Benchmarking web site functions

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Abstract

Purpose – To measure, classify and compare web site functions' development.

Design/methodology/approach – The objectives were achieved by developing a methodology to measure, classify and compare web site functions development. The measurement was based on the presence (or absence) of 91 web site components. The classification was achieved using an applied correspondence analysis. The comparison was performed with respect to 4,485 company web sites from two provinces in Canada. A formal procedure involving 50 assistants was developed to collect data over 5,000 sites within a month period and a conceptual model was developed to interpret results.

Findings – Findings show that web site functions development could be described on a three dimensional space, the three axes corresponding to directions of development. The development status of the whole sample appeared as a cone in which five classes (or categories) of web sites could be identified and described with respect to their development profile. The development of 18 web site functions was also benchmarked with respect to observations within a class and with respect to some other characteristics like the industrial sector and the province where the company was located.

Research limitations/implications – Web site functions development was evaluated only with respect to components accessible to the general public. Development of intranet and extranet were not evaluated and hence taken into account for overall web sites development.

Practical implications – This research project of web site functions development was part of a more comprehensive project aimed at evaluating and documenting the impact of using a web site on business processes. So, combining the results of the two projects, allowed the authors to advance suggestions of how web sites should be developed to generate value for companies.

Originality/value – The approach to web site functions development evaluation is original. The methodology could be replicated anytime. The typology that emerged from the analysis is unique. Moreover, given the large sample of 4,485 web sites, results are statistically valid.

Keywords Benchmarking, Internet, Worldwide web

Paper type Research paper

Rationale

The benchmarking of web site functions was planned as a first phase of a more comprehensive project[1] aimed at documenting the impact of internet technology on business processes. This benchmarking exercise was necessary to identify the most highly developed web sites with respect to specific functions. Companies with such highly developed web sites were recruited for case studies in the second phase of the comprehensive project. The rationale for the benchmarking of web site functions is shown in the conceptual framework (Bégin *et al.*, 2001) in Figure 1.

A web site is a tool that can improve companies' business process performance, particularly with regard to activities and tasks with specific objectives: marketing products and services, selling products, providing after-sales services, etc. Our

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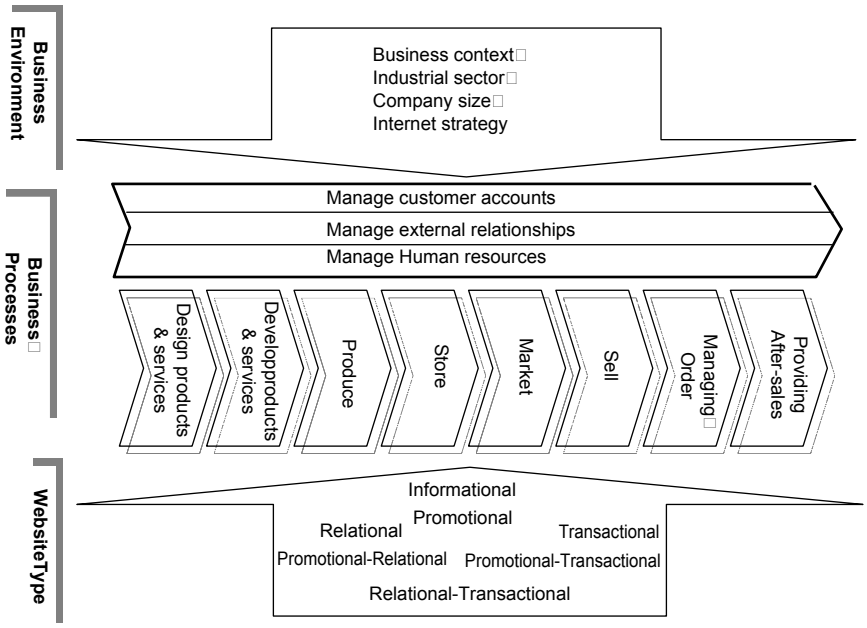

Figure 1.
Conceptual framework

framework identifies 11 such processes that a web site can improve. Moreover, companies have developed various types of web sites to serve numerous purposes with respect to business processes. For example, when a company develops a promotional site, this site will likely be used to market and promote products; when it develops a transactional site, it will likely be used to sell products, and when it develops a relational site, it will likely be used to develop preferred ties with customers, suppliers, employees, investors and numerous other stakeholders. The rationale behind this benchmarking project is, therefore, to understand web site development with respect to the functions that a site performs. We also aim to classify web sites according to their development profile in order to link them to specific business process improvements that we intend to document in the second phase of this comprehensive project.

Methodology

First, we posed the following research question:

RQ1. Given that a web site is a tool used to improve the performance of activities within business processes, how can web sites be measured and compared?

We then established three essential tools:

(1) a method of describing web site functions;

(2) an approach to measure web site development; and

(3) a model to evaluate and compare web site development.

In addition, we needed to plan and implement a data collection and analysis strategy.

Identification of web site functions

A web site function corresponds to a specific task performed by a web site, with each task being related to a specific objective. For example, the identification function corresponds to the task of identifying the company that owns the site, the navigability function corresponds to the task of making it easier to find information on a site, and so on. Figure 2 shows the 18 functions benchmarked in this study. Four of the functions – navigability, security, respect and accreditation – were considered support functions of a site, and the other 14 functions were considered customer value oriented functions because their objective is either to convey information to customers or directly procure information from customers. Table I defines the functions of a web site analysed within this project.

The functions were identified through focus group discussions with experts[2] in web site design and development. Focus group participants were asked: what are the usual functions of web sites? Which functions do companies usually develop on web sites? Which functions of a web site are most useful to companies? The November 2002 project[3] drew significantly on the previous year's results and analyses[4]. Apart from the use of an intranet or an extranet, no web site functions were identified by the participating experts other than those shown in Table I.

Description and measurement of web site functions

The description of web site functions examines how the functions are given concrete form on a web site? Specifically, how does a web site identify the company to which it is related? How is a web site made navigable?

Functions are made tangible on a web site through a set of components or elements of information. For example, the navigability function takes the concrete form of a site map, a tab bar or navigation menu, a switching functionality, a followed path, online web site support, an intuitive search engine or any other navigation component. Table II describes the identified functions in terms of the components of a web site. Components were also identified by the same panels of experts. Overall, 91 components were identified by experts. Moreover, the list in Table II was enriched considerably by the previous year's findings.

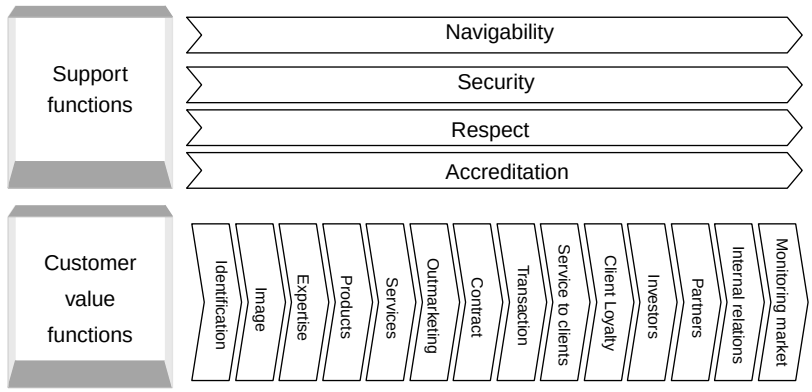

Figure 2.
Web site functions

	Objective of the function
Support functions	
Navigation	To facilitate navigation on a site
Security	To ensure the security of transactions on a site
Respect	To ensure confidentiality and (protect visitors' interests)
Accreditation	To confirm the qualifications of a web site
Customer value functions	
Identification	To identify the company
Image	To promote a company's image of its proper environmental, social and ethical conduct
Expertise	To promote company expertise and brands
Products	To market products
Services	To market services
External marketing	To promote another company's products or services
Contract	To inform clients of transaction-related conditions
Transaction	To carry out a transaction: make a sale or receive a payment
Customer service	To support customers with specific services
Client loyalty	To develop customer loyalty
Investors	To interest and support investors
Partners	To develop a personalized relationship with partners
Internal relations	To develop preferred relationships with candidates and employees
Monitoring and leadership	To monitor and lead changes in a community of customers

Table I.
Definition of web site functions

A component is related to a function if it contributes to that function. For example, a tab bar clearly contributes to navigability. However, the contribution of any given component to a function is not always clear cut. Some components may contribute to more than one function, and components contributing to a function may not all carry the same weight. For example, Table II shows that the company logo contributes not only to the identification function, but also to the image function. The reason the company logo was assigned to the function identification is that the experts on the panels felt that it contributes more to identifying the company owning the site than to promoting the company's image, but it could have been assigned to the image function with a different weight.

The identification of functions and their definition in terms of components are useful to interpret results. However, in order to avoid biased results because of inappropriate assignment of components to functions, the statistical analysis carried out was based solely on the presence or absence of components, and not on their assignment to functions. Moreover, the measurement of components is simple since a component[5] is either present (value 1) or absent (value 0) on a site. The statistical analysis was, therefore, conducted using a matrix where each line represents an observation and each column represents a component. Hence, the assignment of components to functions has no impact on the statistical analysis, although it facilitates interpretation of the various profiles of web site development.

Functions	Components
Navigability	Site map, tab bar or navigation menu, switching functionality, followed path, online web site support, intuitive search engine, other navigational components
Security	Entrance in a secure zone, seal certifying security, payment security
Respect	Policy on disclosure of personal information, opt-out from a mailing list, opt-in to a mailing list, cookies present
Accreditation	Seal certifying the nature of content, seal certifying customer satisfaction, seal certifying conformity
Identification	Company logo, civic address, telephone number, what we do, history of the company, electronic address, location of facilities, divisions and subsidiaries
Image	President's message, mission, values, press review, press releases, membership in associations, business partners, link to business partners, social, ecological and environmental causes, sponsorships
Expertise	Portfolio of achievements, clients' messages, awards and distinctions, ISO or other accreditation, brands
Products	Electronic catalogue, images of company products, product availability, information on product safety, instructions on product care, information on product use, new product announcements, product promotions, free samples, points of sale
Services	Services offered, points of service
External marketing	To advertise products or services from companies with no ties to the company hosting the site
Contract	Prices of products available online, currency used for billing, link to currency rates, choice of currency, information on shipping costs, information on taxes and customs, delivery conditions, conditions related to payment policy, conditions related to guarantees, cancellation of a sale and exchange policy, confirmation before payment, conditions related to financing
Transaction	Online purchasing option, online payment option
Customer service	Online quote, generic information including technical and professional advice, technical support, customer service, transaction history, transaction follow-up, classified ads
Customer loyalty	Personalized client profile, customer survey, contests and drawings, games and other entertainment
Investors	Financial reports, financial indicators, financial analyses by third parties, share transactions
Partners	Access to an extranet, distributor recruitment
Internal relations	Section on careers, skills profiles, conditions related to jobs offered, resume posting, presentation of employees, access to an employee intranet
Monitoring and leadership	FAQ forum, discussion groups regarding products and services

Table II.
Description of web site functions

Data collection method

The data collection method involved five main activities:

(1) development of a data collection sheet;

(2) construction of lists of web site addresses;

(3) establishment of a data collection procedure;

(4) design and implementation of an electronic collection and control system; and

(5) recruitment and training data collectors.

A data collection sheet

The data collection sheet is directly derived from the list of components described in Table II. However, to ensure that each component is interpreted similarly by the numerous assistants that collected data, we provided a clear and comprehensive definition of each component. In some cases, we complemented the definition with an example of what the component looked like on sites where it appeared. After describing the components, we verified the consistency of the interpretations, and we re-organized the order in which the components appeared on the sheet to simplify the data collection process.

In addition to the 91 components, there were five other fields of information: one identifying the company with a code to ensure privacy, one representing the industrial sector, on related to company size, one related to the location of the head office, and one related to the languages of the site.

Lists of web site addresses

We compiled lists of web site addresses of companies from specific industrial sectors whose head office was situated in the Canadian provinces of Québec and Ontario. We confirmed the validity of all addresses before the data collection began. Specifically, we ensured that two addresses did not lead to the same site, that the sites were not under construction, that the sites did not belong to government agencies or non-profit organizations, that there were no pornographic sites, and that the sites were all from the industrial sectors retained. Moreover, we gathered data on company size in terms of the number of employees, and we ensured that the sample reflected the overall industrial picture of the Canadian economy in the two provinces.

Table III shows the number of sites evaluated by industrial sector and by province and Table IV presents the sample population by province and by company size.

Data collection procedure

To enable a large team to collect a sizeable quantity of data, a rigorous data collection procedure was. required. Moreover, to ensure proper comparison of web sites, we needed to collect the data within a relatively short period of time given the pace of web site change. Our objective was thus to collect all the data within a period of four weeks. Data was collected during November 2002, the same period as the 2001 project. Preliminary tests revealed that it took approximately 20 minutes to collect data from a single site. We consequently hired 50 students, divided into teams of six to eight people working under a supervisor. Supervisors were in charge of answering questions and validating the data collected by the students on their team. Supervisors reviewed all the data collected by each student for the first ten web sites. Following that, if they

Table III.
Web sites surveyed in November 2002 by province and industrial sector in Canada

Industrial sector	Québec	Ontario	Total
Agriculture, forestry, fishing and hunting	52	32	84
Construction	142	87	229
Manufacturing	949	796	1,745
Wholesale trade	297	356	653
Retail trade	548	365	913
Transportation and storage	77	42	119
Information and cultural industry	129	142	271
Finance and insurance	92	93	185
Real estate and rental services	71	48	119
Professional, scientific and technical services	45	44	89
Other sectors	55	23	78
Total web sites surveyed	2,457	2,028	4,485

Table IV.
Web sites surveyed in November 2002 by company size in Canada

Company size	Québec		Ontario		Total	
Less than five employees	633	29.5%	261	14.2%	894	22.5%
Between five and nine employees	404	18.8%	317	17.3%	721	18.1%
Between 10 and 29 employees	573	26.7%	552	30.1%	1,125	28.3%
Between 30 and 99 employees	327	15.2%	417	22.7%	744	18.7%
Between 100 and 499 employees	178	8.3%	232	12.6%	410	10.3%
More than 500 employees	33	1.5%	55	3.0%	88	2.2%
Total when size is known	2,148	100%	1,834	100%	3,982	100%
No information on size	309		194		503	
Total	2,457		2,028		4,485	
Less than 500 employees		98.5%		97.0%		97.8%
Less than 100 employees		90.2%		84.4%		87.5%
Less than 30 employees		75.0%		61.6%		68.8%

were satisfied with the students' interpretation of the components, they would review the data collected from one out of every three sites for the remaining sites analysed.

An electronic data collection and control system

The entire data collection and control system was automated. Initially, students received an electronic list of ten addresses from which to collect data. They were also provided with an electronic data collection sheet. When they collected the data from their ten assigned sites, the data collected were sent electronically to the supervisor for validation. Upon validation, another list of ten sites was sent to the student, and so on. The data validated by supervisors were transferred to a secure database. Following four weeks of data collection, we had compiled an electronic database of 4,487 lines and 96 columns.

Recruitment and training of students

Students from HEC Montréal[6] were invited to evaluate web sites. While they were asked to commit to evaluate a minimum of 100 web sites, some students evaluated a

few hundred sites. They were provided with training and were tested with a sample of web sites before they began collecting data. They were also assigned to a supervisor who met with them, answered questions and provided support as needed during the data collection period.

Main results

The main results are:

- a method to identify dimensions of web site development;
- a typology of web sites with respect to their development profile; and
- benchmarks related to function development.

A method to identify dimensions of web site development

The method to identify dimensions of web site development was refined from year to year as the projects were carried out[7]. The method consists of:

- A description of web site development in terms of the presence (or absence) of a set of components (91 components), the list of components being determined a priori by panels of experts.
- The use of applied correspondence analysis (ACA)[8] to identify dimensions (axes) of development, expressed in terms of subsets of components that are present and subsets of components that are absent.

Application of ACA[9] to the matrix composed of the 4,487 data observations (lines), describing 91 binary components (columns), enabled us to identify three main discriminating axes, explaining 24.74 per cent of the total inertia[10] of the observations. This result is highly meaningful given the fact that all data were of a binary type. The first axis, dimension 1, accounts for 13.04 per cent of the total inertia[11], the second axis for 8.41 per cent, and the third axis for 4.02 per cent. Figure 3 shows the observations with respect to the three dimensions defined by the three discriminating axes.

The co-ordinates of the three axes suggest that the development of the web sites examined evolves according to three dimensions. Figure 4 shows the plane formed by axes 1 and 2. Figure 5 shows the plane formed by axes 2 and 3.

Dimension 1, explaining 13.44 per cent of the total inertia of the observations, is labelled the development axis because one extremity of the axis contains sites with very few components and at the other extremity of the axis we find sites with a greater number of components. Therefore, along dimension 1, development refers to the number of components that are present on a site. Figure 4 reveals a cone: the tip of the cone corresponds to very poorly developed sites (very few components are present), and the sites closest to the left-hand side of Figure 4 are more developed (more components are present). Moving toward the left-hand side of the figure, the observations appear to be increasingly dispersed. In effect, they are spread out in relation to axis 2 because the more components there are in a subset, the more likely they are to differ from one another along axis 2.

Dimension 2 is labelled the relational – transactional axis. A site is transactional when the transaction function is developed, and a site is considered relational when it has interactive components other than transactional components. The bottom of

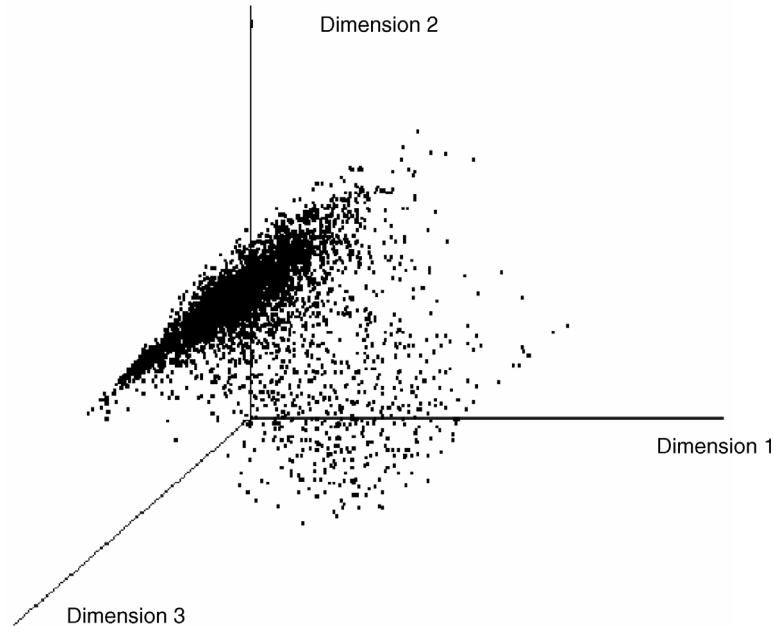

Figure 3.
The sample projected on a three dimensional spaces defined by the three discriminating axes

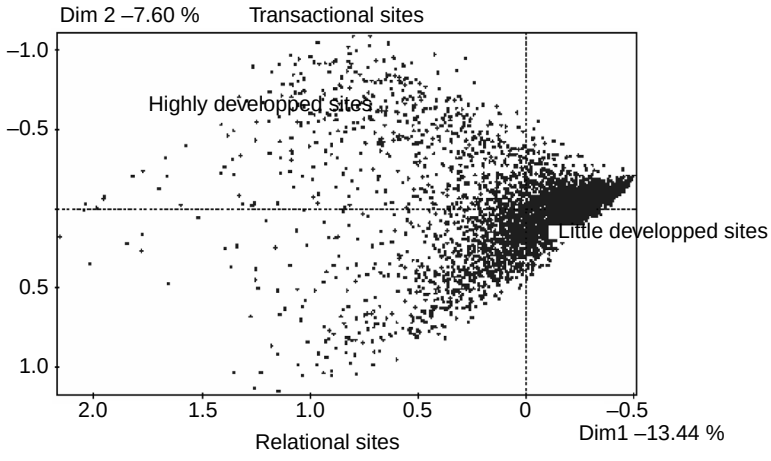

Figure 4.
Plane formed by axes 1 and 2

Figure 4 contains exclusively relational sites. Conversely, the exclusively transactional sites are situated at the top of Figure 4. In the middle of the figure, toward the left-hand side lie the sites that are both relational and transactional, and toward the right-hand side (underdeveloped sites), there are sites that are neither relational nor transactional.

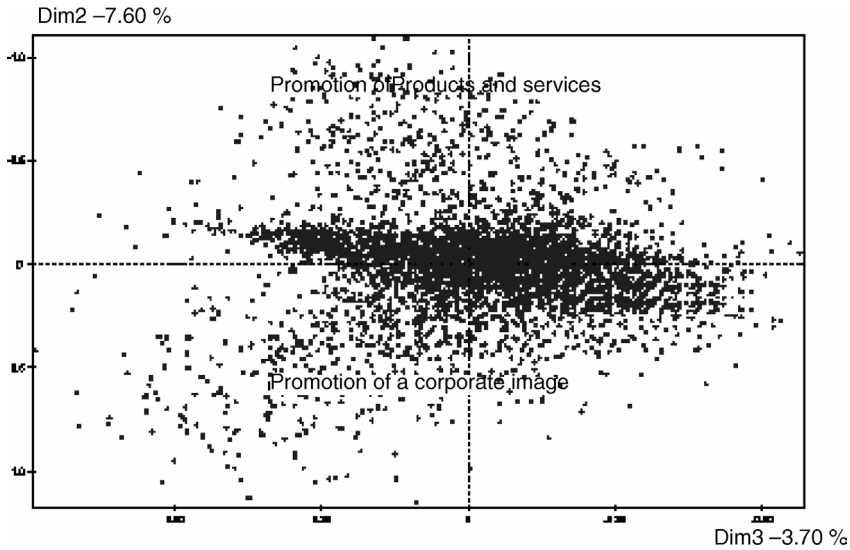

Figure 5.
Plane formed by axes 2 and 3

Figure 5 shows a view from the bottom of the cone of observations. Dimension 3 is labelled the promotional type axis because it distinguishes the type of promotion that is observable on the site. At the top of Figure 5 are the sites that mainly promote company products and services and at the bottom of the figure we find the sites that mainly promote the image and the expertise of a company.

To summarize, our first main result is the development and implementation of a method to identify web site development profiles. We discovered that companies developed relational, transactional, promotional sites of type 1 and 2, or simply informational sites. Promotional type 1 refers to the promotion of products and services and promotional type 2 refers to the promotion of the company image and expertise. This is a major finding that will be confirmed by further results and interpretations. Moreover, in applying this analysis to different samples of data, we clarified other dimensions of web site development[12].

A typology of web sites

After performing ACA, we applied a method called ascending hierarchical classification (AHC)[13], which suggested that there were five main classes of sites featuring similar development profiles. Figure 6 shows the number of sites that were assigned to each class using AHC analysis[14]. Figure 7 shows the location of the centre of gravity of each class with respect to the plane formed by dimensions 1 and 2, and Figure 8 shows the centre of gravity of each class with respect to the plane formed by dimensions 2 and 3.

Description of the classes

Interpretation of class 1 (transactional-relational). Class 1 comprises 254 sites, which corresponds to 5.7 per cent of the sample surveyed. Labelled transactional-promotional, this class consists of sites that are fully transactional, but that also featured some relational characteristics. Companies within this class sell their products through the

sites and accept online payments. Consumers are well informed of the transaction terms, including delivery terms as well as security levels related to the transactions. The well-developed functions within this class are transaction, security, respect, contract and product along with relational type functions internal relations and partners. The image and navigability functions are also substantially developed.

Interpretation of class 2 (relational). Class 2, relational, encompasses 398 sites, which corresponds to 8.9 per cent of the sample surveyed. This class is fully relational and is mainly oriented toward the development of relationships with customers, employees, partners and investors. The most highly developed functions are internal relations, investors, image and expertise.

Most of the sites in class 2 belong to companies with more than 500 employees, many of which operate in the Finance and insurance sector. Moreover, sites within this class are fully bilingual (English and French) and often provide services in other languages as well.

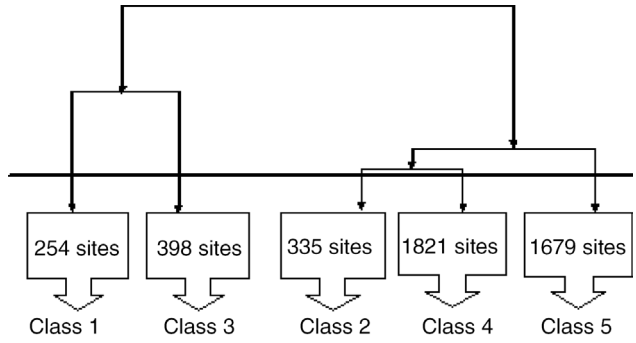

Figure 6.
An AHC of the sample surveyed in November 2002

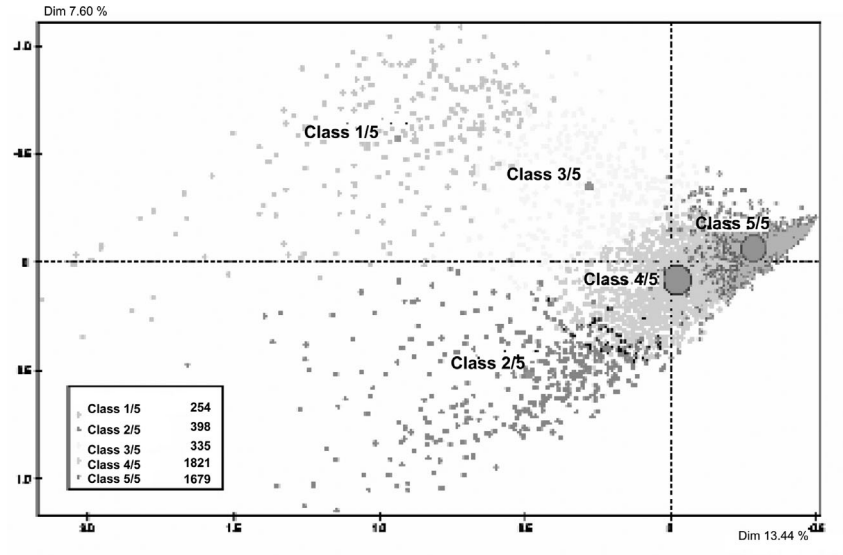

Figure 7.
Classes' centres of gravity with respect to dimensions 1 and 2

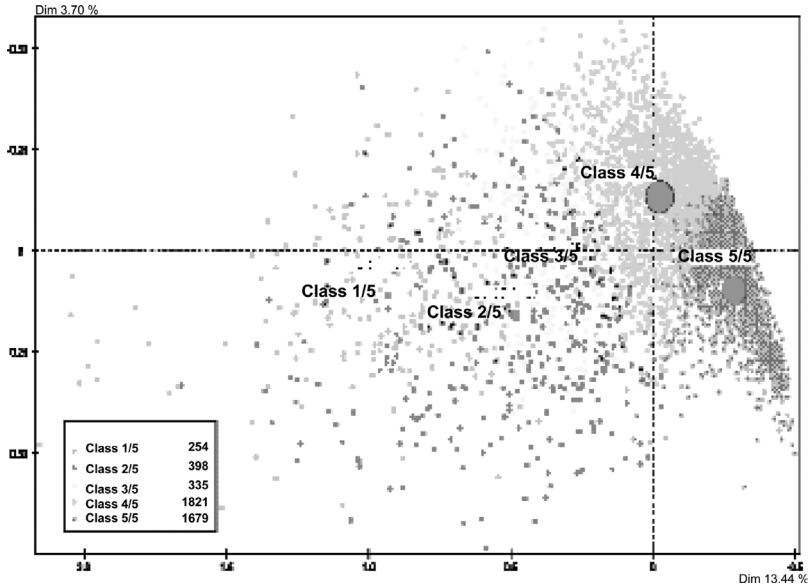

Figure 8.
Classes' centres of gravity with respect to dimensions 1 and 3

Interpretation of class 3 (promotional-transactional). Class 3, labelled promotional-transactional, comprises 335 sites, which corresponds to 7.4 per cent of the sample surveyed. This class includes a majority of companies from the retail sector. Sites within this class are mainly oriented toward marketing products and services and offer an online purchase option. The most highly developed functions are product, contract and transaction, although online payment is not always possible.

Class 4 (promotional-relational). Class 4 comprises 1,821 sites, which corresponds to 40.6 per cent of the sample surveyed. Sites within this class are developed in a promotional way aimed at marketing products, services or expertise, and also in a relational way aimed at developing preferred relations with customers in order to increase their customer base and develop customer loyalty.

The most highly developed functions are products, services, expertise and customer service. Navigability is also well developed.

Many SME (fewer than 100 employees) are found within this class. They mostly operate in the manufacturing, construction and wholesale trade sectors.

Class 5 (informational). Class 5 comprises 1,679 sites, which corresponds to 37.4 per cent of the sample surveyed. This class was labelled informational because these sites are strictly informational. Only the identification function is well-developed. Often, sites within this class resemble a virtual business card. Many are run by businesses with fewer than five employees, and many are French only when the company is located in Québec and English only for companies located in Ontario.

To summarize, the ACH analysis enabled us to define a typology of web sites, to define web sites classes according to their development profiles and to classify web sites within the five classes.

Benchmarks related to function development

We have already described how to measure web site development in terms of the presence (or absence) of web site components. However, in order to analyse the development of functions, it is important to define a description of the functions in terms of the components already measured. Therefore, given the description of functions in terms of components, as presented in Table II, we propose an approach to benchmarking function development. The identification function illustrates the approach.

The following three hypotheses are offered:

H1. A web site function can be defined in terms of components of a site.

H2. Various components related to a function may contribute to the function in different ways.

H3. Not every component related to a function needs to be present for that function to be active.

Given these hypotheses the development (D_i) of a given web site function i can be written as follows:

$$D_i = \Sigma c_{ij} p_{ij}$$

where c_{ij} is a binary variable (which takes the value of 0 when component j is present on a site and 0 if not), related to component j of the function i, and where p_{ij} is the weight related to the contribution of component j to function i.

The weights p_{ij} are equal to: 1, if component j contributes very little to function i; 2, if component j contributes slightly to function i; 3, if component j has contributes moderately to function i; 4, if component j contributes substantially to function i; 5, if component j's contribution is essential to function i.

Accordingly, based on the fact that the range of a statistical distribution $\approx 6\sigma$, we used the following scale, described in Table V, to interpret the score of a function.

Figure 9 shows the interpretation of a function's development.

The development of a site in terms of its functions could be evaluated in a similar way by summing up each function's development score.

Development (site) $= \Sigma D_i$ over all function i.

Figure 10 shows the development of the function identification for a sample of 4,487 observations. In this case, the identification function is developed at least at a normal level for 92.3 per cent of the sites surveyed and only 1.4 per cent of the sites surveyed have a less than rudimentary development of the identification function.

Function development	Score X	Interval range
Very rudimentary	$X <$ MAX/6	MAX/6
Rudimentary	MAX/6 $< X <$ MAX/3	MAX/6
Normal	MAX/3 $< X <$ MAX/3	MAX/3
Substantial	MAX/3 $< X <$ MAX/6	MAX/6
Very substantial	MAX/6 $< X$	MAX/6

Table V.
Interpretation of the value D_i describing the development of function i

Note: MAX is the highest possible score of a function. Such a score occurs when all components describing a function are present on a site

All functions were evaluated with this methodology. In addition, companies can visit http://web.hec.ca/cicma/en/services/bulletins/dev_web/bull_auto.cfm to benchmark their company web site.

Conclusion

We have presented a methodology to benchmark web site development with respect to functions or tasks that a web site can perform. The methodology was refined over three projects that spanned a three-year period. Using this methodology, we have defined a typology of web site profiles and we have established benchmarks of function development. We have illustrated the methodology with an analysis of 4,487 web sites from companies located in the provinces of Québec and Ontario, mainly SME from selected industrial sectors.

This study is based on the premise that a web site is a tool to improve business process performance. Thus, given the fact that general managers consider a web site as a tool that can improve some tasks and activities, it is possible to infer, from the results obtained, the way managers could plan web site development. Firstly, managers must decide how they would like to use the web site, that is its general purpose. For example, will the web site be intended to support the development of products and services, provide after-sales service, manage customer accounts or manage external relationships. Second, given a specific objective of the web site, managers should envision development of functions that would contribute to the targeted objective. For example, if the web site is intended as a promotional tool in the construction sector, the manager should concentrate on the development of the image and expertise functions. Third, based on the most developed sites within a class, managers would have to decide on the subset of components to be implemented within the required functions. For example, managers planning a relational web site could examine how web sites within this class have been developed by companies of a similar size and within related industrial sectors. One limitation of this study is that it does not provide insight into how components can best be organized on a site.

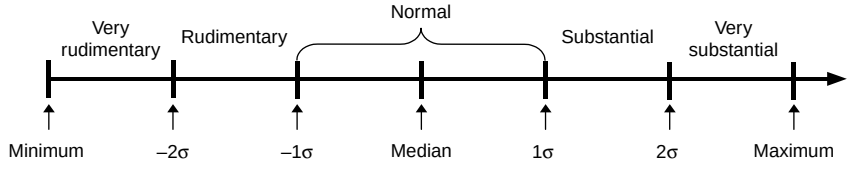

Figure 9.
Interpretation of the development of a function

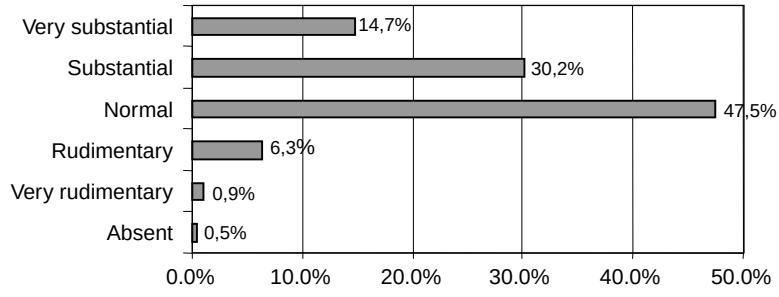

Figure 10.
Development of the identification function using the November 2002 sample

Notes

1. This paper describes the methodology and results of a third consecutive web site function benchmarking project over a three-year period. Data for this last project were collected in November 2002 and the methodology and results presented originate from the November 2002 project. Previous years' results were published in *CMA Management* (Boisvert, 2001, 2002a, b, c, 2003a, b, c; Bégin and Boisvert, 2002a, b, c, d, e; Tchokogué and Boisvert, 2002) available at: www.cma-canada.org.
2. Overall, approximately 20 experts involved in web site development participated in the panels.
3. In the November 2001 edition, we considered only 67 components defining nine functions.
4. Results of the November 2001 edition were published in *CMA Management*, Special issue on Canadian web site development, The Society of Management Accountants of Canada, November 2002 issue, p. 18-32.
5. No attemps were made to evaluate the quality of any component in terms of its programming on a site.
6. HEC Montréal is the business school affiliated with the University of Montréal (www.hec.ca).
7. In the November 2000 edition, we used the ACA with a sample of 2,725 sites described by a set of 60 binary components. In the November 2001 edition, we used the same ethod with a sample of 5,935 sites described by a set of 67 binary components, and in November 2002 edition, we used ACA with a sample of 4,487 sites described by a set of 91 binary components.
8. ACA determines axes called discriminating axes that minimize the distance between the observations and the axes according to a χ^2 metrics (Lebart *et al.*, 1997).
9. A software SPAD (www.decisia.fr) was used to perform the analysis and to generate the figures reproduced in this paper.
10. SPAD software (www.decisia.fr) was used to perform the analysis and to generate the figures reproduced in this paper.
11. The term inertia is assimilated to the one of variance (Clausen, 1998).
12. In effect, we applied the ACA to other data samples, a sample of sites from France and another one from Brazil that we do not discus in this paper.
13. AHC is so named because it separates any sample of observations into two classes in order to minimize the inertia (variance) of each class. According to Figure 7, classes 1 and 3 were initially separated from the three remaining classes. Then, class 1 was separated from class 3, and classes 2 and 4 were separated from class 5. Lastly, class 2 was separated from class 4.
14. SPAD, the same software referenced above was used to perform the ACH analysis.

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