
Facilities Management and Digital Application of Web Engineering: Implications for Business Informatics Systems

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Abstract: A challenge that is facing businesses every day is that of how to promote themselves on the still vastly growing electronic stage. A company's web presence connotes a great deal to its customers, including how professional and reliable the organisation is. Companies are usually quite successful at making their websites look the part and creating a successful corporate image for themselves through their website. There are a vast number of website designers out there who can create a fantastic and aesthetically pleasing website to promote a company's image. But that is not all there is to a successful website. When a website is to be used as a marketing tool and additional line of income things are not so simple. The website provides the gateway to products and services as well as information required by the customer. The true knack to a successful website is to promote these as effectively as possible, and ensuring repeat visits goes hand in hand with customer loyalty.

Keywords: Digital, Web Engineering, Informatics, Navigation, Web Page.

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1. Introduction

Throughout this study the aim will be to establish how this can be accomplished most effectively. This study will be an application to Access Networks, a Sage Business Partner who aims to implement a new website to achieve specific objectives.

- Bring in more business.
- Increase customer awareness of the company, its products and services.
- Develop the corporate image in the sector.

This is a good example as it is in a highly competitive technical area where the factors of effective product, service marketing and extensive customer information resources are paramount to winning over customers.

This study's Literature Review looks at what makes a web page popular, focusing on the direct effects on the end user. It does this through recognition of established key quality factors that have been seen to promote good web site design. The Literature Review will then go through how to apply these key quality factors using a recognised methodology.

Using all of the findings in the Literature Review, a framework of effective website design will be apparent. This will then be applied to the Access Networks website as a test of how effective this framework truly is.

The Research Methodology will aim to establish two things. The first is to find out the information necessary to apply the framework to the Access Networks website. The second will be to look at whether or not the framework was in fact successful in creating an effective website.

This study will then analyse the research results to see if the framework was in fact successful, and if so, answer the question of 'what makes effective business website design', in order for it to be applied to future websites.

2. Literature Review

E-commerce is being implemented and used on a global scale. The use of the Internet as a means of communicating Information, as well as the ability to place transactions online is dramatically increasing. Cox and Dale (2002).

People have come to realise that the internet is a quick and easy means of finding product information as well as actually being able to purchase the product from the comfort of their own home. Businesses have taken advantage of this ease and along with the benefits of a faster sales cycle and cheaper running costs, have realised that online shops produce an effective revenue stream.

With web search engines such as Google it has become even easier for a customer to discover a number of different online shops promoting the same product or service and as such it has become easier for customers to switch from competitor to competitor. "The element of competition has taken a new diversion. "Cox and Dale (2002)

This means that in order for a web page to be effective, it must give the customer what it wants and meet or exceed their expectations; otherwise they will be lost to a rival web site.

Effectiveness of a website is determined by whether it meets its objective. The main objective being in the example of the Access Networks web page is to bring in more business, with other objectives being to increase customer awareness of the company, its products and services and to develop the corporate image in the sector.

3. Web Page Popularity

Dhokalia et al. (1998) did a study on the popularity of web pages. They looked at a number of determinants of web page effectiveness and formulated a set of hypothesis, which they aimed to prove by means of assessing their effect on web page hits. Some of their hypothesis include; whether greater content would make a site more popular, whether monthly or quarterly changes to the site made it more popular. They also considered if the more links to and from other web sites made it more popular, or the use of Java, animations or audio files made the site more popular.

These were interesting hypothesis but their means of assessing the determinants effectiveness were not accurate. Dhokalia et al. chose to use the daily hit rate as the determinant. They chose a sample of about 300 random web pages out of which they got results back from 135. They noted that the variation between the number of hit rates from the different sites in their sample was considerable with a standard deviation of 69,468.

Although Dhokalia et al. did attempt to make their results more ‘tractable’ by trying to group their findings in ranges, the hit rates alone where subject to too many overlooked variables, such as; customer spending habits, promotions the sites were offering at the time, any advertising campaigns the companies may have launched, publicity of the companies— i.e. any news items at the time. These could all affect the hit rates greatly.

The sample used was also relatively small when considering the amount of web pages out there and given that it was meant to be representative of all types of organisations from small businesses to fortune 500 corporations.

Consequently, any results they would have gathered may not accurately resolve whether their determinants/hypothesis were true or not, and little merit can be placed in their determinants of web page popularity.

Web page hits could have been an effective means of determining their hypothesis. If they had simply chosen to limit there sample to a specific type or size of company the reliability of their results could be increased considerably as this would effectively cut out a fair amount of variables effecting the end result. Substantiating their findings with other forms of research could have also helped to fortify their argument.

4. Establishing Design Criteria

In order to understand what makes an effective web site one would first have to determine criteria that the web site should conform to.

There have been many studies on the subject of web site effectiveness, Kim et al. (2003). An abundance of criteria have been established as a means of evaluating web site effectiveness. In a recent study, Kim et al. listed these from 22 different research papers ranging from 1996 to 2001.

They helped to establish a coherent set of criteria that can be used to evaluate existing web sites. This study acknowledged criteria from a variety of different research papers that were focused on the effectiveness of websites and as such one can expect an all round view.

They established three main categories that should be considered when developing a website: Task, Performance and Development.

- Task related factors include presentation quality, content and function adequacy, navigability.
- Performance related factors include response time, transaction throughput, reliability and robustness.
- Development related factors include code complexity, code reliability, flexibility, portability and modifiability.

Although all these factors can be seen as important, in light of the objectives of the Access Networks web site, the factors that this study will focus on those that directly affect the end user, and their perception of the web site.

This includes items based mainly on Task related factors as well as some Performance factors. Development factors are important, but would not directly affect the end user in the same way. (A website could have been developed in two completely different ways but still have the same end result for example)

As such this study will use the following categories when considering quality factor criterion: Appearance, Content, Navigation and Performance.

As stated earlier Kim et al 's study reviewed a number of websites and so a lot of useful information was gathered from a wealth of sources. An extract of their findings can be found in the appendix of this study.

For the purpose of this study the following table has been constructed. The criteria established by Kim et al is in the left hand column and an explanation of each of these has been supplied in the right hand column.

The following table shows the criteria highlighted as well as questions these criteria are supposed to provoke when designing an effective web site:

Content Criteria	
Currency	How recent is the content / information?
Authority	Who stated/wrote the information? Are they a recognised body?
Uniqueness	Is the content / information readily available anywhere else?
Accuracy	Is the content / information correct and reliable?
Coverage	Is all of the expected content / information there?
Objectivity	Is the content / information impartial or subject to bias?
Appropriateness	Is the information suitable for the type of web page?
Entertainment Value	Is the content exciting, amusing or otherwise pleasing?
Appearance Criteria	
Graphics	Consider how many, what type, size and style of pictures
Use of Colour	How can you attract the customer with the right colours?
Design	What type of design would be most appealing?
Video/Sounds	Should video / sound be used? If so what kind?
Impression	What type of impression are we after as a result of the design?
Navigation Criteria	
Navigation Type	Use navigation bars, hyperlinks, image maps, drop downs?
Usability	How easy is it to perform the website function?
Structure	How should the website be structured?
Efficiency	What promotes navigational efficiency?
Performance Criteria	
Speed / Load Time	How can we promote high speeds and quick load times?
Accessibility	How are accessibility problems avoided? – broken links
Reliability	What would make the web site reliable? – does not crash
Robustness	What does it take to make the web site resistant to abuse?

Kim et al went on to evaluate a number of websites against their criteria. Their findings indicate there have been many evaluation categories defined but little evidence displayed of 'real-situation applications' meaning that no study of directly applying their findings of successful criteria in real life.

These criteria have proved to be a good starting point for this study and furthermore this study can be seen to address a real life application, something seen to be lacking in past studies. From here this study can go on to answer some of the questions posed in order to establish key quality factors that lead to website effectiveness.

5. Key Quality Factors

Cox and Dale (2002) defined the main objective of the design was to make sure it was meeting customers needs. They went on to explain that once the web site function is clear, you can then assess the type of customer that will be attracted and therefore, can judge the correct content, graphics, effects and other matter to be added in order to increase value.

The Access Networks web site function is already defined, and so are its objectives.

The first step in respect to the framework will therefore be to establish what type of customer it will be aimed at.

Once Access Networks target customers have been identified - recognising and understanding their expectations is key to producing a web site that will not only attract them initially, but also sustain customer loyalty and repeat visits.

Below is a short list of the key quality factors established in the various research papers, and grouped by the categories already outlined in this study:

5.1. Content

Everything that the customer would want to know about the products or services should be available. If it is there should be no reason for them to look elsewhere. Quality of content also determines customer satisfaction:

- Clear, as to what its function is - information only or transactional.
- Legal Requirements. Place brick and mortar address on the site - for formal complaints.
- Current/ Up to Date. Providing the last updated date on the page gives customers assurance of this.
- Reliable, seen to be from a trusted source.
- Informative, actually provide sufficient relevant and useful information.

5.2. Appearance

Provides the first impression, the more attractive the better as this will make it more appealing for customers to return:

- Design, should be consistent to promote familiarity and ease of use.
- Graphics, to be relevant, clear, not too large. Suitable for use as links.
- Colour, In line with what the customer would expect – corporate image.
- Animations should not distract, need to download plugins may frustrate users.

5.3. Navigation

This influences ease of use and must not be overlooked:

- Links, minimum number to find information or products on the site.
- Structure, clearly and logically organised makes for easier navigation.
- Procedure, should be similar for related items – familiarity avoids confusion.
- Navigation Bar, should be in the same place on each page with general main links.
- Home, a link for the home page should be on every page – perhaps the logo.
- Search, adequate search facilities are a must - e.g. key word searches.

5.4. Performance

Performance factors are important in each of the above sections:

- Speed, as fast as possible.
- Links, no broken links should be on the site - loses customer trust.
- Reliable and Robust, must not break down and must not allow ‘clumsy’ customers to break it - even if they are not using it properly.

These are all generic factors which should be considered, but may need to be applied to each web site differently. As part of this study's framework these key quality factors will need to be applied to the Access Networks web site in such a way that promotes end user satisfaction.

Creative Good (2000) established that in order to achieve customer loyalty and repeat visits, the web site must satisfy customers needs - “common ground between the site's goals and the customer goals; this reveals the ideal customer experience.”

A real emphasis has been based on customer needs and expectations. Webb and Webb (2004) also identified that consumer's expectations and perceptions should serve as a basis for creating and improving B2C web sites.

It is apparent that customers' needs should be considered when designing a web page, but how easy is it to apply these to the actual design?

6. The User Based Design Approach

Abels et al. (1997) acknowledged the importance of user-based web site design in their two part research paper. The first part defined a set of design criteria, based on what the

consumer wanted rather than the web designer's point of view. The second part of their paper went on to produce a user-based methodology of producing a web site based on the criteria established. They recognised that 'software engineers had begun to work more closely with researchers in computer human interaction to enhance identifying and defining user requirements'. (Johnson and Jones, 1997)

The first step was to identify the criteria that users consider in using a web site. This includes characteristics that affect use as well as whether the site is meeting their information needs. They did this by means of a focus group which identified the positive and negative features of web sites.

They categorised these features in to six main groups, arranged in order of rank/importance based on their feedback from the focus group, for example:

Use - Ease of use, ease of navigation.

Content - Usefulness, currency, concise and non repetitive.

Structure - Well organised, straightforward, innovative presentation.

Linkage - Linkage to sites with relevant information.

Special Features - Search capability.

Appearance – Visually attractive.

The candidates chosen for the focus group were esteemed professionals in the field. This included people teaching masters and doctorate business degrees in Baltimore and Washington USA.

Initially they all entered their data in the form of ideas rankings and ratings. This was then subject to scrutiny by the group in order to clarify the data and remove duplicates. They then went on to look at a number of factors affecting their preference of the different web pages.

Through the form of a discussion they analysed their views and managed to rank different areas in terms of importance.

They were evaluating web sites that sourced scholarly and professional literature so some of the criteria they established may not be applicable directly to the Access Networks web site however their research brought up some very interesting issues and emphasised that the user based approach counts. The very nature of this exercise proved that it is in fact the users that are able to determine if a web site is effective or not.

By establishing what the end user truly wants, the web designer is in a much better position to create a web page that will meet their expectations.

Abels et al. can be seen to have produced some very thorough research in to the topic of user based criteria for web pages which holds merit, and can be applied to this studies own example.

Ease of use was ranked highest in their findings closely followed by content. Appearance was mentioned many times and a popular subject raised but when it came to ranking it was considered not so important. If a web page looks fantastic but does not have what you are looking for it is useless to you.

This suggests that content is the fundamental consumer need, with ease of access to that information what makes one web site more effective than another.

The second step of the framework will therefore be to establish the right type of content based of course on what the consumer is after.

7. Conclusions

From the start, this study acknowledged that businesses are facing the challenge of how to promote themselves on the electronic stage, namely the internet. In lieu of this, the main aim of this study was to establish what makes effective business web site design.

In order to further acknowledge the intricacies of this topic, as well as to answer questions lacking in similar studies conducted to date, a real life application was chosen, namely the Access Networks web site, and the answer to the main question could be seen to have been applied to it.

It was noted that the effectiveness of the web site was to be examined in tandem with its ability to meet the business objectives, as achieving these is fundamentally its purpose. It is further noted that the web sites design is of course paramount to its ability to meet these objectives.

As such, many relevant research papers were reviewed in order to establish a framework which could be used to produce the effective business website design, and therefore be seen to answer the question of what makes effective business web site design.

Key quality factors were established and the key areas of Content, Appearance, Navigation and Performance were identified as elements directly affecting end user satisfaction. End user satisfaction and fulfilment was established as paramount to a business web site's success as it was through this that a company experienced customer loyalty and repeat visits, ultimately leading to business objective fulfilment.

The user based design approach was applied in response to this and the various key elements of Content, Navigation, Appearance and Performance were explored in detail, in order to identify how these could be implemented in to a real life web site application. The customer, content and task ranking method was the practical means by which this was effectively accomplished and a usable model was illustrated to encompass the criteria identified.

This lead on to the application of the entire framework established, by means of the research conducted in part one. This research could be seen to have been very effective as it lead to the successful design of the Access Networks website.

Once this website was constructed according to the said framework, all that was left to do was evaluate its performance. If it was seen to be effective in its function and ultimately in achieving the business objectives then the answer to the question of what makes effective business web site design, could be seen to have been established as the framework itself.

As already established, the research gathered in part 2 of this study supports the fact that the framework was in fact successful in producing a successful website.

A large amount of customers agreed that the information they were looking for was 'easy' to 'very easy' to find. They also agreed that the website allowed for the various tasks involved were 'easy' to 'very easy' to perform.

These factors lead to extremely high customer satisfaction. Customers thought that the first impression of the website was of high quality as well as the general

appearance. They also rated Navigation extremely high as well as performance. The website received 4.9 out of 5 in its entirety, an exceptional result.

The website was also assessed on whether it was meeting its business objectives through a number of different factors. 80% of customers were made aware of additional Sage products. 95% were made aware of additional services and 90% could see how the entire Sage solution could be applied to their business. The main business objectives of increasing customer awareness of the company's products and services could definitely be seen to be achieved.

85% of customers were interested in finding out more about the products and services for their company, and 85% of customers were influenced to buy products/services from Access Networks, showing high fulfilment of yet another business objective that being to bring in more business for Access Networks.

The general appearance and first impression of the company were rated extremely high and 100% of customers liked the tools available on the website, 95% would use the website again and 95% would recommend the website over other website. This significantly enhances the corporate image in the sector, meeting yet another business objective. This will also lead to customer loyalty and potentially repeat visits to the website, ultimately leading to increased profitability for Access Networks.

Some limitations were acknowledged during this study. One aspect was that no participants in part 2 of the research opted to search for any 'other' content or perform any 'other' tasks. One reason could be that they found it easier to stick to the list, or it could be the fact that they truly could not think of any at the time. However when they were asked whether they had found all of the information they were after, 10% said no, and website content received the lower score of 4.3 / 5 compared to the overall website score of 4.9 / 5, suggesting that the content needs to be slightly improved to come up to the standard of the rest of the web site.

Seeing as content has been established as one of the most important factors then further research specifically on website content will be required in the case of the Access Networks web site. More detail may have to be considered and further study could be performed. A comparative / discussion based study may be appropriate such as a focus group for example. This would allow several end users / customers to talk about ideas on content which could be more productive than asking just individuals.

Another limitation could be seen to be the relatively small sample size used for the research in part 2. The sample size could be made bigger, however it was hard enough finding the 20 customers that did participate due to the amount of time they had to devote. The exercise itself was however very thorough and so the quality of information could be seen to outweigh the potential quantity from a different sample size.

One way to improve on this would be to send the research questionnaire used in part 2 of the study out to a larger population. This would only include the general web site experience and Yes or No questions as the other parts of the questionnaire would not be effective. The results from this larger population could then be used to corroborate the results received from the smaller sample. Time required for this to be accomplished was beyond the scope of this initial study however. This could also be the basis of further research.

Another limitation was the fact that the informal interviews with the Access Networks staff were not conducted due to time constraints, mainly due to the fact that the

staff were experiencing a very busy period and so were unable to devote the time necessary to give accurate and relevant feedback.

This is unfortunate as the interviews would have given some good insight in to the web sites capability of not only a shop front but also if it could be used by staff when talking to customers on the phone as a visual aid. This can be the focus of future research however and this study is not directly affected by this.

Despite these limitations this study could be seen to be successful in answering the question of what makes effective business web site design. The web design framework established in this study was applied to a real life business web site and this web site has been found to be very successful. It is therefore the conclusion of this study that the answer to what makes effective website design can be found in the framework established throughout this entire study.

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