i=1}^{n} Ii * Ti \tag{7}$$

Where m = number of pages present in the web site, n = type of information present in each web page.

Aggregating the expression (5) and (6), the expression (4) was rearranged as:

$$Total\ usage\ time = ((((\text{Number of media count on each page} + \text{ number of program count on each page} + \text{ number of image count on each page} + \text{ number of information count on each page}) * \text{ number of web pages count}) /Bandwidth) + total\ time\ needed\ to\ use\ the\ information + Other\ factors))) \tag{8}$$

Our productivity measurement method of web services with respect to service and effort can be rewritten as:

$$PMMWS = TaskSize /((((\text{Number of media count on each page} + \text{ number of program count on each page} + \text{ number of image count on each page} + \text{ number of information count on each page}) * \text{ number of web pages count}) /Bandwidth) + total\ time\ needed\ to\ use\ the\ information + Other\ factors))) \tag{9}$$

Bandwidth is a measurement of bit-rate of available or consumed data communication resources expressed in bits per second or multiples of it (bit/s, Kbit/s, Mbit/s, Gbit/s, etc.).

The third assumption underlying this approach is the number of information count on a web site. The content of the web page is filled with various types of information. Different pages are used to construct the web site and allow the user an easy navigation. Navigation and content pages are two distinguishable facts, which are used to evaluate the transitions between both categories by us.

We summarize various types of information and their combination as a new approach to web site productivity measurement and explain how this approach can be used to estimate the degree of fulfillment of a web site's purpose, they are:

- Introductory: The agent provides this type of information whenever the user accesses a new topic or aspect of interest.
- Summary: Overall accessing perspective of items in the current session.
- Comparison: Compares current with previously accessed topic or item common attributes of these are to be identified.
- Search: It is a comparison table of recommended search engines, it shows all the search information in the network. The table comparing some of the best human-selected collections of Web pages.
- Difference: Focuses an aspect of the current topic, which was not present in previous one. This is required to learn better and remember the works of art descriptions.
- Linking: It needs for more information, which creates a link to the information in your file. Each time you open the presentation, it offers to update the links. If the linked information in the file has changed, this updates it in your presentation also.
- Image: It is unique information based and viewer dedicated to serious photography. It extracts metadata (EXIF) from JPG, RAW files and makes it available in a convenient and welcoming interface.
- Curiosity: Additional information to raise the interest of users and increase the visitor's involvement.
- Composite: Even though you may have some information in the Brochure/Booklet site, as you find the questions that customers are asking, you may decide to place information that is more detailed on your site for those who just want more details.

The fourth incorporated assumption in our approach is another time factor, which include the typing speed of the user at the keyboard. The average typing speed of a user on the keyboard is in between 23 to 40 words per minute (Google), it depends on fast, moderate, and slow groups incorporated with the experience of users.

3.3. Case Study Evaluation

The participants in our case study were 40 computer science professionals and all have 10 years of experience on online shopping. The participants have the average typing speed of 40 words per minute. The case study was performed in our research lab, where the bandwidth of the internet was 2Mb/Sec. Before we began, the participants completed initial formalities like registration, fill up the consent form, etc. They were assigned a task-based scenario to find a particular product using different web sites we considered in our study one at a time. In our case study, we used 10 businesses to consumer electronic commerce online shopping web sites. We installed the "Camtasia" software on the server to observe and record all the activities done by different participants in the system. After completion of the task by participants, we analyze the data.

We found that, in a particular website, for example, in Flipkart.com the maximum time on site by a participant is 5 minutes and 21 second, whereas the minimum time on site by a participant is 4 minutes and 00 second. The average time spent on site by all the participants is 4 minutes and 37 second. Figure 1.1 shows the average time spent by the participants when executing the specific task in Flipkart.com website. For doing the particular task, we found a participant visited 10 web pages and cumulatively the visited pages containing 20 program files (on an average 25KB), 30-image files (each image of 25KB), 66 information files (10 KB each), and no media files. The total dimension on site for that particular task is 1435 KB using expression (6). Now considering the bandwidth, we found that 0.70Sec is needed to access the site for completing the given task using expression (5).

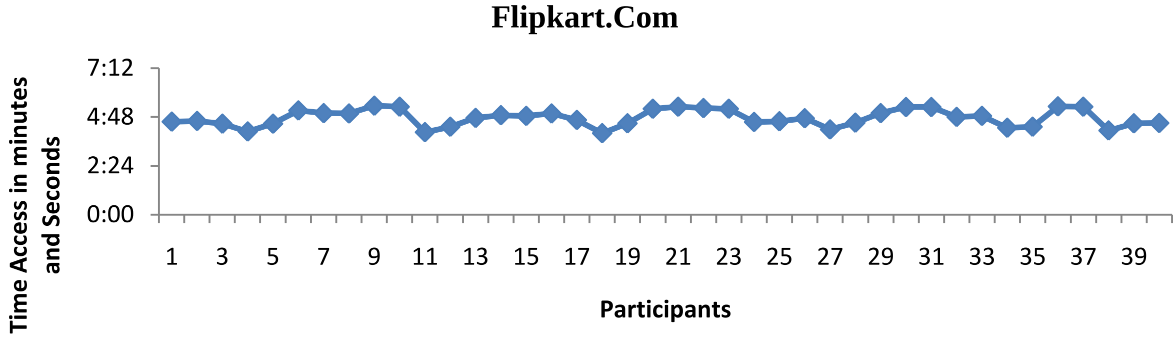

Fig. 1: Average time spent by the participants when executing the specific task in Flipkart.com website

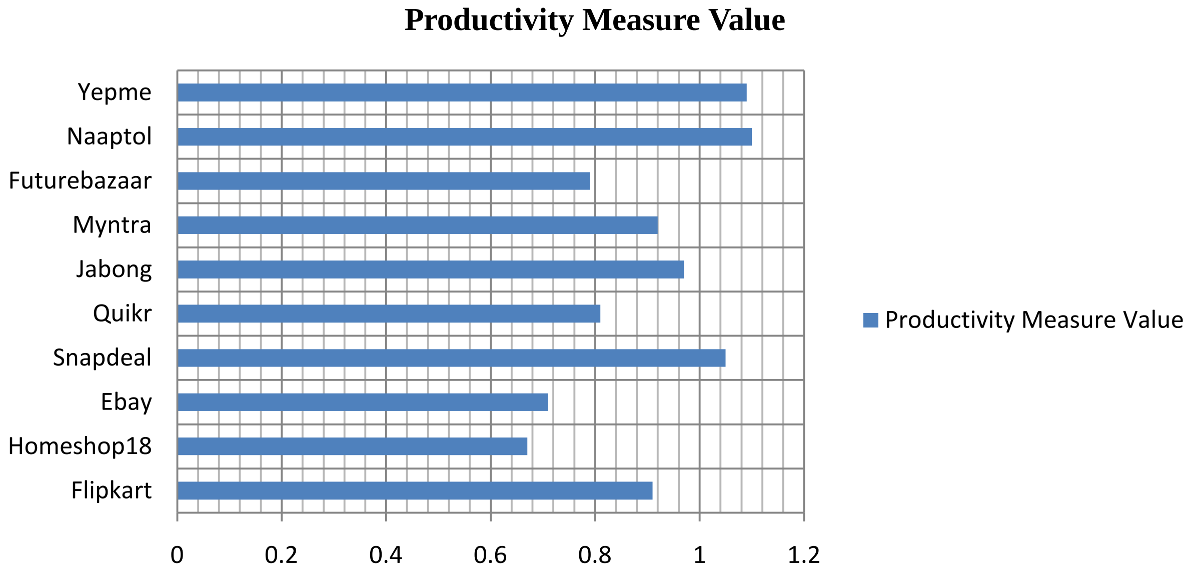

Fig. 2: The relationship between different web site and they needed to be updated or not

The 10 numbers of web pages visited by the participant contain 15, 7, 24, 8, 12 numbers of introductory, comparison, curiosity, difference and linked based information respectively. However, each information required some time to access, which is 4, 5, 3, 9, 2 seconds respectively. Therefore, the total time to navigate the information is 263 second using expressions (7). So we calculated the total actual usability time of the participants to be 303.70 seconds utilizing expression(8). The production value of web services is 0.91 (expression (9)), which lies in- between 0 to 1. Therefore, updating is required. Repeating the analysis in 10 businesses to consumer web sites, we conclude that some of the web sites need updating and some are not. Figure 2 shows the relationship between different web site and they needed to be updated or not. The analysis done based on the specific task performed by the different participants.

4. Validation

After calculating our productivity measurement values in web services, the database administrators and managers of corresponding web sites were contacted to check its accuracy. Out of 10 web site managers, only five managers were responding. They educated us surveyed benefit as a more mind boggling trait than we did, i.e., they comprehended profit as a measure of how effective a site was, and achievement included elements, for example, prerequisites solidness, consumer loyalty, and client/staff identity sort. They are surveying the benefit of the site singularly in view of size and effort at the time of the improvement stage. They were not calculating the productivity, based on user aspects. They have engaged in our method and gave feedback that our approach towards calculating productivity measurement with respect to other aspects is the raw technique and present better results towards finding out problems with the website.

5. Conclusion

We introduce a WWW-based productivity task size measure that can be related to effort. The measure is anything but difficult to develop from an undertaking based model, and it is easy to decipher. Be that as it may, unless the site information are an arbitrary example from a characterized populace, the quantity is relevant just for that information set on which it was made.

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