ICSOFT 2006

First International Conference on Software and Data Technologies

Proceedings

SETÚBAL, PORTUGAL· SEPTEMBER 11 - 14, 2006

Volume 1

ORGANIZED BY

SPONSORED BY

IN COOPERATION WITH

INSTICC PRESS

Proceedings of ICSOFT
First International Conference on Software and Data Technologies
ISBN: 972-8865-69-4
ISBN (13 digits): 978-972-8865-69-6
http://www.icsoft.org

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Organized by
INSTICC – Institute for Systems and Technologies of Information, Control and Communication

Sponsored by
Enterprise Ireland
Polytechnic Institute of Setúbal

In Cooperation with
Object Management Group (OMG)

Hosted by
School of Business of the Polytechnic Institute of Setubal

Edited by Joaquim Filipe, Boris Shishkov and Markus Helfert

Printed in Portugal

ISBN: 972-8865-69-4

ISBN (13 digits): 978-972-8865-69-6

Depósito Legal: 246927/06

http://www.icsoft.org

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BRIEF CONTENTS

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SELECTED PAPERS BOOK

A number of selected papers presented at ICSOFT 2006 will be published by Springer, in a book entitled Software and Data Technologies. This selection will be done by the conference chair and program co-chairs, among the papers actually presented at the conference, based on a rigorous review by the ICSOFT 2006 program committee members.

FOREWORD

This volume contains the proceedings of the first International Conference on Software and Data Technologies (ICSOFT 2006), organized by the Institute for Systems and Technologies of Information, Communication and Control (*INSTICC*) in cooperation with the Object Management Group (*OMG*), sponsored by Enterprise Ireland and the Polytechnic Institute of Setúbal and hosted by the School of Business of the Polytechnic Institute of Setubal.

The purpose of this conference is to bring together researchers, engineers and practitioners interested in information technology and software development. The conference tracks are "*Software Engineering*", "*Information Systems and Data Management*", "*Programming Languages*", "*Distributed and Parallel Systems*" and "*Knowledge Engineering*".

Software and data technologies are essential for developing any computer information system, encompassing a large number of research topics and applications: from programming issues to the more abstract theoretical aspects of software engineering; from databases and data-warehouses to management information systems and knowledge-base systems; Distributed systems, ubiquity, data quality and other related topics are included in the scope of ICSOFT.

ICSOFT 2006 received 187 paper submissions from more than 39 countries in all continents. To evaluate each submission, a double blind paper evaluation method was used: each paper was reviewed by at least two internationally known experts from ICSOFT Program Committee. Only 23 papers were selected to be published and presented as full papers, i.e. completed work (8 pages in proceedings / 30' oral presentations), 44 additional papers, describing work-in-progress, were accepted as short paper for 20' oral presentation, leading to a total of 67 oral paper presentations. There were also 26 papers selected for poster presentation. The full-paper acceptance ratio was thus 12%, and the total oral paper acceptance ratio was 35%.

In its program ICSOFT includes a panel to discuss the future of software development, by six distinguished world-class researchers; furthermore, the program is enriched by one tutorial and six keynote lectures. These high points in the conference program, involving top researchers worldwide, experts in different knowledge areas, have definitely contributed to reinforce the overall quality of the conference.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research and development efforts are recorded here. Secondly, we thank the members of the program committee and the additional reviewers for their diligence and expert reviewing. I would like to personally thank the Program Chairs, namely Boris Shishkov and Markus Helfert, for their important collaboration. The local organizers and the secretariat have worked hard to provide smooth logistics and a friendly environment, so we must thank them all and especially Mónica Saramago for her patience and diligence in answering many emails and solving all the problems. Last but not least, we thank the invited speakers for their invaluable contribution and for taking the time to synthesize and prepare their talks.

A successful conference involves more than paper presentations; it is also a meeting place, where ideas about new research projects and other ventures are discussed and debated. Therefore, a social event including conference banquet was organized for the afternoon and evening of September 13 (Wednesday) in order to promote this kind of social networking.

We wish you all an exciting conference and an unforgettable stay in the lovely city of Setúbal. We hope to meet you again next year for the 2nd ICSOFT, in Barcelona (Spain), details of which will be shortly made available at http://www.icsoft.org.

Joaquim Filipe

INSTICC/Polytechnic Institute of Setúbal, Portugal

(Conference Chair)

CONTENTS

INVITED SPEAKERS

KEYNOTE LECTURES

PROGRAMMING LANGUAGES

FULL PAPERS

SHORT PAPERS

POSTERS

SOFTWARE ENGINEERING

FULL PAPERS

SHORT PAPERS

POSTERS

DISTRIBUTED AND PARALLEL SYSTEMS

FULL PAPERS

SHORT PAPERS

WEB METRICS SELECTION THROUGH A PRACTITIONERS' SURVEY

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Keywords: Web Metrics, Quality.

Abstract: There are a lot of web metrics proposals. However, most previous work does not include their practical application. The risk of doing so, is to limit all the effort made just to an academic exercise. In order to eliminate this gap as well as to be able to apply the work developed, it is necessary to involve the different stakeholders related to web technologies as an essential part of web metrics definition. So, it is crucial to know the perception they have about web metrics, especially those related to the development and maintenance of web sites and applications. In this paper, we present the work we have done to find out which web metrics are considered useful by web developers and maintainers. This study has been performed on the basis of the 385 web metrics classified in WQM, a Web Quality Model defined in a previous work, using as validation tool, a survey made by professionals of web technologies. As a result, we have found out that the most weighted metrics were related to usability. That means that web professionals give more importance to the user of metrics than to their own effort.

1 INTRODUCTION

The spectacular development of the web has led to an increasing importance of related technologies in the functioning of organizations as well as in people's lives. It is compulsory that developed products, both complex applications or simple web sites, satisfy a minimum quality standard (Cutter Consortium, 2000).

In the field of web metrics, a large research effort has been made with proposals from very diverse perspectives.

In spite of the fact that some of the proposed metrics have not been formally defined or theoretically or empirically validated, fortunately, in the last years, the tendency is changing and justification, formalization and validation are also taken into account (Abrahão et al., 2003).

However, most of the work is academic and doesn't take into account industrial concerns. There are some exceptions. Among them, we can cite the works (Reifer, 2000, 2002) and (Mendes et al., 2003, 2005).

To eliminate the gap between practical application and academic world, it is necessary to better involve the different actors related to web technologies. To do so, it is essential to know the perception of web metrics that these actors have.

With this objective, we have performed a survey among web technologies professionals to select the metrics that are considered interesting or useful by them. Once we have the set of metrics, we could measure the web sites or the web applications and obtain corresponding quality indicators.

Our starting point is to consider the metrics that we collected from the literature and were used in our previous study (Calero et al., 2005) in which we classified a total of 385 web metrics, using the WQM quality model.

In the next section, we will expose the criteria followed in the metrics selection that we have used in our survey. In the third section, we will present the survey, its results and conclusions. Finally, in the fourth section, future work will be stated.

2 INTERNAL METRIC SELECTION

As it is not possible to prepare a survey including the 385 metrics classified in WQM, we performed a

first selection with the objective of restricting them into a manageable and representative set of web metrics to be included in our survey.

2.1 Selection Criteria

The selection was made taking into account the following considerations:

a) The number of metrics must be as limited as possible.
b) The selection must cover the different perspectives to be considered.
c) The most relevant works must be examined in a detailed way, especially those having an experimental component.
d) Works based on a concrete methodology must not be refused at the beginning but we will have to bear in mind the possibility of an easy generalization.
e) Given that many aspects such as usability have a great number of metrics, we will have to make an even bigger synthesis effort than with other aspects in which it is clear the lack of metrics.
f) It is not necessary that the selected number of metrics must be proportional to the number of collected metrics per aspect.

According to these considerations, we will establish the following criteria for the selection process:

1. To select those metrics that are proposed in several works.
2. To select those metrics that represent simple concepts.
3. To avoid duplicities, eliminating as much as possible metrics that could be assimilated into others, with respect to meaning, even not representing the same concept.
4. To eliminate metrics coming from the specialization of other metrics. Although they can allow us to measure certain characteristics in a more precise way, they can also made us lose a more general vision.
5. To incorporate some metrics that are not very common with the purpose of introducing variability.
6. To incorporate metrics specific for a methodology but able to be adapted to others.

Furthermore, if at any time there is a contradiction between the criteria, we will prioritize the simplest one.

2.2 Metrics Selection

As we have already indicated, our starting point has been the 385 metrics.

According to criterion 1, we have a set of metrics proposed by a large number of authors and that have also a very simple meaning (criterion 2) such as *Number of Web Pages*, *Depth*, *Breadth*, *Number IN Links*, *Total Number of Links*, *Number of Broken Links*, *%Broken Links*, *Total Number of Images*, *Images per Page*, *Images with ALT Text*, all of them with respect to the Website or Web Application, and *Download Time* (of a page), *Links of a Page* and *Images of a Page*.

We have also included others such as *Compactness*, *Stratum*, and *Cyclomatic Complexity*, based on criterion 5.

Following criteria 1, 2 and 5, we have included the following: *Quick Access Pages*, *Site Map*, *Global Help*, *Scoped Search*, *Stability*, *Link Colour Style Uniformity*, *Global Style Uniformity*, *Foreign Language Support*, *Contact Address*. And we have selected other generic metrics (criteria 2) like *Suitable Information* and *Updated Information*.

Concerning usability, as most of metrics are the result of a specialization (criteria 4), we have extracted the following (remember that other metrics have been already included from other works): *Display Colour Count*, *Text Positioning Count*, *Text Cluster Count*, *Font Count* and *Reading Complexity*, all of them with respect to a web page.

Regarding works related to the development and maintenance of web applications, we have selected (we have not included those included above), following criterion 2: *Media Count, Program Count*, *Total Page Allocation*, *Total Media Allocation*, *Total Code Length*, *Page Allocation*, *Media Duration*, *Media Allocation*, *Code Length (LOC)*, *Code Comment Length*, *Reused Media Count*, *Reused Program Count*, *Total Reused Media Allocation*, *Total Reused Code Length*, *Reused Code Length*, *Reused Comment Length*, *Total Page Complexity*, *Page Complexity*, *Audio Complexity*, *Video Complexity*, *Animation Complexity*, *Scanned Image Complexity*, *Total Effort (Design&Auth)*, *Total Page Effort*, *Total Media Effort*, *Program Effort*, *Experience*, and *Tool Type*. And others like *Total Number Flash Animations*, *Total Number of Icons/Buttons*, *Average Length Audio Clips*, *Average Length Video Clips*, *Reused Web Pages*, and *Reused Docs*.

We include, according to criterion 6, (all of them with respect to the web application): *Web Building Blocks*, *Number of COTS Components*, *Number of*

Object or Application Points, *Number of XML*, *SGML*, *HTML* and *Query Language Lines*, *Number of Web Components*, *Number of Scripts (Visual Language, Audio, Motion)* and *Number of Web Objects*. And based on criteria 5, we have taken the metric *Peak Staff*.

Besides, due to the application of criterion 4, we take into account the model efforts and the total effort: *Total Design Effort*, *Information Effort*, *Navigation Effort* and *Presentation Effort*.

Following criterion 2, we select *Server Scripts*, *Client Scripts*, *Web Page Scripts*, *Web Page WebObjects*, *Total Languages* and *Page Languages*.

We have not considered other metrics that are not relevant as compared to the selected ones because they mean an excessive specialization (criterion 4).

With this selection we have obtained 85 metrics, to be included in the survey (see appendix).

3 SURVEY

In this section, we will deal with aspects related to the survey, its objective, design, obtained results and its discussion.

3.1 Definition of Objectives

We have focused on the following objectives:

- To determine the importance given by web professionals to the considered web metrics.
- To study the impact of participant experience on the importance of metrics.
- To identify other aspects not taken into account in our work and that are considered important by web practitioners.
- To identify the concordances/discordances with the metrics proposed by researchers in the literature.

3.2 Survey Participants

An important aspect to be considered is who the survey target since any community has its own characteristics. For our purposes, our survey is addressed to practitioners involved in tasks of developing or maintaining applications and web systems with diverse degree of experience.

Thus, the technical concepts should not represent any problem. However, to fulfil our purpose, we have to take into account other aspects. For example, if the survey comes from the academic field can be seen by web technologies professionals as it does not fulfil their needs and they can refuse to fill it out. Subjects were not involved only in a passive way. In addition to theirs answers we tried to involve them in the project by soliciting suggestions from them.

For this survey our objective population is the web professionals. For the sample, we have considered professionals that previously we had maintained some contact in the past (or with their companies). Choosing them to conserve the diversity in the applications developed (scope of work), its experience degree, and the companies for whom work.

3.3 Survey Design

To fulfil the fixed objectives, we have structured our survey into three parts:

A. Data of the Subject.
B. Web Metrics.
C. Suggestions.

We have to take into consideration that the survey design is conditioned by the high number of metrics to be included in it. Answering a survey with questions about 85 metrics carries out certain reticences regarding the necessary time to fill it out.

Now, we will deal with each part separately.

3.3.1 PART A: Data of the Subject

There are a great variety of web professionals depending on their experience, their job and the technologies that they use. For these reasons, and following the recommendations of (Pfleeger and Kitchenham, 2001) and (Kitchenham and Pfleeger, 2002a-d, 2003) we have included generic questions about personal data. Thus, part A, Data of the Subject, is composed of three questions:

1) Job (Developer, Maintenance Manager, Others)
2) Years of Experience
3) Category of the developed product:
   a) Web site with static pages
   b) Web sites with dynamic generation of pages, working with jsp, php, asp, within a centralized environment (e. g. applications for small or medium size enterprise)
   c) Web sites using Content Management Systems (such as CMS of Microsoft, Zope, Tipo3,…) in a distributed environment (e.g. applications for a corporation)

3.3.2 PART B: Web Metrics

To make part B as simple as possible, we have decided to use close questions, one for each metric, quantifying the importance of each metric by using a Likert scale with an interval from 0 (not important) to 9 (very important).

To avoid fatigue and motivation loss we decided to start the questioner by simple metrics.

For providing a common background to the subjects, we included in the documentation a minitutorial about the metrics of the survey.

3.3.3 PART C: Suggestions

This part has two open questions. The first is to include suggestions of other metrics that subjects consider interesting, and the second is to include suggestions about the survey. The objective of this part is, on the one hand, to detect metrics that we have not considered, and on the other hand, to validate our survey.

3.4 Results

The survey was sent to the subjects by personalized email, avoiding as much as possible to give the impression of being like a circular to avoid the rejection rate. The survey could be sent back once filled out in electronic or paper format.

66 surveys were sent and we obtained 42 answers (63.6%), during the ten days deadline.

Two participants classified themselves as web users and the rest as professionals with different degrees of experience and different development environment. Then, the sample of web technologies is formed by 40 subjects. From them, we have centred our study as follows.

In the tables 1-4, we show the obtained results for the different subjects categories. In each one of the tables, column *Score* shows the arithmetic average given by subjects of each considered group, and *Deviat*. (or *Dev*) its standard deviation. As we have noted above, each metric has been scored into a scale from 0 (not important) to 9 (very important). The interpretation of the results shown here will be analysed in the following section.

For the set of the 40 subjects, the most accepted metrics are shown in table 1. For those related to technologies of static web pages (Category a, with only 6 subjects), we obtain table 2 (we have included this table in spite of the reduced sample size). Regarding the most valued metrics for categories b and c of subjects (34 subjects), we obtain table 3.

In the table of the appendix, we can see the complete relation of all the metrics studied in the survey ordered according the importance given by these 34 subjects of group b-c. Column *Score* is the average score by the metrics, and *Dev*. its standard deviation, for each of the group considered.

Table 1: Metrics rank for all the subjects (40 subjects).

Metric	*Score*	*Deviat.*
Updated Information	*8.35*	*1.05*
Suitable Information	*8.13*	*1.26*
Download Time	*8.05*	*1.11*
Global Style Uniformity	*7.88*	*1.11*
Scoped Search	*7.65*	*1.69*
Link Colour Style Uniformity	*7.58*	*1.32*
Navigation Effort	*7.55*	*1.50*
Information Effort	*7.48*	*1.55*
Total Effort (Design)	*7.40*	*1.58*
Presentation Effort	*7.38*	*1.56*
Developer's Experience	*7.38*	*1.58*
Quick Access Pages	*7.38*	*1.50*

Table 2: Metric rank for static web page developers.

Metric	*Score*	*Dev*
Suitable Information	*8.33*	*0.82*
Updated Information	*8.33*	*0.82*
Foreign Language Support	*8.00*	*0.89*
% Broken Links	*7.83*	*1.60*
Global Style Uniformity	*7.67*	*1.03*
Link Colour Style Uniformity	*7.50*	*0.84*
Number of IN Links	*7.17*	*0.98*
Number of Broken Links	*7.17*	*1.83*
Download Time	*7.17*	*1.47*
Global Help	*7.00*	*1.10*
Contact Address (e-mail, phone, mail)	*7.00*	*0.63*
Scoped Search	*7.00*	*1.10*

Table 3: Metric rank for b-c subjects category.

Metric	*Score*	*Deviat.*
Updated Information	*8.35*	*1.10*
Download Time	*8.21*	*0.98*
Suitable Information	*8.09*	*1.33*
Global Style Uniformity	*7.91*	*1.14*
Scoped Search	*7.76*	*1.76*
Navigation Effort	*7.74*	*1.26*
Information Effort	*7.68*	*1.36*
Total Effort (Design)	*7.62*	*1.30*
Link Colour Style Uniformity	*7.59*	*1.40*
Presentation Effort	*7.56*	*1.33*
Developer's Experience	*7.53*	*1.54*

We have divided the group b-c in two subgroups: the first one is formed by subjects with at least three years' experience (19 subjects), and, the other one is formed by those subjects with less than three years' experience (15 subjects). In the rest of the section we will refer to them as subgroups I) and II), respectively.

We have decided to perform this division since we think that from three year's experience there is a qualitative leap in developer maturity as well as in their knowledge of the technologies they work with.

For the sake of clarity, in table 4, we have extracted the results corresponding to the best scored metrics (score upon 7.50) according to subgroup I (three or more years experience). As we can see results do not differ very much with respect to those obtained by complete category b-c (see table 3).

Table 4: Metrics rank for practitioners with 3 or more years of experience in categories b-c.

Metric	*Score*	*Deviat.*
Updated Information	*8.37*	*1.12*
Download Time	*8.32*	*0.95*
Suitable Information	*8.21*	*1.18*
Scoped Search	*8.16*	*1.01*
Total Effort (Design)	*8.11*	*0.94*
Quick Access Pages	*8.05*	*0.97*
Information Effort	*7.95*	*1.13*
Total Effort (Design&Auth)	*7.95*	*1.03*
Global Style Uniformity	*7.89*	*0.94*
Navigation Effort	*7.89*	*1.20*
Presentation Effort	*7.79*	*1.13*
Number of Broken Links	*7.79*	*1.96*
Developer's Experience	*7.74*	*1.05*
Page Allocation	*7.53*	*2.06*
Program Effort	*7.53*	*1.47*
Total Page Effort	*7.53*	*1.43*

Furthermore, if we compare the 22 most highlighted metrics by subgroups I and II, we obtain that there are more or less the same metrics except for only four metrics for each subgroup that they do not appear until positions 16^{th} and 15^{th} respectively (see appendix).

3.5 Discussion and Interpretation of Results

We notice that considerations about table 2 – category a), static web page developers– will be only indications, because of the reduced sample size.

The first conclusion we can extract is that Usability is very important. This result was foreseeable taking into account the importance of usability in Web Applications (Calero et al., 2005). Information quality is very important, *Suitable Information* and *Updated Information*. We also note the coincidence of groups a) and b-c) in other four metrics among the most valued also related to usability (*Download Time*, *Scoped Search*, *Global Style Uniformity*, *Link Colour Style Uniformity*).

The rest of the metrics in table 3 are related to effort (*Information Effort*, *Navigation Effort*, *Total Effort*, *Presentation Effort* and *Developer's Experience*). It is paradoxical that developers prioritize the user vs. their effort.

In opposition to the general perception, our survey shows that importance granted in Literature to the number of pages and the number of images does not correspond to the perception that developers have of them.

Nevertheless, we do not mean that the number of pages is not important, since precisely the access to information is made from a page (or a data entry if it is carried out by other system). But these access pages would be the important ones and not those dynamically generated because the most important aspects are the programs that generate pages, the information they contain, how information is presented, and not the number of such pages that can be generated.

A similar reasoning can be made for the number of images. In a small website (and normally static), possibly image processing would be manual. But in a system with thousands of items, they would be provided in a digitalized format, probably in a database. Consequently, system complexity should be measured according to programs that use the database, not to the database size.

As we have already mentioned, to achieve the last cited objective, in section 3.1, we have incorporated into the survey, a third section of suggestions not only regarding metrics but also the survey itself.

With relation to the suggestion of metrics, we have found that almost all are also related to Usability and in particular, to Accessibility and adaptation to standards, compatibility with navigators and, in a lower degree, others related to performance and security.

3.6 Conclusions

In summary, the main conclusions we can extract from the survey are:

- Developers prioritize usability instead of their effort. By this, it is convenient to have tools that

from the first stages of development provide an estimation of product usability.

- Some metrics frequently used in Literature, have a relative importance for developers (e.g. number of pages and number of images). This is because the developed products are complex, with the use of dynamic generation of pages, and the use of Content Management Systems. There is a necessity of metrics and frameworks for that.

4 FUTURE WORK

As we said in the introduction, our work has the purpose of creating web applications quality indicators. We consider it essential to take into account the vision of quality of web professionals. To do so, we have divided our task into two stages, the first stage he consists in having a first approximation to metrics considered relevant by developers and sites and web applications administrators. As a result of this, we have obtained that the best valuated metrics are *Updated Information*, *Suitable Information*, *Download Time*, *Global Style Uniformity* and *Scoped Search*.

The second stage consists of determining the importance of each metric with respect to each quality characteristic and each phase of the life cycle process. Therefore, we must obtain the metric weights with the purpose of obtaining quality indicators of a site or a web application.

However, before starting the second stage, we aim at carrying out the survey again using a different group of subjects to check the validity of the obtained results. The indicators obtained in our work must be able to be incorporated into web development methodologies.

Other aspect to be considered (considering the importance given to usability) is the incorporation of metrics for estimating the end product usability during the development. The same happens with accessibility.

ACKNOWLEDGEMENTS

We would like to thank all participants in this survey for their time and above all, for their suggestions and especially to those that not only indicated suggestions in the survey but also came to talk to the authors about new approaches in our work. Thank you all.

This work is part of the CALIPO project (TIC 2003-07804-C05-03) and the CALIPSO network (TIN2005-24055-E) supported by the Spanish Ministerio de Educación y Ciencia and by the DIMENSIONS project (PBC-05-012-1) supported by FEDER and Junta de Comunidades de Castilla-La Mancha.

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APPENDIX

Metric	Score in group b-c (34 subjects)		Score in group b-c Subgroup Experience>=3 years (19 subjects)		Score in group b-c Subgroup Experience<3 years (15 subject)		Score in group a (6 subjects)		All Subjects (40 subjects)	
	Aver.	Dev.	Aver.	Dev.	Aver.	Dev.	Aver.	Dev.	Aver.	Dev.
Updated Information	8.35	1.10	8.37	1.12	8.33	1.11	8.33	0.82	8.35	1.05
Download Time	8.21	0.98	8.32	0.95	8.07	1.03	7.17	1.47	8.05	1.11
Suitable Information	8.09	1.33	8.21	1.18	7.93	1.53	8.33	0.82	8.13	1.26
Global Style Uniformity	7.91	1.14	7.89	0.94	7.93	1.39	7.67	1.03	7.88	1.11
Scoped Search	7.76	1.76	8.16	1.01	7.27	2.34	7.00	1.10	7.65	1.69
Navigation Effort	7.74	1.26	7.89	1.20	7.53	1.36	6.50	2.35	7.55	1.50
Information Effort	7.68	1.36	7.95	1.13	7.33	1.59	6.33	2.16	7.48	1.55
Total Effort (Design)	7.62	1.30	8.11	0.94	7.00	1.46	6.17	2.48	7.40	1.58
Link Colour Style Uniformity	7.59	1.40	7.47	1.26	7.73	1.58	7.50	0.84	7.58	1.32
Presentation Effort	7.56	1.33	7.79	1.13	7.27	1.53	6.33	2.42	7.38	1.56
Developer's Experience	7.53	1.54	7.74	1.05	7.27	2.02	6.50	1.64	7.38	1.58
Quick Access Pages	7.47	1.56	8.05	0.97	6.73	1.87	6.83	0.98	7.38	1.50
Page Allocation	7.44	2.08	7.53	2.06	7.33	2.16	6.00	2.28	7.23	2.14
Total Effort (Design&Auth)	7.41	1.37	7.95	1.03	6.73	1.49	5.83	3.06	7.18	1.77
Number of Broken Links	7.35	2.09	7.79	1.96	6.80	2.18	7.17	1.83	7.33	2.03
Global Help	7.26	1.36	7.26	1.28	7.27	1.49	7.00	1.10	7.23	1.31
Program Effort	7.18	1.38	7.53	1.47	6.73	1.16	5.17	2.40	6.88	1.70
Total Page Effort	7.15	1.48	7.53	1.43	6.67	1.45	5.67	2.88	6.93	1.79
% Broken Links	7.00	2.15	7.21	2.23	6.73	2.09	7.83	1.60	7.13	2.08
Foreign Language Support	6.91	2.27	7.00	2.13	6.80	2.51	8.00	0.89	7.08	2.15
Reading Complexity	6.88	1.56	7.44	1.04	6.20	1.82	6.83	2.56	6.87	1.70
Numb. of XML, SGML, HTML and Query Language Lines	6.85	1.26	6.74	1.05	7.00	1.51	6.00	1.67	6.73	1.34
Stratum	6.82	2.01	6.94	2.29	6.67	1.68	6.00	1.79	6.69	1.98
Total Media Effort	6.74	1.99	7.32	1.57	6.00	2.27	4.33	2.58	6.38	2.23
Site Map	6.65	1.86	6.95	1.68	6.27	2.05	6.50	0.84	6.63	1.73
Number of Web Page Scripts	6.62	1.41	6.63	1.30	6.60	1.59	6.50	1.52	6.60	1.41
Tool Type	6.62	1.91	6.53	2.06	6.73	1.75	5.83	2.14	6.50	1.93
Impurity Tree	6.61	1.80	6.56	2.09	6.67	1.45	6.83	1.47	6.64	1.74
Number of Reused Web Pages	6.56	1.93	6.58	1.46	6.53	2.45	6.67	1.21	6.58	1.82
Contact Address (e-mail, phone, mail)	6.53	2.33	7.21	1.93	5.67	2.55	7.00	0.63	6.60	2.16
Number of Server Scripts	6.47	1.67	6.21	1.84	6.80	1.42	6.50	1.52	6.48	1.63
Number of Client Scripts	6.47	1.71	6.53	1.26	6.40	2.20	6.83	1.17	6.53	1.63
Number of Web Objects	6.45	1.66	6.39	1.33	6.53	2.03	6.33	1.21	6.44	1.59
Total Reused Code Length	6.44	2.02	6.58	1.68	6.27	2.43	6.17	1.72	6.40	1.96
Reused Code Length	6.41	1.99	6.42	1.77	6.40	2.29	5.83	1.47	6.33	1.91
Total Code Length	6.35	1.74	6.63	1.57	6.00	1.93	6.17	1.17	6.33	1.65
Compactness	6.30	1.47	6.39	1.69	6.20	1.21	6.67	1.21	6.36	1.42
Reused Program Count	6.29	1.90	6.26	1.59	6.33	2.29	6.33	1.86	6.30	1.87
Number of Object or Application Points	6.29	1.43	6.26	1.33	6.33	1.59	6.67	1.03	6.35	1.37
Web Building Blocks	6.26	2.14	6.21	2.07	6.33	2.29	5.50	0.84	6.15	2.01
Number of Scripts (Visual Language, Audio, Motion)	6.24	1.74	6.26	1.82	6.20	1.70	6.17	1.60	6.23	1.70
Number of Web Components	6.24	1.37	6.32	1.16	6.13	1.64	6.50	1.05	6.28	1.32
Depth	6.18	1.87	6.47	1.58	5.80	2.18	6.83	1.60	6.28	1.83
Total Page Allocation	6.18	2.38	6.26	2.28	6.07	2.58	5.33	3.01	6.05	2.46
Code Length (LOC)	6.12	1.85	6.32	1.80	5.87	1.96	5.83	1.47	6.08	1.79
Total Number of Icons/Buttons	6.09	1.83	6.37	1.64	5.73	2.05	5.67	1.51	6.03	1.78
Number of COTS Components	6.09	1.64	6.21	0.98	5.93	2.25	6.33	0.52	6.13	1.52
Web Page WebObiects	6.09	1.81	6.11	1.45	6.07	2.22	6.50	1.05	6.15	1.71
Program Count	5.97	1.96	6.05	1.54	5.87	2.45	5.50	1.97	5.90	1.95
Display Colour Count	5.94	2.20	6.00	2.36	5.87	2.07	6.50	1.52	6.03	2.11
Breath	5.85	1.84	5.95	1.84	5.73	1.91	6.17	1.94	5.90	1.84
Peak Staff	5.85	2.09	5.84	2.34	5.87	1.81	5.83	1.83	5.85	2.03
Total Media Allocation	5.82	2.47	5.58	2.22	6.13	2.80	6.17	2.14	5.88	2.40
Code Comment Length	5.76	2.13	6.32	1.63	5.07	2.52	6.33	1.51	5.85	2.05
Text Positioning Count	5.76	2.35	5.58	2.48	6.00	2.24	6.33	1.63	5.85	2.25
Number of Web Pages	5.65	1.94	5.89	2.02	5.33	1.84	6.33	1.63	5.75	1.89
Media Allocation	5.65	2.41	5.47	2.32	5.87	2.59	5.67	1.97	5.65	2.33
Font Count	5.59	1.97	6.05	2.04	5.00	1.77	5.67	1.51	5.60	1.89
Text Cluster Count of a Page	5.58	2.22	5.50	2.53	5.67	1.88	6.17	0.98	5.67	2.08
Links of a Page	5.53	2.09	5.26	2.18	5.87	2.00	6.00	1.79	5.60	2.04
Number of Total Links	5.47	1.94	5.47	2.06	5.47	1.85	6.17	1.72	5.58	1.91
Number IN Links	5.44	2.06	5.37	2.14	5.53	2.03	7.17	0.98	5.70	2.03
Connectivity Density	5.44	2.27	5.37	2.52	5.53	2.00	6.17	1.17	5.55	2.15
Total Languages	5.41	1.97	5.32	2.31	5.53	1.51	4.83	0.98	5.33	1.86
Images with ALT Text	5.35	2.44	5.84	2.36	4.73	2.46	5.50	1.87	5.38	2.34
Images per Page	5.29	2.14	5.89	1.85	4.53	2.29	6.00	0.63	5.40	2.00
Total Number of Images	5.21	2.25	5.53	2.17	4.80	2.37	4.67	1.37	5.13	2.14
Media Duration	5.12	2.48	4.74	2.18	5.60	2.82	4.17	1.83	4.98	2.40
Number of Page Languages	5.06	1.97	4.89	2.18	5.27	1.71	5.17	1.17	5.08	1.86
Images of a Page	5.03	2.10	5.32	2.00	4.67	2.23	4.83	0.98	5.00	1.96
Reused Media Count	4.94	2.51	4.79	2.37	5.13	2.75	6.33	1.86	5.15	2.46
Cyclomatic Complexity	4.91	2.40	4.89	2.62	4.93	2.19	6.67	1.63	5.18	2.37
Average Length Video Clips	4.91	2.35	4.53	2.12	5.40	2.61	4.50	2.43	4.85	2.34
Total Reused Media Allocation	4.91	2.50	4.89	2.49	4.93	2.60	6.00	2.61	5.08	2.52
Total Number Flash Animations	4.85	2.41	5.26	2.40	4.33	2.41	3.83	1.83	4.70	2.34
Average Length Audio Clips	4.85	2.38	4.47	2.14	5.33	2.64	4.33	2.25	4.78	2.34
Animation Complexity	4.82	2.34	4.89	2.40	4.73	2.34	4.33	1.21	4.75	2.20
Reused Docs	4.79	2.33	4.95	2.15	4.60	2.61	6.17	1.17	5.00	2.24
Media Count	4.71	2.18	5.05	2.09	4.27	2.28	4.67	1.63	4.70	2.09
Page Complexity	4.65	2.10	4.68	2.24	4.60	1.99	6.00	1.67	4.85	2.08
Audio Complexity	4.53	2.25	4.58	2.24	4.47	2.33	4.17	1.17	4.48	2.11
Video Complexity	4.50	2.36	4.58	2.46	4.40	2.32	4.00	1.79	4.43	2.27
Total Page Complexity	4.32	2.20	4.58	2.32	4.00	2.07	3.67	1.37	4.23	2.09
Scanned Image Complexity	4.09	2.02	4.32	1.95	3.80	2.14	3.17	1.47	3.95	1.96
Reused Comment Length	3.85	2.28	4.26	2.47	3.33	1.99	3.83	2.32	3.85	2.26