

INVESTIGATING GOOD USABILITY CONSISTENCY WITHIN AND ACROSS THE  
SOUTH AFRICAN SUPER 14 RUGBY FRANCHISE WEB SITES

by

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## **Abstract**

This study investigates the usability of the South African Super 14 Rugby franchise web sites. Web site usability is a measure of a web site user's experience when visiting a web site. A web site user's experience will determine how well a web site's goals are achieved. The relevant web site goals are, having as many visitors as possible, both unique visitors and repeat visitors, and ensuring that those visitors stay on the web site for as long as possible. This study uses data generation method triangulation to enhance the validity of the findings. The data generation methods are an e-mail questionnaire survey and an expert group consensus method called the Delphi Method. This study shows that within each web site and across all five web sites, there is poor usability consistency. Management guidelines and recommendations for improvements to these web sites are presented, so that the web site goals can be achieved.

**Keywords** (in alphabetical order):

*Comparative web site questionnaire; data generation method triangulation; Delphi Method; e-mail survey; good usability consistency; South African Super 14 Rugby; sport web site evaluation; usability expert opinion; web site analysis; web site improvement.*

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## **Chapter 1: Introduction**

### **1.1 Introduction to the study**

This study is focused at the intersection of the sport of Rugby and the Internet in South Africa. The Internet is important because the Internet market in South Africa is the largest Internet market in sub-Saharan Africa (Goldstuck, n.d.). Rugby is a contact ball sport played by thirty payers on a field, and it is important because it is said to define the character of South Africa in the same way that soccer defines Brazil (Hall, 2007).

Specifically, this study addresses the usability of the South African Super 14 Rugby franchise web sites. The Super 14 is the largest Rugby club competition in the southern hemisphere. The focus of this study is the web sites of the South African Rugby teams that take part in the Super 14 competition, being all the major Rugby clubs in South Africa. The South African Super 14 Rugby clubs are incorporated as franchises, namely the Bulls (<http://www.thebulls.co.za/>), the Cheetahs (<http://www.vodacomcheetahs.co.za/>), the Lions (<http://www.lionsrugby.co.za/>), the Sharks (<http://www.sharksrugby.co.za/>), and the Stormers (<http://www.iamastormer.com/>).

The widespread use of the Internet and large size of the South African Super 14 Rugby franchise fan base attest to the importance of these web sites, and indeed other major sport web sites. The researcher's informal investigations have indicated that users of the South African Super 14 Rugby franchise web sites, including the researcher, have had poor experiences on these web sites. Poor user experiences translate into unused web sites. Web site usability is a measure of a users experience on a web site. Therefore it is critical for their existence that these web sites exhibit good usability; this is the rationale and motivation for this research.

The researcher's informal investigations depict the South African Super 14 Rugby franchise web sites' as having some characteristics that show good usability, but not all characteristics within each web site show good usability. In addition, those characteristics that show good usability in one website are not the characteristics that show good usability in the other web sites

The literature reviewed in this study was obtained from Academic and other sources as indicated by the literature references. Relevant keywords are used in three separate search engines, being the Google Scholar search engine, the Association for Computing Machinery (ACM) digital library search engine, and the Association for Information Systems elibrary search engine. The University of South Africa (UNISA) subject databases were also searched.

The sections of Chapter One that follow complete the introduction to the study. This chapter provides a background to the problem statement and presents the research problem statement. The chapter gives the research objectives and the layout of the research. The chapter closes with the chapter conclusion.

## 1.2 Background to the problem statement

The researcher has had many informal discussions with work colleagues, study colleagues, and acquaintances, who are users of these web sites. The general feedback about these web sites are that the users are frustrated with these web sites. There seems to be a great mismatch between what the users expect from these web sites and what these web sites actually provide. The researcher has experienced the same frustration with these web sites. The result is that these users keep their use of these web sites to a minimum or have just stopped accessing these web sites entirely. There are many substitute web sites that provide alternatives to these web sites, and some of these users now use these substitute web sites only.

## 1.3 The problem statement

Usability is a property of web sites that relates to ease of use. Web sites that show poor usability are difficult to use. The problem with web sites that are difficult to use is that the users will leave these web sites, because leaving a web site is a user's first line of defence when difficulties are encountered (Jakob Nielsen's Alertbox, August 25, 2003). Some examples of difficulties include web sites that ask users to download software before they can enter the web site; web sites that force users to subscribe or register on the home page before continuing; and web sites that are difficult to read.

Web site usability problems are presented in literature, and emphasise the need to focus on web site usability. Dix, Finlay, Abowd, and Beale (2004: 762-763) contend that there will always be some users who have difficulties with any given web site. This is a reasonable contention, because Internet users display great diversity, such as different backgrounds, cultures, interests, viewpoints, experiences, and ages (Dix *et al.*, 2004: 366). It is difficult for web site designers to design web sites to accommodate such diversity. Lazar, Bessiere, Ceaparu, Robinson and Shneiderman (2003) also present the importance of good usability in web sites. Lazar *et al.* (2003) continue to state that there are many published studies of web site usage which reveal that users do experience difficulties on web sites. These difficulties translate into high levels of user frustration and low rates of user success in completing the tasks that they set out to do (Lazar *et al.*, 2003).

The context of this research is the Internet and Rugby; both are significant segments of South African culture. The Internet is significant because Information and Communications Technology (ICT) pervades almost every aspect of daily life and work in South Africa (Wesson & Van Greunen, 2003). The Internet is becoming a part of South African life more rapidly than anywhere else in the world (Hugo *cited in* Wesson & Van Greunen, 2003). Rugby is also significant, because it identifies South Africa in the outside world; it is a major national winter sport (Afolayan, 2004).

As mentioned in the background to the problem statement, Section 1.2, the researcher performed informal investigations on the South African Super 14 Rugby franchise web sites before embarking on this research. These informal investigations showed usability problems on these web sites. It appeared that the South African Super 14 Rugby franchise web sites have some characteristics that show good usability, but not all characteristics within each web site show good usability. In addition, those characteristics that show good

usability in one website are not the characteristics that show good usability in the other web sites

The problem statement then refers to the five South African Super 14 Rugby franchise web sites that do not have good usability consistency, within each web site, and across all five web sites. The problem statement also refers to each website only having some aspects that show good usability, but not all aspects within each web site show good usability. Further, the problem statement refers to those aspects that show good usability in one website not being the same aspects that show good usability in the other web sites.

This research is important for the South African Super 14 Rugby franchises, because this research will provide usability improvement guidelines and recommendations for their web sites. Only when the web sites have consistent, good usability, will the following two web site goals be well supported:

- a) Having as many visitors as possible, both unique visitors and repeat visitors. Sterne (2002: 179) supports this by stating that repeat visitors will end up translating into more revenue; and
- b) Keeping a visitor on the web site for as long as possible. It is important for visitors to stay for as long as possible so that the visitors can view all that the web site has to offer, in order to research, interact, and shop on that web site. In other words, the longer visitors stay, the more likely it is that they will act upon the information on the web site.

This research is also important for all the users of these web sites. Usability improvements will make these web sites easier to use, translating into better experiences and less frustration for the users.

## **1.4 Research objectives**

The primary objective of this research is to measure the usability of the five South African Super 14 Rugby franchise web sites, in order to address the research problem statement. The secondary objective of this research is to improve the usability of the five South African Super 14 Rugby franchise web sites, by providing the web site designers with new insight about how their current web site designs affect the usability of their web sites.

Both objectives of this research are achieved by collecting valid data for evidence about: the overall usability scores of each web site; the major usability category scores of each web site; and the most important usability factors to focus on in order to achieve good and consistent usability. This usability evidence is used to measure the usability of the five South African Super 14 Rugby franchise web sites, and to address the research problem statement. This usability evidence is also used to improve the usability of the five South African Super 14 Rugby franchise web sites, by producing usability improvement, management guidelines and recommendations for the web sites.

## **1.5 Layout of the research**

This research begins with an introduction chapter that provides the background and context of the research. The second chapter is the detailed literature review that sets this research in the context of prior, related research. Chapter Three presents the research methodologies selected for achieving the research objectives and for addressing the research problem. Chapter Four is the presentation and discussion of the data gathered, using appropriate statistical analyses. Chapter Five completes the research by presenting the research conclusions and showing how the research objectives and research problem statement have been addressed.

## **1.6 Conclusions**

Chapter One is the introduction to the research and gives the research setting. Chapter One also declares the problem statement and the supporting reasoning which resulted in the problem statement. The research objectives are provided which indicate the aims of the research. A layout of the entire paper is given to show the structure of the research. Lastly, there is a chapter conclusion to summarise and conclude the introduction.

In conclusion, the extensive use of the Internet and size of the South African Super 14 Rugby franchise fan base indicate the importance of good usability consistency within and across all five South African Super 14 Rugby franchise web sites. The assessment of the web sites' usability from a user and expert perspective will provide management guidelines and recommendations for usability improvements.

This research has value for the South African Super 14 Rugby franchises. This research also has value for all the users of these web sites. Achieving good usability consistency will benefit both the South African Super 14 Rugby franchises and the users of these web sites. Achieving good usability consistency will allow the South African Super 14 Rugby franchises to reach their web site goals of having as many visitors as possible, both unique visitors and repeat visitors; and keeping a visitor on a web site for as long as possible. Users of these web sites will find these web sites easier to use, be less frustrated, and have better experiences on these web sites.

The next chapter is Chapter Two; Chapter Two provides a detailed literature review that sets this research in the context of prior, related research. Chapter Two presents relevant themes from prior, related research, and shows how this research addresses a specific research problem not previously dealt with. Chapter Two also provides the key concepts for this research.

## **Chapter 2: Review of the Literature**

### **2.1 Introduction to the literature review**

Chapter Two follows the Chapter One introduction, which gave a setting to the research. In addition, the research problem statement and the research objectives were presented in Chapter One. Chapter Two is the literature review, and it shows prior, related research. Chapter Two also provides the key concepts for this research, and thereafter the research questions are provided, which rely on the context of the literature reviewed.

The research problem domain is web site usability, and specifically the usability of the South African Super 14 Rugby franchise web sites. The problem statement refers to the five South African Super 14 Rugby franchise web sites that do not have good usability consistency, within each web site, and across all five web sites. The problem statement also refers to each website only having some aspects that show good usability, but not all aspects within each web site show good usability. Further, the problem statement refers to those aspects that show good usability in one website not being the same aspects that show good usability in the other web sites. The literature review provides the basis for addressing the research problem.

The literature reviewed in this chapter was obtained from Academic and other sources as indicated by the literature references. The same twelve keywords were used in three separate search engines, being the Google Scholar search engine, the Association for Computing Machinery (ACM) digital library search engine, and the Association for Information Systems eLibrary search engine. The keywords that were used are, web usability, web use, web interaction, web HCI (Human Computer Interaction), web testing, web questionnaire, web review, web assessment, web engineering, web evaluation, web development, and web problem. In all the searches, secondary searches were done with comparable words, for example usability testing for web testing; and web design for web development. The University of South Africa (UNISA) subject databases were also searched.

The sections of Chapter Two that follow present the themes emerging from the literature. These themes or concepts are produced in a literature matrix which maps the individual literature papers to each theme or concept, shown in Appendix A (Oates, 2006: 87; Webster & Watson, 2002). These themes are universal web site usability; general web site usability design issues; web site usability design guidelines, principles, and heuristics; user analysis for web site usability; general web site usability evaluation or testing issues; web site usability evaluation or testing methods; qualitative web site evaluation methods; quantitative web site evaluation methods; questionnaires to evaluate web site usability; web site usability evaluation criteria, factors or attributes; usability problems or errors on web sites; and the importance of good usability on web sites. After the literature themes, the research questions are put forward. Thereafter, conclusions are drawn from the literature review.

## 2.2 Universal web site usability

Universal usability is defined as an approach to design which focuses on ensuring that all people are able to use the Internet, according to Shneiderman (*cited* in Horton, 2006). Universal usability has an ethical argument to increase participation in Internet communication across the globe, and to reduce the digital divide. The term digital divide is used to describe the alleged growing gap between those who have access to and the skills to use the Internet and those who, for socio-economic or geographical reasons, have limited or no access. One part of universal usability that is becoming very important is the provision of native language web sites in all markets or multi-language web sites, although this may be very difficult in terms of technology or economics (Kralisch & Koeppen, 2005).

The difficulties in designing for universal web site usability include designing for people who speak different languages or come from different cultural backgrounds and who understand images differently (Fitzgerald, 2004). Indeed, the design task is difficult enough when the users are known and experienced frequent users, but designing for a broad audience of unskilled users is a far greater challenge (Shneiderman *cited* in Fisher, Bentley, Craig & Turner, 2004).

One solution that will allow web technology to support universal usability is adaptive interfaces, which can meet the needs of diverse users that access pages in multiple contexts (Horton, 2006). It is emphasised that designing for universal usability must be done at the lowest design level and designed for from the outset (Horton, 2006).

Universal access is also part of universal usability. The object-oriented interface (OAI) model has, as one of its five main elements, support for universal access, as defined by Shneiderman (*cited* in Mahfouz, 2000). The OAI model supports two graphical components in web page design, being metaphors and handles for interface actions, and it suggests that two versions of web sites be built. One version will be graphical only and the other text only. This will accommodate users of differing computers and bandwidth, and enable universal access especially in developing countries which may lack the sufficient telecommunications infrastructure (Mahfouz, 2000).

Web technology and web design models can support universal usability; however, there are still many web sites that do not have universal usability. The lack of universal usability in public, government web sites is especially problematic because these web sites provide a service to the general public which includes skilled users, unskilled users, and disabled users. In the study done by Chan and Swatman (2002), they found that none of the government funded institution web sites accommodated people with disabilities. The lack of universal usability on these web sites was evident even though many governments provide guidelines for developing web sites for people with disabilities. There is an implication that government funded web sites should be most aware of providing for people with disabilities. If this is not the case, then most other, non-government funded web sites will also not provide for people with disabilities. The solution again involves changes to the web site design process, so that universal usability is designed for from the beginning of the design process (Chan & Swatman, 2002).

The provision for universal usability is important for Internet web sites because it is regarded as an ethical consideration, it allows services to be provided to all users, and it

can increase profits from new markets. Although it is difficult to enable universal usability on a web site, technology can support universal usability. The prerequisite for universal usability on web sites is ensuring that the design process includes universal usability as a requirement from the beginning.

## **2.3 General web site usability design issues**

### **2.3.1 The importance of web site design for usability**

Designing web sites that have good usability is important, because users are one click away from visiting another web site. The design process for a web site will determine how usable a web site is, and whether visitors are likely to return to the site, according to Klein (*cited in Agarwal & Venkatesh, 2002*) and Nielsen (*cited in Tan & Lee, 2005*). Web designers must include usability as part of the web site design (Zibell, 2000). The web site design process is critical to the success of any web site (Fisher *et al.*, 2004).

The Internet is increasingly being used as a marketing and e-commerce tool, and poor web site design will result in reduced revenue for business owners (Chan & Swatman, 2002). The design quality of web sites for firms that do business exclusively in the Internet market will impact directly on the firm's success (Song & Zahedi, 2001). The design quality of web sites for electronic commerce and digital government will also impact directly on the success of these web sites (Yen, Hu & Wang, 2005). Web site design can be thought of as a sales representative in a traditional store, a good design similar to a good sales representative will lead to customers having good experiences of the business (Lam & Lee, 1999).

A web site will meet its objectives only if the web site designer has an integrated understanding of technical design, usability and the intended audience, according to Geissler (*cited in Bentley, Craig, Fisher & Turner, 2005*). Design tool mastery alone will result in an ineffective web site (Calongne, 2001). Designing for usability is imperative to facilitate the web site users in accomplishing their goals with ease and satisfaction, as indicated by Abdelmessih (*cited in Tan & Lee, 2005*). Further, in order to effectively design a web site with good usability, it is first necessary to understand the users' expectations and their feelings about the web site (Tan & Lee, 2005).

Understanding the users' needs and expectations, or requirements, is essential for usability in the design process, for example, usability design for marketing web sites must be adaptable to the specific sales phase. In the pre-sales phase of marketing activities, it is necessary for web site designers to create web sites that attract customers on-line, with design criteria such as information quality, learning capability, and playfulness. In the on-line sales phase, it is necessary that web site designers create web sites that obtain and uphold customer trustfulness, with design criteria such as system quality and system use. Finally, in the after-sales phase, it is necessary that web designers create web sites that guarantee customer satisfaction, with design criteria such as providing service quality. This example illustrates how important it is to understand the users' needs and expectations, or requirements, so that usability can be included in the design of the web site, allowing the web site to achieve its objectives (Liu & Arnett, 1998).



A good design process that includes usability has the benefit of sufficiently substituting real life experiences in traditional market places, such as substituting for the user not being physically present in a store and interacting with sales people. Usability design ensures that users are aided in their search for products and services on a web site. Usability design also ensures that web sites transfer the responsibility of successful interaction from the user to the web site; a web site that reduces the user interaction effort will give users a better experience (Mahfouz, 2000).

It has been found that small business web sites ignore usability in web site design and do not assess user needs (Fisher, Craig & Bentley, 2002). When usability is not included in the design of a web site, users will experience a high level of frustration; examples of poor usability design include poor interface design and information design (Fisher *et al.*, 2002).

The success of a web site and its usability is connected. It is crucial to the success of any web site to ensure that the design process has web site usability as one of its focal points. Assessing the users of a web site; their needs, expectations, and characteristics will provide the appropriate usability requirement to be included, upfront, in the design process.

### **2.3.2 User centred design for usability**

An approach to web site usability design is called user centred design. User centred design focuses on the users of a web site during the design process. The objective of user centred design is to keep the interaction simple, ensuring that the user is physically, mentally, and emotionally comfortable while using the web site. In addition, user centred design has design usability goals that are objective, measurable, and operational; any intangible user centred design perspectives cannot ensure usability (Badre, 2002).

Throughout the web development process, user centred design can be measured by evaluating the evolving design against user requirements. User centred design must also take account of established guidelines for web writing style, navigation and page design (Bevan, 2001). User centred design warns against designing web sites where customers' needs are not kept in mind, and only the designers ideas are included in the design. The requirements of the web site target audience must be given top priority, not the requirements of top executives (Nielsen, 1998). User centred design is both design task oriented and user oriented; the effectiveness of a web site and in particular how it delivers information, depends on the designer's synthesis of both orientations (Fisher *et al.*, 2004). In addition, although developing a simple web site may be easy for an expert designer, it appears that some expert designers do not care about how the users will interact with a web site, and the resulting web sites show poor usability. Such poor usability can be seen in web sites that are designed to be fancy, flashy, and colourful, without taking care of usability; by including security, privacy, accessibility, scalability, compatibility, maintainability, reliability, operability, morality, cultural aspects, and legal aspects (Santosa, 2003).

User centred design, for web site success, aims to make web sites trivially easy to use, focusing on supplying the exact information and services that the users want, and doing this fast, according to Nielsen (*cited in* Zibell, 2000). Web site user centred designers must be as concerned with the users' backgrounds or previous experience when using the web

as a communication medium; as are other written media designers such as newspaper editors (Zibell, 2000).

User centred design for e-commerce web sites must consider user limitations and user abilities during design. Web site design must create differentiation in the use of controls, layouts, menus, and links. This means that designers must build into the web site distinct features of cues for the controls; so that users can easily and readily locate and identify the actual button or link they are searching for (Jones & McCoy, 2003). User centred design must result in cognitive compatibility. Cognitive compatibility means that the structure of the web site should match the cognitive structure of the users who are using the system (Santosa, 2003).

Specifically, in a study on web portals, it was noted that user demographics must be considered during design, especially the age of the user. The satisfaction of the older users was less than the satisfaction for younger users, and therefore web portals should be designed differently for older users (Xiao & Dasgupta, 2006). Generally, designing usable web sites requires an understanding of the web site's audience, the category of the web site, the expected content of the web site, the web site usability goals, and how to measure each of these criteria (Calongne, 2001). There are a number of simple, but effective usability design practices, which can assist web site designers to gain an early vision of the product, communicate ideas, evolve, design, develop and evaluate a web site. Six of these twelve practices include setting usability goals, developing story boards, performing early usability testing, measuring each usability attribute, assessing if usability goals have been met, and repeating the process through iterative refinement (Calongne, 2001).

Successful user centred design efforts for web sites will lead to the creation of usable web sites that offer an efficient and pleasant navigational experience. However, if user centred design does not consider the users' characteristics and is based on the designers' mental models this will hinder usability, because the mental model of the web site designer may differ significantly from the users' mental models (Koutri & Daskalaki, 2007).

User centred design for usability indicates that web site designers must first, understand the characteristics of the users, and second, be able to design the web site to accommodate the particular characteristics of these users. The design must result in minimal effort on the part of the users to achieve their web site interaction goals. User centred design is a web site design approach to improve web site usability.

### **2.3.3 Specific web site design considerations for usability**

A key challenge for web site designers is ensuring that the web sites are effective from the business customers' perspective. Effective web sites exhibit easy navigation and are easy to use; these two considerations improve usability (Bentley *et al.*, 2005). Three critical areas of successful web site design are: structure and layout, navigation, and orientation (Zhang, Keeling, & Pavur, 2000b). Designers must be aware that the structure of a web site can affect the actual functional utility considerably (Yen *et al.*, 2005). The web site page structure and the hyperlink structure connecting these pages each have a significant impact on the effectiveness of a web site design, the web site's usability, and the way the web site is used (Yen *et al.*, 2005).

A web site as a whole must be kept in synch with a single design style, for usability, and the web site should be updated through site-wide redesigns and not through continuous feature creep (Nielsen, 1998). Web site design consistency is essential for good usability, and one of the ways of doing this is to have a single department that is responsible for the design of the entire site, or at least a central group that can enforce a single design style (Nielsen, 1998). Designing for web site usability is not a trivial task, there is an enormous potential for web site design variability, and with this variability, different usability success. Web site design variability can occur while the design focuses on, support for generic design tasks, web site interface organisation, design of browser controls and related navigation, and web site personalisation (Gang, 2003).

A web site that learns or retains information about visitors reduces the users' memory load and is beneficial for usability. A simple way that web designers can have their sites learn or retain information about visitors is by allowing the use of the back button and by using a distinctive colour for visited sites (Zibell, 2000). Some regard the download speed as the single-most important design criterion on the web, according to Nielsen (*cited in Nah, 2003*). This means that web designers need to ensure that their sites can be accessed within a reasonable amount of time, which is within two seconds for every page, or they risk losing revenues from the web site (Nah, 2003). Web site designers are warned to use animation carefully in web environments. Human peripheral vision is very good at perceiving movement and animation may cause visual interference that negatively affects information seeking (Zhang & Massad, 1997). Considerations such as resolution, colour, refresh rate, bandwidth, and type of browser have implications for web site effectiveness and usability (Mahfouz, 2000). It is up to the web site designers to balance the design trade-offs; for example balancing the negative effects of adding all the various multimedia which take longer to refresh and view, against the benefits of very good advertising (Mahfouz, 2000).

Five business web site design considerations for usability are, page loading, content, navigation efficiency, security, and a consumer or marketing focus, according to Gehrke and Turban (*cited in Agarwal & Venkatesh, 2002*). A framework focused on the information quality aspect of web site design is comprised of four information quality considerations, being intrinsic, contextual, representational, and accessibility, as proposed by Katerattanakul (*cited in Agarwal & Venkatesh, 2002*). Seven key factors of information design are, quality of the information and content; quantity of information; accessibility, easy to read; understanding of the audience; topography, design of the text, attractiveness; and locating information (Fisher *et al.*, 2004).

It is also important to realise that different web site domains have different design considerations for usability; for example, e-commerce web sites will focus on security and privacy considerations while entertainment web sites will focus on engagement and interaction considerations (Zhang, von Dran, Blake, & Pipithsuksunt, 2000a). In a study on online shopping web sites it was found that graphics used in the design of a web site is likely to vary with user product item familiarity, according to Chau *et al.* (*cited in Agarwal & Venkatesh, 2002*). Consumers use different web site features for different tasks, so web designers must use activities or scenarios in designing to ensure that the web site features support the users in each of their tasks (Tan & Lee, 2005). Home pages cannot be designed in the same way for different industries; web site designers should modify the format, layout, and style of each home page, in order to accentuate the preferred contents for each industry and corporation (Cheung & Huang, 2000).

There are many specific web site design considerations for usability. All of the specific web design considerations are aimed at improving the experience of the user, and there is a financial profit to be made by doing this. No specific design consideration can be applied in the same way to every web site; each web site domain will apply a specific design consideration in a particular to optimise the usability of that web site.

### **2.3.4 Web site usability design difficulties**

Web site designers create web sites based on their understanding of required features, and these understandings can be very different to the users' perceptions and use of those features (Caruana, Wilkin & Cybulski, 2004). The cause of the understanding gap is due to serious deficiencies in the commonly adopted web design methods. Usability heuristics are an answer these deficiencies, and although generic usability heuristics can be applied, domain-specific heuristics must be developed and maintained (Caruana *et al.*, 2004).

A usability design difficulty, common to web sites, is the difficulty of designing for a diverse user population. Further, different web users have different goals and approach web sites with their own particular concerns and interests, so web designers must design web sites that adapt to match the individual user's needs (Gnaho & Larcher, 1999). This turns web site usability design and web site usability testing into complex tasks (Faulkner, 2003). The complexity of web site usability design tasks is also due to the growing popularity and complexity of the web itself, and therefore the design process needs to be supported by more powerful web engineering methods (Gnaho & Larcher, 1999).

There are an abundance of web sites that exhibit poor usability, and this suggests that most web site designers have little knowledge of user interface design and usability engineering; this is a huge problem (Borges, Morales & Rodriguez, 2003). Web site usability design difficulties that result in web sites with poor usability are the lack of appropriate facilities, resources, and usability engineering expertise to effectively apply the various web site design methods that are expected to promote good usability (Borges *et al.*, 2003). In addition, a web site usability design difficulty can exist when the design factors that made a web site attractive in initial adoption become quite different from what drives continued usage; the usability user preferences change over time (Davern, Te'eni & Moon, 2000).

Web site design difficulties obstruct good usability on web sites. The reasons for the web site design difficulties include heterogeneous web site user populations that are hard to define, poor user requirements understanding, and a lack of good usability design processes and techniques.

## **2.4 Web site usability design guidelines, principles, and heuristics**

### **2.4.1 Requirements for guidelines and shortcomings of guidelines**

It is important for web site designers to follow established usability design guidelines so that the web interfaces are usable (Koutri & Daskalaki, 2007). Indeed, designers of web pages can also improve the usability of already developed web site pages by applying established guidelines (Borges *et al.*, 2003). Established guidelines must adhere to the following criteria: they must be short, simple, and practical; the users must not need to have user interface design and usability engineering knowledge to apply them; and they must be supported by usability evaluation and testing. Established guidelines must be constantly reviewed; this is because technology continually advances and new elements are repeatedly integrated into the design of web pages (Borges *et al.*, 2003). However, the application of usability guidelines do not by themselves guarantee a usable web site, a separate validation process is required in order to confirm that the web site is usable (Levi & Conrad, 2003).

Further, usability guidelines can show a number of limitations which reduce their applicability within the web site design process (Mariage, Vanderdonckt & Pribeanu, 2005). Following are some of the major limitations of usability guidelines, according to Mariage *et al.* (2005). Some guidelines can be compared to high-level principles only and their application may not result in measurable usability success. Designers may accept a guideline based on the credibility of the guideline's author, and not based on measurable usability outcomes. The vast majority of guidelines require interpretation and the same guideline may be interpreted very differently from one designer to another. Guidelines can have specific domain jargon which can be difficult to understand or apply; this may slow down the design process. Many guidelines are stated without reference to their context of use, this causes designers to not know when and how to apply them. Misunderstood guideline vocabulary can lead to invalid generalisations or invalid specialisations on the part of the designers. Usability guidelines range from very detailed guidelines to very general guidelines, the very detailed guidelines are easier to interpret and apply than those that are very general. Guidelines also do not provide clear ways of checking the results of their application, and determining testing procedures can consume resources. Guidelines can be mapped along two dimensions: the amount of interpretation they require before being applied and the quantity of implementation details provided in the guideline definition. Lastly, usability guidelines for web sites should be clearly differentiated from guidelines for traditional GUI applications (Mariage *et al.*, 2005).

Usability design guidelines can provide web site designers with expert knowledge about how to build web sites with good usability. The source of the guidelines and the context of the guidelines are important in order to assess their validity and applicability. Guidelines vary in many ways and can be difficult to interpret and measure; their relevance must be carefully assessed before use.

### 2.4.2 Web site usability guidelines, principles, and heuristics

Design guidelines are usually specific and are particular to a certain design context. Design principles are usually less specific, and provide very general instruction about good design approaches. Design heuristics are rules of thumb or golden rules; design heuristics are collections of rules to follow to ensure design success and are usually compiled by experts.

The following design guidelines are recommended for designers; these design guidelines will result in web sites that have good usability and in web sites that have repeat visitors: the quality and quantity of information on a web site must be appropriate for each type of visitor; both the designers and the web site owners must develop a set of realistic scenarios representing what they believe visitors will want to do when they visit the web site; usability testing must be part of the design process; rather provide too much information on a web site than too little; the organisation, format, and layout of the information must be carefully designed (Fisher *et al.*, 2004). Microsoft also presents usability guidelines that are organised around five major categories: content, ease of use, promotion, made-for-the-medium, and emotion, as indicated by Agarwal and Venkatesh (2002). Content refers to the informational and transactional capabilities of the web site. Ease of use relates to the cognitive effort required by the web site users when using a web site. Promotion captures the advertising of a web site on the Internet and other media. Made-for-the-medium relates to configuring a web site to fit the needs of each category of user. Emotion recognises the affective reactions invoked by a web site.

The following HCI principles apply to web site usability design: user centred design early on in the development process; early human factors input; task environment analysis; iterative design; and continuous testing, according to Badre (2002). User centred design requires defining the user culture early in the development process, including user characteristics, user types, levels of expertise, and user task descriptions. Early human factors input furthers the user centred design principle by considering and designing for the emotional and psychomotor human factors early on in the development process; it is easier and cheaper to do it early on in the process. Task environment analysis results in functionality definition, by distinguishing the tasks and subtasks performed; the analysis must also include all aspects of the web task environment, which includes the physical, social, and aesthetic. Iterative design allows design refinement by successive design steps. Continuous testing enhances design quality and reduces the amount of faults reaching the users.

The Object-Action Interface (OAI) model has five principles in web page design: compactness and branching factors; sequencing, clustering, and emphasis; support for universal access; good graphical design; and navigational support, as specified by Shneiderman (*cited in* Mahfouz, 2000). Compactness and branching factors refer to page length and the number of links, respectively. Sequencing, clustering, and emphasis refers to sequencing web page objects based on spatial importance, grouping relevant items together to show relationships, and using fonts and colouring to have certain items stand out, respectively. Support for universal access refers in particular to accommodating users with different computers and bandwidth capacities. Good graphical design relates to attracting the attention of the users to certain content by using various colours and font sizes. Lastly, navigation support prescribes the page and information layout and flow.

There are additional usability principles that are tailored to web systems, as presented by Levi and Conrad (2003): speak the user's language, use words, phrases, and concepts familiar to the user; be consistent, indicate similar concepts through identical terminology and graphics; minimise the user's memory load, take advantage of recognition rather than recall; build flexible and efficient systems, accommodate a wide range of user sophistication and diverse user goals; design aesthetic and minimalist systems, create visually pleasing displays; use chunking, write material so that documents are short and contain exactly one topic; provide progressive levels of detail, organise information hierarchically, with more general information appearing before detail that is more specific; give navigational feedback, facilitate jumping between related topics; do not lie to the user, eliminate erroneous or misleading links. Lastly, two important principles are provided by Agarwal and Venkatesh (2002), the first is consistency in design, and the second is the recognition during design which states that the current knowledge of each category of user will affect how each category learns new artifacts and devices.

Designers do not always follow design principles; following are ten usability principles that web site designers most frequently violate (Jakob Nielsen's Alertbox, November 10, 2003). Emphasize what the web site offers that is of value to the users, and how the web site services differ from those of key competitors. Use a liquid layout that allows users to adjust the homepage size. Use colour to distinguish visited and unvisited links. Use graphics to show real content, not just to decorate your homepage. Include a tag line that explicitly summarises what the site or company does. Make it easy to access anything recently featured on your homepage. Include a short site description in the window title. Do not use a heading to label the search area; instead use a "search" button to the right of the box. With stock quotes, give the percentage of change, not just the points gained or lost. Do not include an active link to the homepage on the homepage.

A set of ten heuristics for general computer interface usability evaluation are: visibility of the system status; match between the system and the real world; user control and freedom; consistency and standards; error prevention; recognition rather than recall; flexibility and efficiency of use; aesthetic and minimalist design; help users recognise, diagnose, and recover from errors; and help and documentation, as proposed by Nielsen (*cited in Ssemugabi, 2006; Dix et al., 2004: 325-326*). The first nine of the preceding set of ten heuristics are also presented by Nielsen (1994a). An additional four heuristics were proposed to be added to Nielsen's ten heuristics to make a set of fourteen web site heuristics, these additional four are: navigation; structure of information; physical constraints, and extraordinary users, according to Barber (*cited in Ssemugabi, 2006*). The navigation heuristic indicates that the design must result in users always knowing where they have been, where they are, and where they can go next. The structure of information heuristic indicates that related information must be clustered together with clearly labelled headings, and that the users must be able to comprehend the content by scanning the web page. The physical constraints heuristic indicates that the web page objects, such as icons, must be spaced in such a way so that users can access each object easily and manipulate each object easily. The extraordinary users heuristic indicates that, in addition to the social and cultural needs of all users, people with disabilities must be catered for.

A further eight heuristics for general computer interface usability design are: strive for consistency; enable frequent users to use shortcuts; offer information feedback; design dialogues to yield closure; offer error prevention and simple error handling; permit easy reversal of actions; support internal locus of control; and minimisation of short-term

memory load, as proposed by Shneiderman (*cited* in Ssemugabi, 2006; Dix *et al.*, 2004: 282-283). There are many other heuristics provided to improve the usability of system interfaces; for example there are heuristics for the design of the Start user interface, there are other heuristics by Holcomb and Tharp, by Poison and Lewis, by Carrol and Rosson, there are heuristics listed in the Macintosh Human interface guidelines, and there are the heuristics of the SunSoft usability guidelines (Nielsen, 1994a).

Design guidelines, principles, and heuristics all aim to improve the design process so that the resulting systems are effective, successful, and exhibit good usability. The context and source of the design guidelines, principles, and heuristics are important; these two factors with determine how relevant, appropriate, and credible the design guidelines, principles, and heuristics are.

### **2.4.3 Specific web site, program coding guidelines and content guidelines**

There are specific, web site, program coding guidelines for web site usability improvement, according to Horton (2006), these are: use markup to describe document structure; avoid meaningless and misleading markup; eliminate unnecessary clutter; communicate relationships among elements; apply a consistent design; make functional elements workable via the keyboard; use text for essential information; and accommodate serial access to page content. When markup is used to describe a document's structure, then the document can be accessed by other software and processed by other systems. Coding standards emphasise that meaningless and misleading markup must be avoided; coding standards will allow clear connections to be made between documents and data. It is important to minimise the web site page objects that are not directly related to the page content, this eliminates unnecessary clutter. Relationships among web site objects must be communicated by similarity, proximity, and continuity, so that correct interpretations can be made. Consistency in design will result in users being able to apply previously learned experience to new contexts. People with disabilities will be able to use a web site if functional elements are made to be workable via the keyboard. People with visual disabilities will also benefit when text is used for essential information, so that software can read out the text. Lastly, the most relevant information will be communicated to the user first, if serial access to page content is accommodated.

In addition, there are many guidelines for web site content. A foremost guideline is to use conventional, good writing style when writing the content of a web site (Morkes & Nielsen, 1997). Such conventional, good writing style includes the arrangement of the content, so that the wording and categorisation of the information is appropriate for the set of users. Conventions such as using topic sentences, limiting each paragraph to one main concept, and presenting the correct volume of information, are critical. Research shows that web site users scan web pages; they do not read every sentence and every word on every page; the following content guidelines aim to accommodate this user practice, as per Morkes and Nielsen (1997): text must be scannable and concise; writing must be simple and informal; there must be summaries and the inverted pyramid writing style; information must be well-organized and easy to find; a hypertext structure must be provided, graphical elements must complement the text; and humour must be used with caution.

Further content guidelines, that support the way web users scan web pages to find the information they want, are provided by Bevan (2001), and these guidelines follow. Make



the text scannable by using bulleted lists, highlighted keywords, relevant headings and short sections of text. Always start with the conclusion, and then give the details of the topic. Endeavour to make the text concise and objective by avoiding marketing exaggeration or subjective claims or boasting. It is important to not include unnecessary “white space” because this impedes scanning the text. User will not read large amounts of text online, so set up large pieces of information for printing or downloading as a file. Always assist the users to navigate through the content by telling users what to expect and by highlighting important links. The content of the homepage is vital to the success of the web site; design it so that it is quick to download, make the homepage content easy to read and use, ensure that the homepage can be viewed correctly in many different browsers, and allow the homepage to be read correctly by text-only browsers.

Several content guidelines promote readability in particular; and these guidelines also address that way that web site users scan web pages; these guidelines are provided by Zibell (2000). These guidelines are: web pages must not be text-heavy and must make effective use of white space; the pages must have no unnecessary graphics; the pages must use high contrast for graphics and text; the pages must include only necessary information; and the pages must present a clear and simple display of information. A web site with good usability will adhere to the least-effort principle, which indicates that a web site must require a user to use the least amount of effort to complete the needed interaction (Zibell, 2000). A measure of a web site’s usability is to determine if the web site content has been reduced to its very essence, as per Veen (*cited in Zibell, 2000*).

Web site, program coding guidelines and coding standards exist to guide designers toward building web sites with good usability. The content of a web site presents a web site’s very purpose for being. Content guidelines provide specific directions for designers to be able to communicate a web site’s content effectively to the web site users; this effective content communication ensures good usability.

## **2.5 User analysis for web site usability**

User analysis is the detailed scrutiny of a web site and web site users, done before the web site design process, in order to identify the purpose of the web site and how the users will use the web site (Fisher *et al.*, 2004). User analysis is important to ensure good web site usability; knowledge of the characteristics and needs of web site users will enable web site owners to adapt a web site to its particular type of users, and also adapt future lines of product features and offerings to its particular type of users (Mithas, Ramasubbu, Krishnan & Fornell, 2003).

It is vital for web site designers and owners to know which web site features encourage web site users to interact and stay on the web site; equally important is knowing which web site features are distracting, neutral, or offensive (Singh & Dalal, 1999). In order to determine which features encourage users and which features discourage users, it is suggested by Singh and Dalal (1999) that, like advertisements, the web site must be routinely subjected to diagnostic pretesting. Diagnostic pretesting is similar to a pilot study where the advertisement is shown to a small representative group of potential consumers, and then the consumers are asked a number of questions about the advertisement.

Audience analysis is a prerequisite for good readability, and good readability will allow good usability, according to Zibell (2000). Audience analysis is an investigation of the intellectual level, previous experience, motivation, and reading goals of the expected web site audience. Audience analysis is compared to investigating a written media's readers; where the knowledge of the readers' reading and education levels assist a writer to choose vocabulary, depth of concepts and explanations, organisation of content, tone, and voice. Further, the web site's architecture, interface, and interaction must be appropriate to the level of the audience in order to be effective. Audience analysis must be thorough, and audience analysis must result in clear web site user goals, to ensure that a web site can be usable and useful (Zibell, 2000).

Web sites can be created without any user analysis, and creating such web sites may be a simple task. Such web sites will show poor usability. User analysis or an examination of the web site audience, and understanding the web site category and content will enable a web site to exhibit good usability, as per Calongne (2001). Calongne (2001) continues by providing the key activities to be included in the web site design process: identifying target audiences and classifying them into user classes, identifying the type of web site, and determining the content of the site and any constraints or boundaries to it. Identifying target audiences and classifying them into user classes is a core and vital task which must be performed by every web site designer. Understanding the web site audience, their characteristics and needs will assist the web site designer to select the correct desktop publishing and layout choices. These choices include the use of colour, background images, fonts, styles, and multimedia components. Lastly, user analysis will give the web site designer the understanding of the degree of control the web site users will require during the activation of objects and hypertext selections (Calongne, 2001).

User analysis is essential when designing a web site, because user analysis will specify the intended contexts of use, according to Bevan (2001). The user analysis task must include: an identification of the important user groups; the expected reasons for users accessing the site; the expected frequency of users accessing the web site; the expected user web site experiences and expertise; the expected nationalities and languages of the users; the type of information that the users will look for; the expectation of how users will they want to use the information, such as read it on the screen, print it or download it; the browsers that the users will use and how fast their communication links will be; and the size of the user screens or windows that will be used, as well as screen colours (Bevan, 2001).

Another form of user analysis is called potential user, goals modelling, and it consists of eliciting, classifying, and describing the high level goals of web site users, as provided by Gnaho and Larcher (1999). Potential user, goals modelling, can be further described as identifying, classifying, and building a model of the potential users of a web site. The potential user, goals model, is based on two main concepts, the first concept is the user role and the second concept is user profile. The user role identifies a role that a web site user will fulfil, and the user profile describes the preferences, interests, and knowledge of each user role (Gnaho & Larcher, 1999).

User analysis must be an integral part any web site design process to ensure good usability of the resulting web sites. User analysis involves understanding the users of the web sites, their attributes and needs, and how they will use the web sites. Only once user analysis is performed can clear usability goals can be set for the design process. Clear usability goals provide steady, attainable objectives for good usability on web sites.

## 2.6 General web site usability evaluation or testing issues

### 2.6.1 Definitions and rationale for web site usability evaluation or testing

Usability testing can be defined as a process which determines how well a software system meets its usability criteria, and this process uses data derived from a sample of representative users, according to Rubin (*cited* in Prescott & Crichton, 1999). Usability evaluation can be defined as the activity of collecting data from a predefined sample of users that perform certain tasks in a specified work context to measure the usability of a software system, as per Preece (*cited* in De Villiers, 2000). Usability testing and usability evaluation are different terms for the same concept.

Usability testing can be further described as a process of measuring HCI characteristics of a system and identifying usability weaknesses for subsequent correction (Levi & Conrad, 2003). Usability testing can range from highly structured testing to highly informal testing, from very expensive testing to very cheap testing, and from time-consuming testing to relatively quick testing (Levi & Conrad, 2003). Usability testing will lead to systems with better usability; the more effective the usability testing is; the greater will be the improvement in the system's usability (Levi & Conrad, 2003).

Usability testing and user analysis are seen as complementary, and both of these activities are frequently excluded in the web design process (Fisher *et al.*, 2004). Rapid web site development requires usability testing to be performed early and often in the development process; in order for the resulting web site to have good usability (Calongne, 2001). Empirical usability testing is a vital usability testing method; empirical usability testing is carried out by web site users who perform specific use scenarios while being closely observed by a trained observer (Calongne, 2001).

Indeed, the usability testing data obtained from a representative group of web site users early on in the development process will give fast and early feedback to the designers, and it will enable the designers to make design corrections, make changes to an e-business strategy, and improve how a web site operates (Seethamraju, 2004). Without doing some type of usability testing it is impossible to know whether or not the web site meets the usability needs of the actual web site users, or how well it fits the physical, social and organisational context in which it will be used (Preece *cited* in De Villiers, 2000). In the electronic commerce field, especially in business-to-consumer commerce, it is vital to perform usability testing to determine whether users will be able to transact easily (De Villiers, 2000).

From a cost perspective, experience shows that effective usability testing can be done relatively easily, relatively quickly, and for only a small cost after normal staff time (Levi & Conrad, 2003). Levi and Conrad (2003) continue to state that it is certain that almost any method of usability testing will improve the usability of a system, as long as the results of the usability testing are absorbed by the development team and acted upon. Furthering that point, usability testing can be compared to most methodological process improvements, and it is likely to gain recognition and acceptance as the benefits materialise through use. In addition to this, empirical usability testing has the advantage over heuristic evaluation, where HCI experts decide what will cause users difficulties,

because empirical usability testing provides undeniable results; an empirical user test shows exactly where users have difficulties. However, it is still up to the empirical testers to interpret the empirical test results and determine the root cause of the difficulties. Usability testing will provide convincing evidence that the resulting systems exhibit improved usability, and that the actual web users benefit in direct, measurable ways (Levi & Conrad, 2003).

The web site home page is seen as especially important, because it provides the first impression and will determine if a user decides to continue further on a web site. Therefore it is crucial to perform usability testing on the home page of a web site. The home page can be compared to the cover of a magazine or company report and so usability testing must be done to ensure that the home page is effective (Zhang *et al.*, 2000b). The home page will set the tone and theme of the web site, and it will usually change less frequently; so the importance of the home page and the relative ease of performing usability testing on this page only, instead of the entire web site, make the home page a necessary target for usability testing (Zhang *et al.*, 2000b).

Usability testing or usability evaluation must be a core part of any web site development process, in order for a resulting web site to show good usability. Usability testing can have many different forms and any form will improve the usability of a web site if the appropriate usability testing results are incorporated in the design process as design requirements.

## **2.6.2 Web site usability evaluation or testing processes**

Usability testing must contain testing tasks that represent system uses that are common to the total user population, in addition, these usability testing tasks must state what must be done and not how it must be done (Calongne, 2001). Usability testing must be performed early on in the development process, and usability testing must occur frequently as iterative refinement, which allows the designer to continuously measure the usability metrics and monitor the usability of the developing web site (Calongne, 2001). Usability testing first requires web site user analysis, and then detailed descriptions of the interactions that these users require, only then can usability testing result in a web site that is effective and measurably usable (Calongne, 2001). The exact procedure of a usability testing process is less important than whether the outcome of the usability testing is effective at each stage of the design process (Calongne, 2001).

The basic elements of usability testing are described by Rubin (*cited* in Prescott & Crichton, 1999), and these elements follow: the development of problem statements or test objectives; the use of a representative sample of users whether randomly chosen or not; the representation of the actual work environment; the observation of the users who test a representation of the product; controlled and sometimes extensive interrogation of the participants by the test monitor; the collection of quantitative and qualitative performance and preferences measures; recommendation of improvements to the design of the product; and the constraints on usability testing that may exist, for example budget, equipment, and time constraints. These basic elements appear to be broad and appear to require a large amount of effort to implement, but they can also be applied so that the usability testing is quick, cheap, and extremely effective (Rubin *cited* in Prescott & Crichton, 1999).

Three general objectives of usability testing can be identified in the testing of any user interface, regardless of the type of interface, the hardware or software, the stage of design, the use or not of people in the testing process, the testing method used and the type of data gathered, according to Rubin (*cited in De Villiers, 2000*). These objectives are: testing to determine if the design meets the user requirements; testing design decisions to determine how design decisions impact a user and a user's interactions with the system; the analysis of problems with the design to understand the size of the problems and the effort required to remedy them (Rubin *cited in De Villiers, 2000*).

The usability testing process may require a large amount of effort and resources during both the usability preparation phase and usability execution phase; however usability testing can be done in parallel so the more people committed to the usability testing the less time it will take to do the usability testing (Chrisman, Diller & Walbridge, 1999). Usability testing must adhere to the following rules: begin as the project starts; test early and test often; keep the testing process simple and straightforward; keep the usability tests narrow in focus and do not try to learn too much in one test; compensate the test respondents in some way; debrief the respondents promptly after each test session; after the usability testing, communicate the findings to the system developers and all other relevant parties (Chrisman *et al.*, 1999). Usability testing which is based on a small budget will still result in significant usability improvements (Chrisman *et al.*, 1999).

One particular type of usability testing, done in the area of e-commerce, is protocol analysis, which is effective in showing the nature of usability problems experienced by typical users, as per Benbunan-Fitch (*cited in Tan & Lee, 2005*). The study by Tan and Lee (2005) showed that protocol analysis will provide greater insight into the usability of a system than that gained from other usability testing methods. In the study the protocol analysis required the participants to verbalise their thought processes and strategies as they performed the specific testing tasks. Further, the usability testing instructors recorded, collected, transcribed, and interpreted the verbal protocols to create design requirements that fitted the protocol data. An advantage of protocol analysis, in this study, is that it only requires a small number of participants due to the richness of the resulting data; however the particular study covered only the content, navigation, and interactivity aspects of web sites, and failed to do a comparative investigation of the web sites (Tan & Lee, 2005). Web site prototypes are another way to develop web sites, and even web site prototypes must undergo rigorous usability testing that starts with an expert review and is followed by a user test (Hahsler & Simon, 2000). Any web site, prototype, implementation and usability testing will be iterative processes, and will finally lead to an implemented production system (Hahsler & Simon, 2000).

Web site usability testing must be a carefully planned activity. Web site usability testing must be implemented early in the development process, and continued throughout the development process. Web site usability testing can be done with a small budget, and any amount of web site usability testing will provide good returns in terms of final web site usability.

### 2.6.3 Difficulties with web site usability evaluation or testing

Although web site usability testing will result in significant improvements in the usability of a web site, there are difficulties implementing web site usability testing. Web site usability testing can be seen as a difficult task because it is very ambitious and labour-intensive (Dettling & Schubert, 2001). In addition, web site usability testers have to meet the following criteria, which are difficult to meet: they must be thoroughly trained to administer the test and they must understand the test criteria very well; they must be experienced web users themselves; they must take the time to go through all four transaction phases, the information, agreement, settlement, and after-sales phase, for each web site tested, including delivery and payment (Dettling & Schubert, 2001). It is also difficult, economically, to test the usability of every page on a web site, so it is important for designers to understand the business objectives and intended contexts of use, and to perform usability testing on the structure and style within which new pages are developed (Bevan, 2001).

Usability testing often experiences the difficulties of limited budgets and recognition, and a solution to these difficulties is to use only five participants for effective usability testing, instead of bigger samples typically required for empirical research (Faulkner, 2003). Faulkner (2003) continues to explain that bigger samples may require resources that are not readily available to usability testers, who are often regarded as external to the core development team. There are two sources that give rise to the guideline that only five participants are needed for effective usability testing, the first source is the secondary analyses of other testers' data by Nielsen (*cited in* Faulkner, 2003) and the second source is the law-of-diminishing-returns arguments made by Virzi (*cited in* Faulkner, 2003). Both of these sources demonstrated that statistical rigor can be relaxed considerably in real-world usability testing. However, in applying the assumption, usability practitioners have experienced another difficulty, being the risk that when usability testing relies on only one sample of five participants then almost half of the identified problems can be missed, even though each successive participant markedly increases the odds of finding the problems (Faulkner, 2003). Although usability testers may like a simple solution such as the five user assumption, it is still very important that the test participants are representative of the target population, and the subsequent difficulty of this statement is that defining the target population is very complex and imprecise (Faulkner, 2003).

Indeed, usability testing on web sites has the distinct difficulty of user population definition because web sites contrast to most other software in that web sites do not have a well-defined audience with a limited set of tasks that a user can perform; web site visitors can arrive at a web site for many different reasons (Agarwal & Venkatesh, 2002). The definition of a web site user is difficult because anyone can access any web site; and each web site user and the associated user goals, for example information seeker, surfer, or transactor, are a unique set of usability requirements that can affect the design of a web site (Agarwal & Venkatesh, 2002).

There is not one solution to usability testing that is free of all difficulties, each usability testing solution must be weighed against the implications of missing usability problems. One of the greatest difficulties experienced in web site usability testing is defining a web site user population. Web site user populations are difficult to define because they consist of a vast variety of users each with potentially different reasons for accessing a web site. Each web site user's reasons for accessing a web site and each web site user's needs while

on a web site may be different; so each web site user and may require a different usability design.

## **2.7 Web site usability evaluation or testing methods**

### **2.7.1 Definition and purpose of usability evaluation or testing methods**

A web site, usability testing method may be defined as a systematic procedure for gathering data about user interaction and user experience on a web site (Fitzpatrick *cited* in Ssemugabi, 2006). The purpose of a web site, usability testing method is to support the design of usable, interactive web sites, by testing the design to ensure that the web site actually performs as expected and meets the usability requirements of the web site users (Ssemugabi, 2006). A usability testing method must be applied throughout the development life cycle; it must not be applied as a separate, single phase in the development life cycle (Dix *cited* in Ssemugabi, 2006).

There are two recurrent themes in all of the approaches to usability testing methods, as presented in the study by Agarwal and Venkatesh (2002). The first theme indicates that any usability testing method must be multifaceted; the usability testing method must use a variety of different measures. The second theme indicates that any usability testing method is affected by the personal, subjective judgements of the participants. In other words, a usability testing method is not intrinsically objective in nature, but it is influenced by the participants' personal interpretations of the web site and interactions with the web site. Even with this subjective element, usability testing methods have the basic assumption that it is possible to discover, at varying levels of granularity, which web site features have good or poor usability (Agarwal & Venkatesh, 2002).

A web site, usability testing method is a predetermined, systematic set of ordered activities for the purpose of assessing the usability of a web site. A web site, usability testing method will be based on the subjective experience of web site users, and this subjectivity is essentially what the method must test, to produce a measure of a web site's usability.

### **2.7.2 Considerations for selecting appropriate usability evaluation or testing methods**

The most important decision for a usability tester is how to select the most appropriate usability testing method (Fitzpatrick *cited* in Ssemugabi, 2006). Different usability methods that are applied to the same web site do not always produce absolutely consistent results (Ssemugabi, 2006). The usability method decision will be affected by factors such as time, money, and the expertise of the tester (Parlangeli *cited* in Ssemugabi, 2006).

Further, selecting the most appropriate usability testing method requires consideration of the factors that differentiate the usability testing methods; and consideration of the practical implementation factors of the usability testing methods (Preece *cited* in Ssemugabi, 2006). The factors that differentiate the usability testing methods are: the stage at which usability testing is carried out; the style of the usability testing; the level of subjectivity or objectivity of the usability testing method; the type of measures involved; the information provided; the immediacy of the response; the level of interference implied;

the resources required; and the context of the web site (Dix *cited* in Ssemugabi, 2006). The practical implementation factors to be considered if the particular usability testing method is to be successful are: users; facilities and equipment; schedule and budget constraints; and tester expertise (Preece *cited* in Ssemugabi, 2006).

There is another important consideration, and that is how many different usability testing methods to apply, and this includes the assessment of the advantages and disadvantages of each usability testing method; more than one usability testing method will increase the reliability of the results (Ssemugabi, 2006). The assessment of the relative effectiveness and efficiency of different usability testing methods is not a trivial task (Agarwal & Venkatesh, 2002). Simple usability testing methods are suitable to provide a measure of the overall usability of a web site; and detailed usability testing methods are suitable to isolate specific usability defects on a web site; however, both types of usability testing methods are recommended as they complement each other throughout the development life cycle (Agarwal & Venkatesh, 2002).

There are many usability testing methods available, and the choice of which usability testing method or methods to use is a very important choice, because each usability testing method will produce different results. The production of different results does not make usability testing methods unreliable, because each usability testing method is suited to a particular context of use. The critical task is selecting a usability testing method that is optimised for a particular context of use.

### **2.7.3 Classifications, descriptions, benefits, and disadvantages of methods**

One way of classifying a usability testing method is based on a method's approach, which can be whether end users will be involved or not, the stage of system development, or the place where the usability testing will be carried out (Ssemugabi, 2006). Another way to classify a usability testing method is based on whether a usability testing method uses empirical testing; model based testing; an observational method; a query technique; or an expert testing method (Ssemugabi, 2006).

Empirical, or experimental, usability testing is based on the use of scientific experimental methods to test hypotheses about the usability of a web site, and although scientific experimentation can be very expensive or impractical in some cases, there are certain cases where it is appropriate to apply it for web site usability testing (Preece *cited* in Ssemugabi, 2006). The advantages of empirical usability testing are: they are established methods; they produce quantitative data for statistical analysis; they have good reliability and validity and the results can be replicated; however, the disadvantages of empirical usability testing are: they demand many resources; they require specific knowledge about the context of use; they are time consuming to perform; the tasks tested can be artificial and restricted; and it may not be possible to generalise the results to a full working web site (Ssemugabi, 2006).

Model based or analytical usability testing methods, for example goals, operators, methods and selection (GOMS), enable system designers to analyse and predict the usability of web site design choices in terms of the physical and cognitive operations that must be performed by the user (Preece *cited* in Ssemugabi, 2006). Further, model based usability testing methods can be used when the web site is represented by formal or semi-formal



specification, and this makes these methods suitable for usability testing in an early phase of system development (Preece *cited in* Ssemugabi, 2006). The advantages of model based usability testing methods are: they are useful in early design; and they require few resources so they are relatively inexpensive; however, the disadvantages of model based usability testing methods are: they assume that all users are experts; and they are difficult to use because there is limited guidance on how to apply these methods (Ssemugabi, 2006).

Observational usability testing methods, for example think-aloud or protocol analysis, directly identify users' usability problems and are performed by observing users interacting with a web site; this may be done either by observing users in their natural setting, or by observing users performing predetermined tasks in a laboratory (Dix *cited in* Ssemugabi, 2006). The advantages of observational methods are: they quickly identify the usability problems; and the verbal protocols provide rich information; however, the disadvantages of observational methods are: the observation can affect user activity and performance levels; and the analysis of data can be time and resource consuming (Ssemugabi, 2006). In addition, protocol analysis can provide a consumer's detailed behaviours and examine each sub-activity leading to an eventual purchase; such detail is not possible with surveys, questionnaires, logs, and clickstream data (Tan & Lee, 2005). The verbal utterances that occur during protocol analysis provide insight into the expectations and preferences of a consumer, while the consumer is going through the purchasing process (Tan & Lee, 2005).

Query usability testing techniques, such as interviews and questionnaires, obtain usability data by questioning a user directly; these methods are relatively simple and cheap to administer (Dix *cited in* Ssemugabi, 2006). The advantages of query usability testing techniques are: they capture users' opinions; the questions can be tailored to each individual in an interview; the rating scales lead to quantitative results; and the questionnaires can be used on large groups; however, the disadvantages of query usability testing techniques are: a low response rate for questionnaires; possible interviewee and interviewer biases; analysis of data can be complex and lengthy; and interviews are time consuming (Ssemugabi, 2006).

Expert usability testing or reviews, for example heuristic usability testing and walkthroughs, are regarded as being inspection methods where experts inspect the web site in order to predict problems that users will encounter when they use a web site; apart from being inexpensive, these techniques are generally easy to learn and are effective in identifying usability problems (Preece *cited in* Ssemugabi, 2006). The advantages of expert usability testing methods are: they are easy to use; they can be used at any stage of system development; they use few resources and are inexpensive; problems are detected efficiently; and experts can suggest solutions to problems; however, the disadvantages of expert usability testing methods are: they cannot capture real user behaviour; there are problems in locating experts; and they are subject to evaluator bias (Ssemugabi, 2006).

A different way of classifying usability testing is to classify usability testing as subjective preferences, objective performance, experimental evaluation, or direct observation (Benbunan, 1999). A usability testing method will be regarded as subjective preferences where users are asked to test a web site using one or more rating scales in a questionnaire (Dumas & Redish *cited in* Benbunan, 1999). Subjective preferences can be difficult to obtain if the user population is widespread and diverse, such as for commercial web sites

(Nielsen *cited* in Benbunan, 1999). Subjective preferences are further limited, providing misleading results because users tend to give web sites good ratings even if the web sites are unusable (Benbunan, 1999).

Objective performance is determined by measuring the time taken for a web user to perform a specified task on the web site (Benbunan, 1999). This measure must not be used to determine web user productivity because this measure will be influenced by variables beyond the control of the web user, such as connection speed and Internet traffic (Nielsen & levy *cited* in Benbunan, 1999).

Experimental evaluation is undertaken in a controlled environment where web interface design parameters are manipulated and the resulting effects on user performance and preferences are studied, so that causal relationships can be established (Benbunan, 1999). Experimental evaluation is a suitable method for the interface design phase in the development life cycle (Preece *cited* in Benbunan, 1999).

Direct observation consists of observing and monitoring the behaviour of a sample of users using a web site (Benbunan, 1999). Direct observation has the advantages of being as effective as formal experimentation, and it is easier and less expensive to conduct (Instone; Sullivan *cited* in Benbunan, 1999). Protocol analysis is a direct observation usability testing method, and it consists of users thinking aloud while they perform predetermined tasks on a web site (Benbunan, 1999). Protocol analysis has the advantages of being the most systematic and valid of the direct observation methods, and the process of verbalisation reveals the assumptions, inferences, misconceptions and problems that the users encounter on a web site; however, protocol analysis has the disadvantages of being more expensive and more time consuming to perform (Ericsson & Simon *cited* in Benbunan, 1999). In general, direct observation usability testing methods do not require the participation of many users, because systematic tests with a small group of representative users can identify most web site usability problems (Benbunan, 1999).

A further classification of usability testing methods is to group them as general usability testing methods or contextually sensitive usability testing methods (Badii, 2000). General usability testing methods evaluate whether a web site includes dominant interaction paradigms that enhance general usability and that facilitate successful HCI; contextually sensitive usability testing methods exceed the general usability testing methods by evaluating whether a web site is a smart or re-adaptive interactive system and is contextually-aware with some capability for reflective reasoning and (re)learning (Badii *cited* in Badii, 2000).

Both general usability testing methods and contextually sensitive usability testing methods can be conducted with a variety of instruments and protocols; these include paper-based surveys, video-recorded task series, tape-recorded interviews, as well as integrated on-line usability evaluator tools that run concurrently on the web during usability testing (Badii, 2000). The on-line usability evaluator tool was found to be preferred to the interviews and paper-based surveys, because the on-line usability evaluator tool was less disruptive to the participants, more manageable, resulted in less data capturing constraints and distortions, and registered a lower annoyance factor because participants did not have to switch focus between the screen and the piece of paper on the desk or the interviewer (Badii, 2000).

There is also a usability testing method classification along the following four dimensions: method class, method type, automation type, and effort level (Ivory & Hearst, 2001). The method class dimension describes the type of usability testing done at a high level; and there are five method classes: testing, inspection, inquiry, analytical modelling, and simulation. During testing an evaluator observes users using a web site to determine usability problems; during inspection an evaluator applies a set of criteria or heuristics to determine any usability problems; during inquiry the users provide feedback on a web site through interviews and surveys; and during analytical modelling an evaluator applies user and interface models to determine any usability problems; during simulation an evaluator also applies user and interface models, but this time uses the models to simulate a user on a web site to determine any usability problems (Ivory & Hearst, 2001). The testing, inspection, and inquiry classes are suitable for formative (that is identifying specific usability problems) and summative (that is obtaining general assessments of usability) purposes; analytical modelling and simulation are engineering approaches to usability testing that enable evaluators to predict usability problems via the user and interface models (Ivory & Hearst, 2001).

The method type dimension describes how the testing is implemented within a method class, such as the thinking-aloud protocol method type within the usability testing class or the information processor model method type within the simulation class (Ivory & Hearst, 2001). During the testing method class, further method types are: question-asking protocol, shadowing method, coaching method, teaching method, co-discovery learning, performance measurement, log file analysis, retrospective testing, and remote testing; during the inspection method class, the following method types exist: guideline review, cognitive walkthrough, pluralistic walkthrough, heuristic evaluation, perspective-based inspection, feature inspection, formal usability inspection, consistency inspection, and standards inspection; during the inquiry method class, the method types are: contextual inquiry, field observation, focus groups, interviews, surveys, questionnaires, self-reporting logs, screen snapshots, and user feedback; during the analytical method class, the method types are: GOMS analysis, user interface development environment (UIDE) analysis, cognitive task analysis, task-environment analysis, knowledge analysis, design analysis, and programmable user models; and during the simulation method class, the method types are: information processing modelling, petri net modelling, genetic algorithm modelling, and information scent modelling (Ivory & Hearst, 2001).

The automation type dimension describes the automated testing aspect, and automation taxonomy is used to stipulate which aspect of a usability method is automated (Balbo *cited* in Ivory & Hearst, 2001). The automation taxonomy is none, capture, analysis, and critique; none indicates that there is no level of automation which means that an evaluator performs all aspects of the testing method; capture indicates that software automatically records usability data such as logging interface usage; analysis indicates that software automatically identifies potential usability problems; and critique indicates that software automates analysis and suggests usability improvements (Ivory & Hearst, 2001).

The effort level describes the human effort needed to carry out a method; the automation taxonomy is expanded to include the non-automated requirements of a method, these are: minimal effort, model development, informal use, and formal use (Balbo *cited* in Ivory & Hearst, 2001). The taxonomy is not necessarily ordered by the amount of human effort that is required because this will depend on the actual method used: minimal effort does not require interface usage or modelling; model development does require the evaluator to

develop a user interface model or a user model in order to apply the method; informal use requires completion of freely chosen tasks that are not specified or pre-planned by a user or evaluator; and formal use requires completion of predetermined tasks (Ivory & Hearst, 2001).

Another usability testing method classification exists whereby usability testing methods are classified as: expert inspection, early mock-ups, or functional prototypes (Bevan, 2001). Expert inspection checks web site pages for both adherence to house style (consistency of layout) and expert recommendations; early mock-ups are prototypes developed early in the development life cycle and tested by a representative sample of users performing predefined tasks; and functional prototypes are fully functional portions of a web site based on all previous design standards and testing, and the functional prototypes are also tested by a representative sample of users performing predefined tasks (Bevan, 2001).

A classification for electronic, commercial web sites classifies usability testing methods as: cognitive walkthroughs, heuristic evaluation, review-based evaluation, model-based evaluation, observational techniques, usability testing, empirical methods, and query techniques (De Villiers, 2000). A cognitive walkthrough is described as the process an evaluator undertakes by stepping through the interactions required by the web site in order to find any usability problems; walkthroughs require four tasks: a description of the web site; a description of the task that the user must perform; a list of the interactions needed to complete the task; and a description of who the users are (De Villiers, 2000).

A heuristic evaluation is described as a set of guidelines or general principles, originally developed by Jakob Nielsen and Rolf Molich, to test design decisions that have already been implemented; the list of heuristics includes: visibility of system status; match between system and real world; user control and freedom; consistency and standards; error prevention; recognition rather than recall; flexibility and efficiency of use; aesthetic and minimalist design; help functions; and assisting users to recognise, diagnose, and recover from errors (De Villiers, 2000).

Review-based evaluation is described as the study of literature for evidence to support or refute the different design decisions that have been implemented; model based evaluation is described as the use of particular cognitive and design models, such as GOMS, to test the design methodology or design rationale; and observational techniques include think-aloud, protocol analysis, and post-task walkthroughs (De Villiers, 2000). Usability testing is described as the use of the general usability principles from HCI; these being learnability, flexibility, and robustness; and five steps are required for usability testing: know your purpose within the context; find ordinary users; watch and learn; collect the data; and go back to the drawing board (Instone *cited* in De Villiers, 2000). Empirical methods are described as the formulation and subsequent testing of hypotheses, using controlled subjects and variables; and query techniques are described as interviews and questionnaires (De Villiers, 2000).

A further classification of usability testing methods classifies usability testing methods into three main groups: exploratory testing, threshold testing, and comparison testing (Levi & Conrad, 2003). Exploratory testing is most effective early in the development life cycle; it is conducted with no preconceived ideas about where the usability problems are or what form they may take; it specifically aims to find parts of a web site where user confusion,

slow-down, or mistakes may occur; it results in a list of usability problem areas as the outcome (Levi & Conrad, 2003). Threshold testing benchmarks the performance of a web site against predetermined usability goals, and usually accompanies a beta release; and comparison testing compares the usability characteristics of two different web site designs to determine which has the better usability, and it is generally performed at the early prototyping stage (Levi & Conrad, 2003).

In addition, a classification of five usability testing methods is provided: card-sorting, heuristic evaluation, scenario-based testing, questionnaire for user interaction satisfaction, and mining the logs (Levi & Conrad, 2003). Card sorting provides a high level view of global questions of organisation and structure (Levi & Conrad, 2003). Card sorting is performed by a group of users provided with a set of randomly ordered index cards, each of which is labelled with a concept from the task domain; the users are then requested to: scatter all the index cards; sort the index cards into small piles according to similarity; arrange the small piles into larger groups that appear to belong to an overall category; and invent a name for each of the larger groupings stage (Levi & Conrad, 2003).

Heuristic evaluation is carried out by HCI experts who investigate a web site, identify usability problems, and classify each problem found as a violation of one or more usability principles, or heuristics; heuristic evaluations require a project overview document that describes the objectives, target audience, and expected usage patterns; and a second required document is the list of heuristics (Levi & Conrad, 2003).

Scenario-based testing begins with domain experts, who in conjunction with the web site designers, create scenarios or specific tasks that cover the major functionality of the web site, and simulate expected real-life usage patterns with representative user samples; the results are then analysed with measures such as whether the respondents successfully completed the tasks, the time taken for each task, and the number of pages accessed for each task (Levi and Conrad, 2003).

Questionnaire for user interaction satisfaction consists of a scaled questionnaire, and mining the logs enables the designers to continue usability testing after implementation (Levi and Conrad, 2003). Mining the logs negates the need for testers to obtain usability experts or representative user samples because the real users' sessions are captured in detail in the logs and are available for analysis; the weakness of using these logs is that the interaction goals of the users remains unknown and there is no way to query the user about these goals (Levi and Conrad, 2003). Card-sorting, heuristic evaluation, scenario-based testing, questionnaire for user interaction satisfaction, and mining the logs present usability testing methods that are not intimidating for both participants and testers, and in addition they are all relatively easy, quick, and cheap (Levi & Conrad, 2003).

Yet another classification identifies eight distinct usability testing methods: heuristic evaluation, guideline reviews, pluralistic walkthroughs, consistency inspections, standards inspections, cognitive walkthroughs, formal usability inspections, and feature inspections. (Nielsen *cited* in Agarwal & Venkatesh, 2002). Furthermore, analytic and empirical usability testing methods form another classification, analytic usability testing methods include approaches such as heuristic evaluation, cognitive walkthroughs, guidelines, and GOMS, whereas empirical usability testing methods refer to all methods generally termed as user testing (Gray & Salzman *cited* in Agarwal & Venkatesh, 2002).

It has been observed that two of the most frequently used web site usability testing methods, are heuristic evaluations and laboratory testing (Agarwal & Venkatesh, 2002). Heuristic evaluations are performed by a small number of evaluators using an established set of guidelines or heuristics; and laboratory testing is conducted by web site users to provide detailed insight into any usability problems encountered by the users while interacting with the target web site (Agarwal & Venkatesh, 2002).

There are many different classifications of web site usability testing methods, and similar methods may be classified differently by different sources. The use of a particular usability testing method will depend on its comparative applicability with other usability testing methods, the evaluator's available resources and time, and how familiar the evaluator is with that particular usability testing method.

## **2.8 Qualitative web site evaluation methods**

### **2.8.1 Benefits of qualitative web site evaluation methods**

Qualitative web site evaluation methods are beneficial because they are an easy-to-use method for organisations and researchers to evaluate the usability of their web sites (Benbunan, 1999). Qualitative, open-ended comments are beneficial also as confirmations for quantitative statistics, examples of open-ended comments are: the web site is easy to use or I like the site layout (Ssemugabi, 2006). It is important to understand those qualitative characteristics of web sites, which individually, collectively, and inconspicuously result in the subjective feelings of satisfaction or frustration for web users (Levi & Conrad, 2003). Qualitative web site evaluation methods can provide insight into those areas of a web site that users find annoying or those areas that have poor usability (Levi & Conrad, 2003). An example of a qualitative web site evaluation method is protocol analysis; which has the benefits of being a systematic and relatively inexpensive method for testing web site usability (Benbunan, 1999). Another benefit of protocol analysis, as a qualitative web site evaluation method, is that it can identify specific usability problems that impact the acceptance of a web site (Benbunan, 1999).

Qualitative web site evaluation methods provide rich, detailed, non-numerical data. Such data can consist of words, pictures, and audio; and can complement numerical data from quantitative methods. The qualitative web site evaluation methods give evaluators valuable insight into the usability of a web site.

### **2.8.2 Descriptions of qualitative web site evaluation methods**

Qualitative web site evaluation methods are often used together with quantitative web site evaluation methods, and in such cases, the instruments used did gather both quantitative and qualitative data (Bentley *et al.*, 2005). Free text or verbal responses have been used to gather the qualitative data, where instruments that gather both quantitative and qualitative data have been employed (Fisher *et al.*, 2002). In addition, such instruments that gather both quantitative and qualitative data provide very satisfactory results (Prescott & Crichton, 1999).

An example of where only qualitative data was collected is an empirical study consisting

of in-depth interviews over a period of two years (Johansson & Mollstedt, 2004). Another example of a qualitative web site evaluation method is a study on how users read web pages (Morkes & Nielsen, 1997). Here an initial study was conducted first, which was exploratory, qualitative, and aimed at generating insight into how users read web pages and what they like and dislike; then hypotheses were formulated based on the qualitative data, which was used in a later quantitative study (Morkes & Nielsen, 1997). A further qualitative web site evaluation method was performed using the discount usability engineering approach, which employs only a small number of users; the findings reported were qualitative because quantitative, statistical data analysis is not appropriate for this method (Nielsen, 1994b).

A particular qualitative web site evaluation method was conducted with open-ended interviews and discussions, which avoided following predetermined sets of questions that would limit the study scope, according to Sandhu and Corbitt (2003). Sandhu and Corbitt (2003) described the process as beginning with the researchers providing the topic to the respondents, who were then probed for their opinions about the topic. The topic was about interaction control in a web-based e-service system. Each respondent was interviewed, and each interview was taped, and subsequently transcribed for analysis. All interview responses were verified and converged with the responses from the other respondents, as well as other sources. The qualitative data gathered provided important and rich information (Sandhu & Corbitt, 2003).

A qualitative web site evaluation method was also used to empirically evaluate the effectiveness of the web site design framework of two web-bookstores (Caruana *et al.*, 2004). Caruana *et al.* (2004) stated that the qualitative web site evaluation method combined with the features condensation method, resulted in the identification of several major and minor gaps existing in the commercial web sites, and these gaps emphasize serious deficiencies in the commonly adopted web design methods. The study used interviews to gather the qualitative data, and web developers were interviewed with an unstructured style because this offers the advantage of the results being unbiased by any preconceived ideas of the interviewer and so provides data that is valid. The interviews with the web developers began with a broad open primary question, which was followed by further probing to manage the interview and give the interview direction. The interviews with end users were semi-structured interviews that gave an interview framework to guide the interview, and also allowed for other ideas and issues to be investigated and captured (Caruana *et al.*, 2004).

Qualitative web site evaluation methods have been employed with recorded success. Many qualitative web site evaluation methods have used verbal qualitative data, mostly obtained from interviews. Where qualitative web site evaluation methods are appropriate, these methods tend to provide in-depth, comprehensive data.

## 2.9 Quantitative web site evaluation methods

Quantitative web site evaluation methods measure quantifiable usability goals, and quantifiable usability goals allow web site usability to be measured with degrees of confidence (Calongne, 2001). Such quantitative web site evaluation method measurements include: how long it takes for each page to load; how responsive is the system to a user's request; and how often does the user go to the wrong web pages when seeking specific information (Calongne, 2001).

Other quantitative measurements, such as those used to quantify the potential benefits from different web site writing styles, that were identified in a previous qualitative evaluation, are: task time, number of task errors, number of correctly remembered items, time to recall site structure, number of pages correctly identified, and a subjective satisfaction measure using a ten-point Likert scale (Morkes & Nielsen, 1997). Quantitative web site evaluation methods can also measure criteria such as the loyalty of users and the stickiness of web sites; stickiness refers to the ability of a web site to remain in a user's set of favourite web sites over time (Christ, Krishnan, Nagin & Guenther, 2002).

In one study, a particular quantitative web site evaluation method measured users' eye fixations, to obtain quantitative data about the noticeability of bricklets, which are small windows with specific useful information that make navigation faster and easier (Djamasbi, Tullis, Hsu, Mazuera, Osberg & Bosch, 2007). Here, a programmed eye tracker was used to record users' fixations on the page where the bricklets were placed; and the eye tracker was able to record how many times a user looked at the specified area for a period longer than 300 milliseconds (Djamasbi *et al.*, 2007). In addition, a self-report quantitative survey was used, which was a bricklet visual appeal five-point rating scale survey (Djamasbi *et al.*, 2007).

Quantitative web site evaluation methods have made use of the Likert scale to obtain quantitative data. Likert scales are suited to questionnaires, and an example of the use of a Likert scale is one where statements and questions were submitted requiring a response on a five-point scale, one was rated the lowest score and five the highest (Fisher *et al.*, 2002; Fisher *et al.*, 2004). A Likert scale is an agree/disagree scale for user responses to predefined questions. Another example of a Likert scale is where a user was asked to rate a web site on its overall usability, after visiting the web site, using a three item Likert scale (Chiravuri & Peracchio, 2003). Evaluators too, can be asked to respond to Likert scale type statements (Bentley *et al.*, 2005), and all web site usability constructs have been measured using a seven-point Likert scale (Kuan, Vathanophas & Bock, 2003; Wells, Wright & Carnigan, 2007).

Quantitative web site evaluation methods have also made use of a seven-point semantic differential scale, where web users provided feedback after using a web site, such as rational-emotional feedback to items for example user attitude toward the home page and sponsor and likelihood of further exploring the web site (Singh & Dalal, 1999). This seven-point semantic differential scale has endpoints labelled as favourable and unfavourable, and all the items are measured on this seven-point scale; each user was asked to think of each home page as a person and the degree to which the users thought that the page was rational-emotional was measured by characteristics such as: tender, factual, heart warming, sensitive, gentle, rational, emotional, and logical (Singh & Dalal, 1999). In summary, two attitude persuasion measures were used: one measured the attitude toward the home page;



the other measured the attitude toward the sponsor of the home page (Singh & Dalal, 1999).

Another quantitative web site evaluation scaling technique was used to measure the quantitative difference in mental model loads, or excessive cognitive effort that the users experienced while viewing different web sites (Santosa, 2003). The users were asked to find pieces of information on each of the web sites and the scale, representing the web sites loads, captured and measured the mental model loads (Santosa, 2003).

Quantitative web site evaluation methods can be structured as performance models, and formally represented as formulae that consist of evaluation metrics such as activity duration and message length (Gnahou & Larcher, 1999). Quantitative web site evaluation method frameworks are also proposed, one framework classifies real-world design problems into generic web site design categories and maps each resulting category into a graph model which can be analysed or solved using appropriate analytical techniques (Yen *et al.*, 2005). This framework proposes to measure web site accessibility in a systematic and quantifiable manner by modelling web site design problems using well-defined structures and rigorous analysis methods, and it is debatably more advantageous than current qualitative methods (Yen *et al.*, 2005).

A different quantitative web site evaluation method was used where a range of quantitative use features were defined for each of the user goal-tasks, and the overall usability was obtained by combining the constituent user goal-tasks' usabilities through a weighted scheme (Hu & Chang, 2006). Only after the quantitative specifications have been captured, can the overall usability of system be calculated (Hu & Chang, 2006). This quantitative web site evaluation method is applied at system analysis stage, and after task analysis, where each task is given the usability user requirements by specifying the required quantitative value for each of its basic use features; and at this stage, the weight and use frequency of each task can also be specified because at this time the task's importance and use frequency in the target system can be clearly determined according to the analysis of the current system (Hu & Chang, 2006).

Quantitative web site evaluation methods provide numerical data that can be analysed using statistical methods to give the findings validity. Quantitative data has a further benefit of being free from interpretation in terms of the actual numbers and can be checked by other parties. There are well established quantitative web site methods that add rigor to any research.

## 2.10 Questionnaires to evaluate web site usability

### 2.10.1 Use, development, and design of questionnaires to evaluate web site usability

Questionnaires designed to evaluate web site usability must ask good questions, and be useful and usable; designing such questionnaires must be a core skill for usability practitioners (Wilson, 2007). Questionnaires and interviews both query users; and are the major data generation methods used to evaluate web site usability (Ssemugabi, 2006). A questionnaire is a commonly used HCI technique for evaluating web site usability; and two established questionnaires for web site usability evaluation are: the Questionnaire for User Satisfaction (QUIS) and the Web site Analysis and Measurement Inventory (WAMMI) (Kuan *et al.*, 2003). Both of these techniques gather data about the usability of web sites using the following usability evaluation constructs: attractiveness, control, efficiency, affect, learnability and satisfaction; and the questionnaires are regarded as valid tools for evaluating web site usability, especially e-commerce service web sites (Kuan *et al.*, 2003).

The design of a questionnaire must begin with the definition of its high level goals, and from the high level goals will follow the detailed questions (Gillham *cited in* Ssemugabi, 2006). Questionnaires must also adhere to ethical principles, which require a questionnaire to explain its aim, introduce the researcher, provide detailed instructions on how to complete it, and it must contain a consent form (Ssemugabi, 2006). Questionnaires can have limitations; a survey used a questionnaire that was designed to research end users on their satisfaction with web sites, and it suffered from the limitations of a small sample size, only 29 valid data responses, and the practical difficulty of applying the questionnaire (Xiao & Dasgupta, 2002).

Once a questionnaire has been designed, it is important to evaluate that design, and the most important criterion of a questionnaire design is the diagnostic quality of the data gathered by the questionnaire (Tullis & Stetson, 2004). Tullis and Stetson (2004), described how they had been using their own questionnaire for their past research, which evaluated the subjective reactions that respondents experienced while using a web site, and they had fears that the questionnaire was not providing the required level of reliability mainly due to the small sample sizes. Therefore, they embarked on further research, using several sample sizes, to evaluate their questionnaire's effectiveness compared to some of the standard questionnaires, which were reported in the literature for evaluating the subjective usability of interactive systems. The focus of the research was to address the question of whether any of the questionnaires could reliably distinguish between the ratings of one web site versus another. A total of five questionnaires for evaluating the usability of a web site were used with a total of 123 respondents; the other questionnaires that were used were the Questionnaire for User Interface Satisfaction (QUIS), System Usability Scale (SUS), Computer System Usability Questionnaire (CSUQ), and Microsoft's Product Reaction Cards (Tullis & Stetson, 2004).

Questionnaire pilot studies are important to determine if a questionnaire has the correct level of validity and reliability, and to determine if there are any problems with the questionnaire, such as ambiguous wording or the time required to complete it. A pilot study of 10 junior and senior level students was used to evaluate a preliminary version of a questionnaire, each respondent completed the questionnaire and provided feedback to the researchers, and after consideration of the respondents' feedback several questions were reworded (Zhang *et al.*, 2000b).

Questionnaire design is a complex process, the questionnaire design process must have the following attributes: clear objectives, persuasion, efficiency, clear wording of questions and responses, question order, and bias analysis (Wilson, 2007). Clear objectives will guide the questionnaire designer and ensure that each question conforms to the overall purpose of the questionnaire; persuasion is a characteristic that energises respondents to answer the questionnaires carefully and completely; efficiency relates to keeping the number of questions to a minimum while still measuring the constructs satisfactorily; clear wording of questions and responses provides understanding about how the language of the questions and any response categories influence the respondents; question order acknowledges the effect of the order of the questions and the responses; and bias analysis gives understanding about the possible biases in the design of questions, responses, scales, and the effect of these biases on the data interpretation (Wilson, 2007).

Questionnaires are a common data gathering method in the evaluation of web site usability; they are an efficient technique to gather large amounts of data with few resources. The design of a usability questionnaire is a critical and complicated process. Only a rigorous design process will result in a questionnaire with acceptable validity and reliability; and both these characteristics are vital for good quality data.

### **2.10.2 Descriptions of questionnaires to evaluate web site usability**

A questionnaire with a high level goal of evaluating the usability of an e-learning application begins with general questions about demographic information and respondents' experience, after which follows the specific questions about the system being evaluated (Ssemugabi, 2006). Ssemugabi (2006) continues to describe the questionnaire as having the specific questions as statements based on usability criteria; and where necessary, the statements were rephrased or partitioned to be appropriate for each respondent's experience; respondents completed a five-point Likert rating scale to show their level of agreement or disagreement with each statement. Further, respondents could write any problems that they experienced regarding each criterion in the space at the end of each criterion, being open-ended responses, because one of the main objectives was to identify usability problems. In addition, the respondents were assumed to not completely comprehend the associated criteria terminology because the criteria were very general, so a set of statements was presented under each criterion to elaborate its meaning, and to support and motivate the respondents to complete the questionnaire. The questionnaire contained a concluding section, with two subsections, so that respondents could provide evaluations of both the system's overall usability and the system's support for learning; the first subsection allowed respondents to list the most severe problems encountered, and the second subsection allowed respondents to state their overall impressions and make any final comments.

A questionnaire, which was used in two questionnaire surveys, to produce a subjective satisfaction measure, took the form of a paper-and-pencil questionnaire; a portion of the questions asked about specific aspects of working with the site, and other questions asked for an assessment of how well certain adjectives described the site; and all questions used ten-point Likert scales (Morkes & Nielsen, 1997).

A particular questionnaire was only completed after evaluators performed predefined tasks on several web sites; each evaluator performed the exact same predefined tasks on the same web site and then responded to the same questionnaire; the questionnaire explored the evaluator's experience and views of each web site; thereafter the evaluators began the predefined tasks for the next web site (Bentley *et al.*, 2005). A different questionnaire that obtained and analysed a user's experience and views of several web sites also required that each respondent first complete a series of predefined tasks for a given scenario on each web site after which they completed the questionnaire (Fisher *et al.*, 2002; Fisher *et al.*, 2004).

Another questionnaire consisted of two major sections; the first major section gathered data on the respondents' background such as gender and age, and the second major section gathered the respondents' ratings on the perceived importance of the different web site usability dimensions; and all questions used a seven-point rating scale (Aladwani, 2003). There was an additional questionnaire that also used a seven-point rating scale to evaluate web site usability, in the study by Palmer (2002).

A questionnaire has been used in conjunction with web site logfile analysis in order to increase the reliability of the study's findings, and for comparison purposes; the self-report data that the respondents supplied in the questionnaire was compared with the actual web site logfiles (Kralisch & Koeppen, 2005). The web site that was evaluated was a highly used multilingual e-Health web site, and it was stated that the results were not representative of the entire population; the results refer to the patient sample only because the results were obtained from a small sample (Kralisch & Koeppen, 2005).

A survey used a questionnaire to gather data; it was a paper-based questionnaire that was distributed to 340 undergraduate and graduate students to gather data about their satisfaction with web-based portals (Xiao & Dasgupta, 2006). Another survey used an online questionnaire to obtain responses from 1,140 users, being assistant professors, member of the administrative staff, full professors, adjunct professors, students, and unidentified users; the questionnaire asked general, user satisfaction questions about the content and services provided by the university's existing web-based information system (Hahsler & Simon, 2000).

Another survey used a questionnaire to measure several constructs for the specification of a structural model with a dependent variable of frequency of use of a web site, and the questionnaire gathered response data about two web sites: the respondent's favourite site and the school's site (Davern *et al.*, 2000). The questionnaire obtained background demographic data, and included questions about content quality, structural quality, frequency of use, and a number of other potential covariates, including the name and URL of the favourite site (Davern *et al.*, 2000).

A set of two slightly different critical incident questionnaires was used to gather data from over 300 respondents about information quality problems that they encountered while performing predefined tasks on the World Wide Web; the first questionnaire gathered data about problems that the respondents found relating to their use of the Internet in general; the second questionnaire gathered data about specific key dimensions of information quality: accuracy, completeness, relevance, timeliness, and amount of information (Klein, 2002). Klein (2002) further describes that the respondents were both graduate and undergraduate students, and they were requested to use their own comprehension of the

questionnaire questions and questionnaire terms while completing the questionnaires. Continuing, both the first and second questionnaires were used to generate a pool of varied incidents for analysis due to the exploratory nature of the research. In addition, the preliminary results were based on an initial analysis of 132 responses; and included in the analysis were 75 responses asking about use of the Internet in general and 57 responses asking about use of the Internet for a course research project. Although the preliminary data was suggestive of a finding that users who have encountered information quality problems on the World Wide Web, rate information quality on the World Wide Web less favourably than users who do not report such problems, the sample size in this group of questionnaires was not large enough to address the research question with much statistical confidence (Klein, 2002).

The Questionnaire for User Interaction Satisfaction (QUIS), which was developed by the Human-Computer Laboratory at the University of Maryland, was used by researchers to measure users' subjective feelings of satisfaction or frustration (Levi & Conrad, 2003). The QUIS is not claimed to be a flawless survey instrument, however, it is regarded as an industry standard in the discipline of Human-Computer Interaction; it has been designed to be a reliable and consistent, cross-platform and cross-application satisfaction measure, however, the QUIS does not specifically address web sites: all the questions on the QUIS necessitate the respondents to circle a scale value ranging from one to nine to indicate their satisfaction; and every section also has space for free-form comments (Levi & Conrad, 2003). A recent version of the QUIS has been modified so that it can be used for web sites; some of the irrelevant questions were removed and questions that are particular to hypermedia applications such as web sites were added; the modification consisted of the least number of changes possible so as not to introduce bias or inadvertent redundancy; the QUIS is recommended to be administered immediately after a user has interacted with the system being evaluated (Levi & Conrad, 2003).

A post experiment questionnaire can be used after participants complete an experiment with a web site. Respondents completed a post experiment questionnaire about their experiences on web sites, the questionnaire asked about their feelings and purchase intentions while they performed predefined tasks on the web sites (Tan & Lee, 2005). The post experiment questionnaire was important to provide data for the examination of discrepancies in the respondents' attitudes toward the web storefronts and to confirm the verbal protocols; the post experiment questionnaire also rated the intentions to purchase from the two web storefronts on a scale one to seven (Tan & Lee, 2005).

A questionnaire was also designed to determine the important web design elements to be used in evaluating a web-based customer behaviour model (Song & Zahedi, 2001). Two pilot tests were done with the questionnaire; the respondents were first required to investigate a web site and then complete a pre-questionnaire to verify if they had adhered to the requirements of the experiment, thereafter they completed the main questionnaire (Song & Zahedi, 2001).

A task-specific questionnaire was used between two groups of respondents to gain insight about the effect of training on perceptions of information quality on a web site (Klein, 2003). A screening questionnaire was used to assist in the identification of different groups of users based on gender, age, library experience, and computer experience (Chrisman *et al.*, 1999). A web site questionnaire was used to understand user experiences while browsing specific web sites at three kiosks that were set up in the particular stores

(Agarwal & Venkatesh, 2002). A webmaster questionnaire was used as part of an evaluation framework to evaluate pertinent web site design factors (Liu & Arnett, 1998). An online questionnaire was used to measure the web site design using a five-point Likert scale (Lam & Lee, 1999).

The effectiveness of questionnaires to objectively measure web site usability may be negatively affected by: a respondent's subjective experience of the quality of a web site may depend on the particular nature of products and services offered on that web site; the previous online experiences of a respondent; and web technology knowledge of a respondent (Seethamraju, 2004).

The form of a questionnaire will vary depending on the purpose of the questionnaire. A common practice for web site usability questionnaires is to have respondents perform predefined tasks on a web site and then complete a usability questionnaire. Usability questionnaires can gather both demographic, factual data and subjective, usability data, which is data about a respondent's experiences on a web site.

## **2.11 Web site usability evaluation criteria, factors or attributes**

In the 1990s, the most important usability factors to measure usability were ease of learning and ease of use; ease of learning provided a usability measure by comparing the time it takes a user to learn a predefined task on an unfamiliar web site to the time it takes that user to learn the same task a different way; and ease of use provided a usability measure by counting the minimum number of actions required to complete a task successfully (Badre, 2002).

Web site usability factors with strong psychometric properties were identified as: consistency, navigability, supportability, learnability, simplicity, interactivity, telepresence, content relevance, credibility, and readability (Lee & Kozar, 2004). Usability has multiple components and is traditionally associated with five usability attributes, being learnability, efficiency, memorability, errors, and satisfaction, according to Nielsen (*cited in Chiravuri & Peracchio, 2003*). Another definition of usability includes attributes such as relevance, learnability, safety of the system, and the users' attitude to the system (Lecerof & Paterno *cited in Chiravuri & Peracchio, 2003*). Usability research has indicated that navigability and organisation of a web site are important factors (Nielsen *cited in Chiravuri & Peracchio, 2003*; Schneidermann *cited in Chiravuri & Peracchio, 2003*).

A home page and the corresponding web site are fundamentally communications messages, therefore it must be possible to develop goals and to measure the effectiveness of the site in communications terms; communications goals for a web site include: information goals, awareness goals, belief goals, persuasion goals, and attitudinal goals (Singh & Dalal, 1999). The following web site technical usability criteria are perceived to have different importance in developing and developed countries, these features are: security, ease of navigation, search facilities, availability, valid links, personalisation or customisation, speed of page loading, interactivity, and ease of accessing the site (Aladwani, 2003). The following web site usability criteria are used to measure the success of a web site, these are: web site download delay, which is the speed of access and display rate within the web site; navigation, which is the organisation, arrangement, layout, and sequencing; content, which is the amount and variety of product information; interactivity,

which is customisation and interactivity; and responsiveness, which is feedback options and frequently asked questions (FAQs) (Aladwani, 2003).

The usability of a web site must be described with criteria that are the essential user tasks that the web site is intended to support (Lee, 1999). The essential user tasks for a web site include: finding the desired information by a direct search or discovering new information by browsing; comprehending the information presented, which includes sub tasks such as reading and image processing; and a wide variety of specialised tasks specific to certain web sites, such as the ordering and downloading of products, or other tasks which may require users to execute specific procedures (Lee, 1999).

It is proposed that different web site domains have different sets of usability evaluation criteria (Zhang *et al.*, 2000a). In the financial domain, the five most important criteria are: up-to-date information, accuracy of information, multiple information sources, easy to navigate, and timely information; in the educational domain, the five most important criteria are: easy to navigate, search tool, accuracy of information, comprehensiveness of information, and clear layout of information; in the governmental domain, the five most important criteria are: easy to navigate, clear layout of information, up-to-date information, search tool, and accuracy of information; in the e-commerce domain, the five most important criteria are: security of data, easy to navigate, appropriate explanatory text, search tool, and product and service price concerns; in the health or medical domain, the five most important criteria are: accuracy of information, easy to navigate, search tool, up-to-date information, and comprehensiveness of information; and in the entertainment domain, the five most important criteria are: visual design, easy to navigate, site responsiveness, multimedia, and up-to-date information (Zhang *et al.*, 2000a).

A number of studies attest to the importance of usability criteria such as perceived ease of web site use, easy navigation, design and layout, readability of the text, user friendliness, access time, response time and download delays (Vaidya & Nandy, 2005). Other studies have stated that the broad usability criterion called web site quality includes the following specific criteria: service quality, security, consistency, content quality, information quality, scalability, availability, accuracy of the information, relevance, completeness of data, and perceived attractiveness of the web site (Vaidya & Nandy, 2005).

Web site usability can be measured by three key factors, these are: information, display, and ease of use (Fisher *et al.*, 2002). The information factor is comprised of: quality of the information and content, quantity of information, accessibility, easy to read, understanding of the audience, and appropriateness; the display factor is comprised of: quality of the display, the design of the text, and the colours and graphics presented; the ease of use factor is comprised of: usability of the site, quality and effectiveness of links, ease of navigation, ability to complete the task effectively, and time to complete task including down load time (Fisher *et al.*, 2002). Web site usability can furthermore be measured by four key factors, these are: speed, accuracy, confidence, and satisfaction (Rumpradit, 1998). Web site usability is measured by users' subjective responses to general web site quality criteria, such as systems aesthetics, design, ease of use, accessibility, and interpretability (Caruana *et al.*, 2004). Web site usability is also measured by additional web site quality criteria, these being content, presentation, navigation and search, information quality, service quality, usability, usefulness, and enjoyment (Caruana *et al.*, 2004).

Other factors have been identified as important factors for web site usability; these factors concern the quality of a web site and determine if users will revisit a web site, these factors are: content, layout, ease of finding information, ease of navigation, and emotional experience (Seethamraju, 2004). In addition, personalisation has been stated as a key factor that attracts visitors to a web site; information quality, system use, system design quality, and playfulness, have been stated as four major factors for the success of an e-commerce web site; trust, inter-activeness, ease of use, content, functionality, reliability, and speed of delivery, have been stated as web site service quality factors; web site design, pricing, access to a web site, and the speed with which pages download have been stated as important factors by companies that rate web sites and make comparisons between their competitors; and understandability, adequacy, usefulness, access, usability, and entertainment have been stated as important web site evaluation factors (Seethamraju, 2004).

Six criteria for the measurement of consumer perceptions of web site service quality are: ease of use, content, timeliness of response, accuracy of content, aesthetics, and privacy; the factor ease of use includes user friendliness, loading or transaction speed, search capability, and easy navigation (Seethamraju, 2004). A conceptual model of web site usability consisted of four key quality factors: ease of use, customer confidence, on-line resources, and relationship services (Cox & Dale *cited in* Seethamraju, 2004). Several web site criteria were validated to measure the success of a web site, these are: download delay, organisation of the site measured in terms of sequence, layout and arrangement, web site content that includes amount and variety of product or company information, and customisation and interactivity that covers easy navigation and responsiveness (Palmer *cited in* Seethamraju, 2004). A multi-dimensional scale was developed, based on four factors, to measure user-perceived web quality, these are: technical adequacy, specific content, content quality, and appearance (Aladwani & Palvia *cited in* Seethamraju, 2004).

Online trustworthiness is a part of web site usability, and the factors that affect online trustworthiness include ease of navigation, good use of visual design elements, overall professional look of the web site, ease of carrying out transactions, appropriate and useful content, conveying expertise, providing comprehensive information, projecting honesty, lack of bias, shared values, mixing advertisements, web site maintenance, navigational architecture, interface design elements, information content accuracy, reputation, and level of user control (Corritore, Marble, Wiedenbeck, Kracher & Chandran, 2005).

Web quality criteria include information or content quality, representation quality, and usability and functionality (Zo & Nazareth, 2001). Information or content quality consists of accuracy, currency, reliability, completeness, uniqueness, and purpose; representation quality consists of aesthetics, graphic design, layout and alignment, and originality; and usability and functionality consists of accessibility, navigation, consistency, site understandability, and flexibility (Zo & Nazareth, 2001).

Information quality factors include accuracy, completeness, consistency, currency, believability, objectivity, reputation, value-added, relevancy, timeliness, appropriate amount of data, interpretability, ease of understanding, representational consistency, concise representation, accessibility, and access security (Klein, 2003; Klein, 2002). Web site effectiveness criteria are regarded as being either technical characteristics or marketing functions; technical characteristics include audio, video, navigability, hyperlinks, and the



use of frames; and marketing functions include information such as general data, instructions, usage, promotion, online sales, and service or support (Kim, 2002).

Important web site usability factors, for web sites that cater to different cultures, are the web site design factors of: layout, colours, images, and fonts; in addition to their intended meaning and usability, the cultural messages of each of these factors must be carefully examined (Fitzgerald, 2004). Web site quality and usability evaluation criteria are: appropriateness of the web site to a user's needs; professionalism of the web site; percentage of users who can find the information they need; ease with which users can locate information; number of accesses to key pages; and the percentage of users visiting the site who access key pages (Bevan, 2001).

Other web site evaluation criteria include: findability, relevance and features such as relevant content, member directory, two-way communication and special features such as calendars, chat rooms, usability including fast loading, test tags on graphics, visible navigation choices, compatibility with common browsers, navigation aids, the company's objectives on the site, broken links, testing of contact information and reply time, and updates and maintenance (De Villiers, 2000).

Five major web site usability factors are: content, ease of use, promotion, made-for-the-medium, and emotion (Agarwal & Venkatesh, 2002). Content evaluates informational and transactional capabilities of a web site and consists of four sub criteria: relevance, which relates to the pertinence of the content to the core audience; media use, which signifies the appropriate use of multimedia content; depth and breadth, which examines the appropriate range and detail of topics; and current and timely information, which captures the extent to which a web site's content is current (Agarwal & Venkatesh, 2002). Ease of use concerns the cognitive effort required in using a web site and consists of three sub criteria: goals, which relate to clear and understandable objectives; structure, which focuses on the organisation of the site; and feedback, which captures the extent to which the web site provides information (Agarwal & Venkatesh, 2002). Promotion concerns the advertising of a web site on the Internet and other media; made-for-the-medium concerns tailoring a web site to fit a particular user's needs, such as mass customisation and personalisation; and made-for-the-medium consists of three sub criteria: community, which captures if the web site provides users with an opportunity to be part of online group; personalisation, which reflects the technology-oriented customisation of the web site; and refinement, which relates to the particular prominence given to current trends (Agarwal & Venkatesh, 2002). Emotion concerns the affective reactions invoked by a web site and consists of four sub criteria: challenge, which captures the idea of difficulty as it relates to a sense of accomplishment instead of simply functional complexity; plot, which relates to how the site piques the user's interest; character strength, which relates to the credibility conveyed by the site particularly via the individuals portrayed on the site; and pace, which examines the extent to which the site provides users an opportunity to control the flow of information (Agarwal & Venkatesh, 2002).

The following web site usability evaluation criteria have also been stated: accuracy, authority, objectivity, currency, and coverage (Beck *cited in* Zhang *et al.*, 2000b). Another three factors, important to the development of an effective web page, are: presentation, navigation, and quality; presentation, especially of information on a web site home page, must take into consideration graphics, colours, the amount of information displayed, and the way that the information is organised; navigation is based on a user's perception of

being able to readily find the hyperlinks to move around the web site; and quality is more than just good presentation of information, it must attract visitors to the web site (Zhang *et al.*, 2000b).

A further five web site usability evaluation factors are: content, navigation, design, business, and informational influence (Tan & Lee, 2005). Content is described as the nature of the information that the web site presents and the content of the information presented, content includes information accuracy, relevance, timeliness, completeness, understandability, consistency, conciseness, reference, relevancy of links, and advertisement; navigation is the ability of web site visitors to move around the web site and locate the information they want, navigation includes orientation aids such as site maps, speed of page loading, presence of menus, and search functions; design involves the aesthetic experience of web site users, design includes logos, consistency of layout, clarity and legibility of text, low plug-in requirements, and organisation of information; business concerns the business model that the web site adheres to, business includes shopping cart, product specifications, promotions, storage of customer personal information, warranty, order tracking, customer feedback, and privacy assurance; and informational influence concerns the opinions and subjective views of users about the products and services offered on the web site, informational influence includes customer comments and ratings of products, experts' comments of products, and bulletin boards (Tan & Lee, 2005).

Another set of five web site usability evaluation factors are: promotion, service, informational influence, self-efficacy, and resources facilitation (Song & Zahedi, 2001). Promotion communicates price and similar information to web site visitors; service provides visitors with the ability to examine the nature and features of products and services; informational influence concerns the opinions and subjective views of users about the products and services offered on the web site; self-efficacy concerns web site personalisation; and resource facilitation provides the facility to customise a product according to a visitor's specific needs (Song & Zahedi, 2001).

Several criteria that determine whether a web site is well designed and exhibits good usability are: information quality, learning capability, playfulness, system quality, system use, and service quality (Liu & Arnett, 1998). The information quality criterion has the following sub criteria: relevant, accurate, useful, timely information, flexible and customised information on products or services comparability, differentiation, complete description of products or services, price information, satisfying ethical standards, and perceived products or services quality; the learning capability criterion has the following sub criteria: interactive function between customers and businesses, interactive function among customers, well defined link, help function and customised search engine; the playfulness criterion has the following sub criteria: enjoyment, excitement, feeling of participation, charming, and escapism; the system quality criterion has the following sub criteria: security, rapid access, rapid error recovery, precise operation and computation, balanced payment method between security and ease of use, and coordination; the system use criterion has the following sub criteria: confidence, control, ease of use, track on-line order status, and privacy; and the service quality criterion has the following sub criteria: quick responsiveness, assurance, empathy, and following-up service (Liu & Arnett, 1998).

In addition, web site usability evaluation criteria are indicated as being: web site structure and layout, navigation, and orientation (Hong & Moriai, 1997). The web site structure and layout criterion includes: balance of web site structure, support of multiple views,

organisation metaphors, document size, visual setting, and predictability, and essential information; the navigation criterion includes: search services, hyperlinks, table of contents, navigation types, dead-end documents, return hyperlinks, consistency, and presentation; and the orientation criterion includes context, navigation history, and where to go next (Hong & Moriai, 1997).

Further web site usability evaluation criteria are: navigation; ease of use, frustration, design appeal, graphics, interface consistency, appropriate text size, appropriate text display, and the amount of relevant information (Fisher *et al.*, 2004). Web site usability can also be evaluated by the following criteria: ease of learning, retention of learning over time, speed of task completion, error rate, and subjective user satisfaction (Levi & Conrad *cited in* Chan & Swatman, 2002). Web site quality criteria can include download delay, navigability, and visual appeal (Wells *et al.*, 2007). Web site content evaluation criteria include accuracy, relevance and completeness, media format, and timeliness; while web site structure or navigation evaluation criteria include size, page layout, structure or navigation, response time, and security (Yen *et al.*, 2005). Central evaluation factors for web site usability is the smooth navigation of the user and easy access to the information sought (Koutri & Daskalaki, 2007). Two vital factors that will determine the effectiveness of a web site are how easily users are able to navigate and how easy the site is to use (Bentley *et al.*, 2005).

Furthermore, a web site evaluation criterion that may be perceived by the users as an indication of a web site's quality is the number of languages offered on a web site (Kralisch & Koeppen, 2005). Two other factors affecting the users' perceptions about the usability of a web site are: entertainment value and richness of the media of a web site (Mahfouz, 2000). A user's satisfaction as a measure of web site usability is a construct consisting of five criteria: content, accuracy, format, ease of use, and timeliness (Xiao & Dasgupta, 2006). A successful e-commerce web site must meet the needs of the users according to perceived usefulness and ease of use (Dettling & Schubert, 2001).

Web site usability has been measured by many different criteria; there is not one set of web site usability criteria that can be applied to all web sites. It is important to select the web site usability evaluation criteria that will provide valid and reliable data, and meet the specific usability evaluation objectives of the particular web site and particular web site domain.

## **2.12 Usability problems or usability errors on web sites**

The progress in web site development technology has made it possible for web sites to be rich in graphics and animation; however there are still many usability problems that have negatively impacted business revenues and customer retention (Badre, 2002). The ten most important web site usability problems are: the web site user is not considered; it is slow due to large multimedia files; the information is disorganised and poorly structured; there is a lack of standards and consistency; design consists of showing off technology; designers treat the web as a brochure; pages are cluttered; developers do not maintain and update sites; pervasive banner ads are annoying; and page layout is poor (Badre, 2002).

Other web site usability problems include: writing on web sites is poor; finding specific pages that contain answers to user questions is very difficult and results in users wasting

excessive amounts of time; web sites are difficult to use; graphics take too long to download; and a serious usability problem is slow response times (Morkes & Nielsen, 1997). Another two web site usability problems are: different browsers and platforms display web pages differently, such as a page that fits on one screen and is oversized on another; and transmission of web site information over the Internet can be very slow, particularly graphics, sound, and video, and this results in user frustration (Starr *cited in* Ssemugabi, 2006).

Further web site usability problems are: the majority of web sites currently on the Internet result in complicated navigation and searching, which results in both inexperienced and experienced users becoming lost and frustrated; web sites are continuously changing, with pages dynamically appearing and disappearing, so users cannot rely on web sites for constant content; and the quality control of content on the Internet is poor, some of the information cannot be trusted (Alessi & Trollip *cited in* Ssemugabi, 2006). Indeed, bad navigation design results in a substantial reduction in the usability of a web site (Hahsler & Simon, 2000). The majority of web site activities involve browsing and searching, and where no navigational support is provided, users will get lost in the information space, and will be discouraged to explore and use a web site (Rumpradit, 1998).

Simplicity is vital for user satisfaction and web site usability; simplicity allows the web site designer to engage the users through their experience on the web site and the web designer must not alienate users with incomprehensible jargon; further, a web site must not offend users by hiding the correct pathway, misleading them, or not providing them with a way to fix their mistakes (Zibell, 2000). Common mistakes that web designers make are: bad links, which consist of broken links, incorrect links, and links that do not go where they say they will go; inconsistency, which relates to visual cues that tell the user nothing or misinformation, labelling schemes that do not match from one page to the next, incomplete or incomprehensible site structure; and varying depths of difficulty from one page to the next; and insecurity, which consists of no notification that any information a person gives is secure, no mention that the information will not be shared, no confirmation that the information was received, and no explanation of how the security of the site works (Zibell, 2000).

Web site usability problems become evident when the following scenarios occur: when users are overwhelmed by the amount of information on a web site such as when users retrieve pages with a screen or more of unstructured text; when users encounter small thumbnail pictures that have too much photographic detail shown in too little space to be clearly visible; when users see under construction markers; when users experience server error messages; when users come across evidence that a server was not being kept up to date; when users come across pages with questionnaire forms that do not fit the screen; and when users have to wait for information to be retrieved over the Internet (Nielsen, 1994b).

The following are included as web site usability problems: unclear wording and vocabulary; users must remember too many things; graphics are useless and overused; understanding the site design is approximate; correspondence between the site design and the users' needs remains vague; navigation poses problems; a site is conceived without a well defined target population; design is not guided by the users' goals; and privacy and safety are insufficient (Head *cited in* Mariage *et al.*, 2005).

The following web site usability problems result in user frustration: user inexperience, system complexity, time delays, and poor interface design (Mendoza & Novick, 2005). In addition, novice users are sure to encounter errors, because they lack knowledge of the web site that they are using; unwanted features like auto formatting result in unnecessary complexity and lead to poor usability; long Internet download times result in lost time and increase user frustration; and poor web site interfaces result in reduced productivity, greater frustration, and more errors (Mendoza & Novick, 2005).

There is an abundance of web sites that exhibit poor usability, caused by: web site designers that have little knowledge of web site user interface design and web site usability engineering, and this results in user frustration, discouraged exploration, wasted user time, and increased Internet traffic; web site dialogues that contain irrelevant or rarely needed information; web sites that do not speak the users' language with words, phrases and concepts familiar to the users; inconsistent words, actions, and situations; links that are pointing to pages that do not exist; and pages with colours that do not reproduce well on black and white printouts (Borges *et al.*, 2003). Other web site usability problems that result in user disorientation are: poorly supported page browsing and navigation; poor web site structure; inappropriate and misleading links; and confusing and disorganised pages (Borges *et al.*, 2003).

A further web site usability problem that results in user disorientation, excessive user cognitive process overhead, low user satisfaction, and loss of potential sales, is poor web site design (Tan & Lee, 2005). Poor web site design will result in irrelevant information on a web site, which results in users not being able to locate the appropriate web site features to perform the required tasks and user feelings of frustration and anger (Tan & Lee, 2005). Any web site that is neither flexible nor adaptable will put the burden and responsibility of successful interaction on the user, this increasing the user's workload and results in poor web site usability (Mahfouz, 2000).

Web site users can also become disoriented on a web site due to unfamiliarity of the web site subject matters; getting distracted from viewing a large number of items; unfamiliarity with the structure or conceptual organisation of the hypertext network; and general inexperience of using the web (Santosa, 2003). In addition, web site usability can be adversely affected by animation on a web site, because human peripheral vision is very good at perceiving moving objects, and animation may cause visual interference that affects information-seeking performance (Zhang & Massad, 1997).

The web site usability problem of low page-loading speed has been stated as the number one complaint of web users, according to Hamilton (*cited in* Lam & Lee, 1999). Also, business content is an important determinant of web site usability, because the quality of the presentation of the content and the usefulness of the content will result in a potential customer being attracted to, or driven away from a web site (Crow & Nelson *cited in* Lam & Lee, 1999).

Two of the contributors to poor web site usability are: insufficient understanding of the web site target population needs during the design process; and insufficient usability testing during the design process (Fisher *et al.*, 2004). Other contributors to poor web site usability and user frustration are: web sites that contain too much irrelevant information, web sites that do not contain enough relevant information, disorganised text, poor quality of information, poor text display, and poor text size (Fisher *et al.*, 2004).

An important web site usability problem is the problem of physical interpersonal conversations that are inadequately catered for on web sites; this is due to the limited screen space and the elimination of individual senses such as smell, taste, and touch (Wagner *cited in* Senger, Gronover & Riempp, 2002). The problem of poor physical interpersonal conversations manifests during the initiation of customer contracts, complex consultation services and contract negotiations, and these are therefore areas in which personal contact cannot be substituted by contact on a web site; and surveys have proven that a large number of online purchases are aborted because the customers do not receive satisfying or timely responses to their questions (Wagner *cited in* Senger *et al.*, 2002). To continue, personal selling, or getting to know the customer very well, is also a problem because of the difficulty in tracking the characteristics and buying patterns of very large numbers of individuals on web sites (Gillenson, Sherrell & Zeltmann, 1999). Further, web sites exacerbate the problem of poor physical interpersonal conversations by not returning contact or correspondence after offering such (Senger *et al.*, 2002).

Other causes of poor web site usability are: a highly diverse user population which is non-trivial to predict or measure; a highly diverse set of end-user computer configurations, including hardware, systems software, and browsers; a wide disparity in connectivity speed and bandwidth; a deployment environment which gives the illusion of being much more powerful than it actually is; and a deployment environment that blurs the distinction between the web site content and the browser used to access this content (Levi & Conrad, 2003). Web site information that is not controlled and presented to the user in a meaningful way, will create complexity in the user task and result in poor usability; also when information is incomplete or is missing, the users' attitude towards the web site is negative and results in poor usability (Sandhu & Corbitt, 2003). Web site information quality problems are common on the Internet (Klein, 2002). Many web sites are poor in quality and difficult to use; web site users become frustrated when the design, quality, and usability of a web site is poor (Caruana *et al.*, 2004).

Web site usability problems are varied and include navigation problems, content problems, and misunderstood user requirements problems. The effects of web site usability problems are frustrated and dissatisfied web site users, underused web sites, and reduced economic activity on web sites. Correctly implemented web site usability evaluation methods will assist to mitigate web site usability problems.

### **2.13 The importance of good usability on web sites**

Good usability on a web site will enable a company to optimise their marketing to target users, better inform users of valuable opportunities, and better advise users about what they can use towards their benefit; and in addition to saving costs, good web site usability will give users access to all of the company's services and to all of the information about those services, which makes interacting and transacting with a company more convenient and this increases the financial worth of a web site (Djamasbi *et al.*, 2007). Therefore, good web site usability ensures that a web site accommodates its users, and this in turn ensures that a company benefits financially (Djamasbi *et al.*, 2007). A web site with good usability is regarded as a successful web site, as a web site that contains useful information, as a web site that displays information in a manner that is appropriate for its users; the result is a web site that is highly functional, visually pleasing for users, and provides a good overall experience with a company (Djamasbi *et al.*, 2007).

A critical success factor for e-business is good web site usability (Lee & Kozar, 2004). Good web site usability enables users to receive true value from spending time on a web site, it enables users to do business on a web site, and it enables a company to earn a positive cash flow from a web site (Nielsen, 1998). Web site users usually stay on a web site page for less than a minute, and this number is decreasing as the number of web sites increases, so it is important for web site designers to provide users with beneficial thin slice judgements, which are judgements made on a very brief exposure to information, so that users become repeat visitors and repeat customers for the long term profitability of a company (Chiravuri & Peracchio, 2003).

In order for a web site user to stay longer on a web site, explore a web site, return to a web site many times, and transact on a web site, the web site must have good web site usability (Geissler *cited in Bentley et al.*, 2005). A web site with good usability will receive high ease-of-use ratings from the users; also the web site and the business will receive high credibility ratings from the users (Bentley *et al.*, 2005). Good web site usability is shown in effective navigation and design, which will increase the probability of users transacting on a web site (Bentley *et al.*, 2005). Good web site usability will result in good user reactions, and these good reactions are a necessity for any subsequent user transactions on a web site (White & Manning *cited in Bentley et al.*, 2005). Web site users are known to leave a web site that has poor usability, especially in the form of poor navigation, complex structure, or if too many clicks are needed to reach the required information (Bentley *et al.*, 2005). Good web site usability in the areas of content and design will result in a favourable user opinion about the web site's business or company (Bentley *et al.*, 2005).

It is imperative that web site designers who design interfaces for e-commerce web sites have good web site usability as a goal and this goal is a prerequisite for converting users into customers; there is theoretical as well as empirical evidence that shows that good usability is positively associated with user satisfaction, and this is in turn positively associated with the intention of planned purchases (Kuan *et al.* 2003). The selection of an effective interaction design, usability testing, and usability evaluation methodology is important for web site improvements and good usability, and forms the basis for the success of a web site (Darisipudi, Sharma & Sharma, 2007). There is increased awareness that the success and financial performance of a web site is dependent how good the usability of the web site is (Aladwani, 2003).

Good web site usability is dependent on the awareness of web site designers about the importance of good web site usability and its effect on the anticipated financial performance of a web site (Fisher *et al.*, 2002). Good web site usability will result in users having a good experience the first time they use a web site and the first time they try to find the required information, and both these positive experiences will result in those users returning to the web site repeatedly (Fisher *et al.*, 2002). Good web site usability will also result in users recommending a web site to others (Shang & Dran *cited in* Fisher *et al.*, 2002). A good understanding of a web site's users by the web site designers is part of good web site usability, and this understanding is vital for the success of a web site (Fisher *et al.*, 2002; Fisher *et al.*, 2004). Web designers must be aware that the next web site is just a click away, and web site users will leave a web site if the web site exhibits poor usability; poor usability is evident when users are not satisfied, users cannot complete a task or users are frustrated by their experience (Fisher *et al.*, 2002; Fisher *et al.*, 2004).

A web site has the purpose of attracting users and distributing information and products, poor web site usability will result in users leaving a web site and the associated e-business failing; good web site usability will be realised by cost savings even when there is no actual exchange of money, an organisation's cost savings will be directly related to a web site's usability, in terms of user support, such as calls or e-mail to a help desk (Levi & Conrad, 2003). Good web site usability is a key determinant of a web site's success, and web site usability evaluation provides key metrics for web site design; other benefits of good usability are: a reduction in the number of errors, enhanced accuracy, more positive attitudes toward the web site, and increased usage of the web site (Agarwal & Venkatesh, 2002).

Poor web site usability is evident when a web site does not meet the needs of the target users, or it does not provide quality in use, or it is incomplete; poor usability results in a web site not meeting the organisation's needs, and can be seen as an indication of corporate incompetence (Bevan, 2001). Good web site usability is evident when a web site is useful and easy to use, and these attributes are significant determinants of how well a web site is accepted by the users, their attitude toward a web site, and a web site's actual use (Davis *cited in* Kralisch & Koeppen, 2005).

An in depth understanding about the unique characteristics of the particular types of users using a web site facilitates good web site usability; the resultant good web site usability will enable a web site to satisfy those users individually, and increase customer satisfaction, customer loyalty, and corporate profits (Gillenson *et al.*, 1999). Good web site usability is experienced by the users of a web site, and is a reflection of the quality of the services that an organisation provides (Wells *et al.*, 2007). Good web site usability will result in customer satisfaction, and customer satisfaction is an aim of electronic commerce in order to assure transactions on a web site (Lam & Lee, 1999). Good web site usability is paramount to ensure that a web site catches the attention of a user within thirty seconds; otherwise the users will just omit the remainder of a web site and go to other web sites (Hong & Moriai, 1997).

Good web site usability ensures that web site users have good experiences when they interact with a web site; a bad user experience will result in a user leaving that web site. Good web site usability is a prerequisite for the success and the financial profitability of a web site. Including usability design as part of the web site design process will make good web site usability achievable.



## 2.14 Research questions

The literature review provides the background for this research. The literature review demonstrates a need for this research by stating the importance of web site usability, and web site usability relates directly to the research problem statement. The literature review also provides the key concepts for this research. The literature review indicates why usability is critical; what usability problems occur; how design practices impact usability; how usability has been evaluated both qualitatively and quantitatively; and what criteria have been used to measure usability.

Research question one is a measure of the overall usability of the web sites, and this is mentioned as a relevant measure in Section 2.7.2 (Agarwal & Venkatesh, 2002); Section 2.9 (Chiravuri & Peracchio, 2003); Section 2.9 (Hu & Chang, 2006); Section 2.10.2 (Ssemugabi, 2006); and Section 2.13 (Djamasbi *et al.*, 2007). Research question two measures the underlying usability criteria of the web sites. Section 2.11 provides many cases where usability is measured by underlying web site usability evaluation criteria, factors or attributes. Research question three follows from research question two; with a purpose to extract the most important underlying usability criteria that are appropriate for the web sites in this research. Section 2.11 again provides the background of underlying web site usability evaluation criteria, factors or attributes.

The three research questions have been formulated to achieve the research objectives, to measure the usability of the five South African Super 14 Rugby franchise web sites, and to address the research problem statement. The research methodologies described in Chapter Three will be used to provide answers to these research questions. Following are the three research questions:

Research question one: How good or poor are the web sites' overall usability scores, in isolation and relative to one another?

Research question two: Are the web sites' usability criteria scores good and consistent, in isolation and relative to one another?

Research question three: What are the most important factors to focus on in order to achieve good and consistent usability?

## 2.15 Conclusions

In summary, Chapter Two is a thorough review of the relevant literature. It highlights the importance of good usability on web sites. It shows what research has already been conducted in terms of web site usability, what problems have been encountered, how these problems have been approached, and what questions have been answered. Chapter Two provides the context for the rest of this research.

In conclusion, the literature reviewed declares the pervasiveness of the Internet and web based systems, states the importance of web based systems, and proclaims that usability is critical for web based system success. The literature emphasises that usability evaluation

must be a carefully planned task and it is a prerequisite for good web site usability. The literature indicates that there is no web site evaluation method that is a panacea; each method must be weighed against the implications of missing usability problems and be suited to the particular context of use. One of the key difficulties experienced in web site evaluation is the accurate definition of web site user populations, due to the diverse nature and locality of Internet users. Usability evaluation must, in effect, measure the subjective experiences of the web site users. Questionnaires are a common and efficient data gathering method in the evaluation of web site usability, and must exhibit the necessary validity and reliability. A chosen questionnaire must measure criteria relevant to the particular context of use. Good web site usability is a prerequisite for the success and the financial profitability of a web site.

This research will provide value to the South African Super 14 Rugby franchises, because this research will improve the usability of their web sites, and so better support their web site goals. These goals include having as many visitors as possible, and keeping visitors on the web site for as long as possible. This research will also provide value to the many South African Super 14 Rugby fans, because this research will improve the usability of these web sites, and subsequently improve each fan's experience on these web sites.

Chapter Two provides the context, relevance, key concepts, and research questions for this research. The next chapter, Chapter Three, details the research methodologies that are to be used to answer the research questions. The relevant aspects of the research methodologies are presented and described in Chapter Three. Chapter Three provides a clear plan for responding to the research questions.

## Chapter 3: Research Methodology

### 3.1 Introduction to the research methodology

Chapter Three follows the Chapter Two literature review, which gave a setting to the research, presented prior, related research, and provided the research questions. Chapter Three details the research methodology theory for this research, while the following chapter, Chapter Four describes how that research methodology theory was employed in practice for this research.

This research sets out to obtain identical types of data from a group of people, in a standardised and systematic manner. The data is obtained in this way so that statistical patterns in the data can be determined and generalised to a larger population than the population targeted in this research. This research obtains both demographic data about each respondent, such as respondent age; and rating data about the South African Super 14 Rugby franchise web sites, such as the web sites' navigation ratings.

This research uses a general research strategy called a survey research strategy. Survey research strategies are commonly used to evaluate software systems, and survey research strategies have gained extensive acceptance and use in the Information Systems field (Olivier, 2004: 86; Oates, 2006: 93). The survey research strategy used by this research uses a questionnaire as the primary data generation method, because questionnaires can generate large amounts of data at relatively low monetary cost and in relatively short time periods (Dix *et al.*, 2004: 349); Section 2.7.3 (Dix *cited* in Ssemugabi, 2006); and Section 2.10. The data generated from the questionnaire is quantitative, which allows for statistical analysis.

In addition, this research uses a second research strategy called the Delphi Method. The Delphi Method has been widely used to obtain consensus of expert opinion on various subjects, and in this research the subject is the usability of the web sites. The data generated from both research strategies are then compared or triangulated. The benefits of method triangulation include better validity of the research findings and it allows the data from the one method to be corroborated or refuted by data from the other method. The data generated from the e-mail questionnaire survey is corroborated or refuted by the data generated from the Delphi Method.

Both research methodologies used in this research provide answers to the research questions formulated in Chapter Two. The research questions are:

Research question one: How good or poor are the web sites' overall usability scores, in isolation and relative to one another?

Research question two: Are the web sites' usability criteria scores good and consistent, in isolation and relative to one another?

Research question three: What are the most important factors to focus on in order to achieve good and consistent usability?

Information was gathered on these research methodologies from textbooks and Internet based articles. The textbooks that were used are research methodology textbooks, HCI

textbooks, and statistics textbooks. The Internet based articles were obtained from Academic and other sources as indicated by the literature references. The following keywords were used: data types, data collection methods, questionnaires, Likert scales, non-Likert scales, non-respondents, questionnaire types, questionnaire validation, population size, sample size, Sekaran principle, bias, central limit theorem, survey methods, Delphi, Delphi and evaluation, Delphi and usability, Delphi and usability and web, Delphi method, and Delphi technique. In all the searches, secondary searches were done with variations on the initial words, for example quantitative data for data types.

Chapter Three begins with an introduction to the research methodology that is applied in this research. After the introduction, the types of data gathered are described; an analysis of the Likert scale is presented; and the data collection method is discussed. Then the types of questions in the questionnaire are presented; the questionnaire's validation is determined; and the population size and sample size is detailed. Thereafter, data handling is explained; the method triangulation with the Delphi Method is described; the themes from the Delphi Method literature are shown; and the Delphi Method research methodology is detailed. Lastly, the chapter conclusion is written.

### **3.2 Types of data**

Data can be classified in a number of different ways. Data can be categorised as primary or secondary data. Primary data is data that is collected for the first time, for a particular research, it is unique to the particular research and has not been previously published. Primary data can provide research with data that is current and appropriate. Secondary data is data that has already been collected by someone else for a different purpose to that of the new research. Secondary data can provide data on a much larger scale than can be collected as primary data, and so contribute to new research.

Data can also be classified into quantitative data or qualitative data. Quantitative data are numerical data which represent an amount or a count for a single observation within a set of observations (Witte *cited* in Hodgson, n.d.). Quantitative data can be analysed statistically for patterns, so that conclusions about the data can be drawn (Oates, 2006: 245). Qualitative data are words, sentences, descriptions, or codes that represent categories for a single observation within a set of observations (Witte *cited* in Hodgson, n.d.). Qualitative data can be rich and detailed, allowing for varied explanations (Oates, 2006: 277).

Further, data can be categorised as subjective or objective data. Subjective data are personal opinions or personal judgements, while objective data are obtained from precise measurements of physical instruments (Hodgson, n.d.). Subjective data can be collected from users where, for example, they provide an assessment of how easy they find using a computer interface. Objective data can be collected from instruments that, for example, measure the time it takes users to perform certain tasks on a computer interface. The data collected in this research is primary, quantitative, and subjective. This data has the benefits of being current, available for statistical analysis, and appropriate, respectively.

### 3.3 The Likert Scale

The Likert scale is named after Rensis Likert, a sociologist at the University of Michigan from 1946 to 1970. The Likert scale was designed to measure psychological attitudes. The Likert scale does this by presenting an examinee with five responses to each item, ordered on an agree/disagree continuum. The five responses in the continuum are strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, strongly agree. Each response has a numerical label from one to five, one being strongly disagree to five being strongly agree. An important feature of the Likert scale is that no single item is itself a Likert scale; all items in the scale must be added together to provide an overall score, which is then only used to measure the respondent's attitude (Gregory, 2004:123-124; Uebersax, 2006).

By definition, the Likert scale must have the following features: the scale must contain several items; response levels are arranged horizontally; response levels are anchored with consecutive integers; response levels are also anchored with verbal labels which connote more-or-less evenly spaced gradations; verbal labels are bivalent and symmetrical about a neutral middle; and the scale always measures attitude in terms of level of agreement/disagreement to a target statement (Uebersax, 2006).

An advantage of the Likert scale is that it is easy to use and understand, both for the researcher and the respondent (Hasson & Arnetz, 2005). Further advantages of the Likert scale are: there is a neutral point that allows for expression of indifference and does not force the respondent to answer; Likert scales are empirically more valid than forced-choice scales, because it reduces acquiescent response bias; and it uses interval data placing equal distance between the response options (Measurement standards, 2003).

Clason and Dormody (2005) dispute whether Likert scales provide interval data, indicating that it is probable that the Likert scale will provide ordinal data. Ordinal data is regarded as being of a lower level, than interval data; lower level data give less information about an observation than higher level data (Lind, Marchal & Wathen, 2005: 10-14).

A specific limitation of the Likert scale is that a total score from a multi-item Likert scale may be the result of many different combinations of ratings, which leads to a loss of information about the scale items, and may lead to incorrect conclusions (Hasson & Arnetz, 2005). In addition, the discrete nature of the scale may not accurately measure the continuous, infinite values of the measured variable (Clason & Dormody, 2005). Likert items also provide no information about the importance of each item to respondents, resulting in responses to items that may be unimportant to the respondents (Ambrose, Clement, Randolph & Chauvot, 2004).

The Likert scale discussion is provided because it has been used in many usability instruments, presented in Section 2.9 and Section 2.10.2. The instrument used in this research does not make use of the Likert scale, because the question type used has more differences to the Likert scale than similarities. Similarities include, subjective data is being represented with numbers, and the scores for each item are summed to obtain totals for measurement. Differences include, attitudes are not being measured, respondent responses are not in terms of agreement and disagreement to a target statement, the defined Likert scale format is not used, and the data in this questionnaire is continuous ratio data.

Ratio data is the highest level of data, higher than interval data, which is higher than ordinal data (Lind *et al.*, 2005: 263-270). Ratio data has the benefits of having a true zero to the measurement scale, equal differences in the characteristics are represented by equal differences in the measurements, and numerical ratios of the data are true. The true zero allows for addition, subtraction, multiplication, and subtraction of the data (Oates, 2006: 248).

The questionnaire used in this research has both positive and negative questions. The positive questions require the respondent to provide a continuous rating from zero to positive ten, both points inclusive. The negative questions require the respondent to provide a continuous rating from negative ten to zero, both points inclusive. In all questions zero means that the item is not available to rate.

### **3.4 Data collection method**

Survey research strategies often use questionnaires as the data collection or data generation method (Olivier, 2004: 10; Oates, 2006: 95). The questionnaire used in this research provides quantitative data about how users rate the South African Super 14 Rugby franchises web sites. The questionnaire data is suitable for rigorous statistical analysis, which allows for inferences about the data. The questionnaire is an appropriate tool for collecting data, because it provides quantitative data, detailed in Chapter Four, which is used to address the problem statement and the research questions, presented in Chapter One and Chapter Two respectively.

A questionnaire is an instrument or tool used for collecting or gathering data from respondents. A questionnaire consists of a series of questions, items, or prompts to which the respondents are expected to provide answers. The answers provided by the respondents are the data. If the data is quantitative then statistical analysis can be done, else the data is qualitative and qualitative analysis techniques can be applied.

An advantage of questionnaires is that they are very economical compared to other data generation methods, large amounts of data can be generated with low costs of materials and time (Oates, 2006: 229; Dix *et al.*, 2004: 349; Kirakowski, 2000). In addition, questionnaires can have standardised answers that make it simple to compile the data, and the administration of self-administered questionnaires requires no special social skills of the researcher.

The researcher's motivation for using the questionnaire as the data collection method is based on these advantages of questionnaires over other data collection methods such as interviews, observations, and documents. These advantages of using a questionnaire directly address the researcher's constraints, the constraints are very limited research funding and limited time to collect the data and complete the research.

Usability questionnaires have the advantage of providing feedback from the users' perspective, and this feedback is independent of the system, so usability data from one system can be compared to usability data from another system, based on the same usability questionnaire; questionnaires are good for subjective measures (Kirakowski, 2000).

In contrast, questionnaires can provide relatively shallow data for a broad sample, whereas other data collection methods such as interviews can provide relatively detailed data for a narrow sample. Questionnaires have the disadvantage of only providing the respondent's reaction to the items; it is not able to provide why the respondent reacted in a particular way or any further explanations about the respondent's responses. Questionnaires that have quantitative data only, have the disadvantage of not having the detailed explanatory qualitative data, which enhances the researcher's understanding of the respondent's quantitative responses (Kirakowski, 2000; Oates, 2006: 229-230).

Further disadvantages include the standardised answers frustrating respondents; and only demographic groups that are literate, not visually handicapped, and can understand the terms used in the questionnaire, will be able to participate as part of the questionnaire survey sample (Kirakowski, 2000; Oates, 2006: 229-230). There is also no way of confirming if the questionnaire was answered truthfully, dishonest respondents can answer randomly and submit the questionnaire.

### **3.5 Types of questions**

Questionnaire questions can be categorised into factual questions, opinion questions, and attitude questions (Kirakowski, 2000; Oates, 2006: 222-223). Factual questions include demographic questions such as date of birth and occupation, and physically measurable questions such as how quickly a specific task was completed. Opinion questions ask about the respondent's personal belief or judgement, such as how a respondent rates a particular web site. Attitude questions are contrasted to opinion questions, because respondents must focus inward when answering attitude questions. Attitude questions include asking about how the respondent feels when using a certain system (Kirakowski, 2000; Oates, 2006: 222-223).

Questionnaire questions can also be categorised into open and closed questions (Kirakowski, 2000; Oates, 2006: 222-223). Open questions allow the respondent to answer as she or he wishes; there are usually empty lines available for the respondent to write the answer that she or he wishes. Closed questions force a respondent to choose an answer from a limited number of answer options, shown at the end of each closed question. Open questions are suited for rich, detailed respondent views, exploratory questions, and they take less time to prepare on the questionnaire. Drawbacks of open questions include requiring more effort from respondents to answer, and they are more difficult to analyse.

Closed questions have the advantages that they are far quicker to analyse, they are good for processing huge amounts of data, and they are quicker for respondents to answer. Drawbacks of closed questions are that they take longer to design to ensure that they are complete, they may cause respondent frustration if the answers are not complete, and they may enable respondents to answer without thinking carefully enough (Kirakowski, 2000; Oates, 2006: 222-223).

The questionnaire used in this research is the Website Effectiveness Review (n.d.). The entire questionnaire is used as presented on the web site, to retain its validity and reliability. The web site grants the public authority to use this questionnaire. The questionnaire has been developed by research at Trinity College Dublin and was originally

developed by Professor Dan Remenyi. The questionnaire has already been in use at the time when the researcher downloaded it.

The Website Effectiveness Review questionnaire was selected because it has proven validity and reliability. In addition, it has been used in practice for assessing how web site users experience web sites in order to improve those web sites, which meets the objectives of this research. Also, the literature supports the relevance of the items in the questionnaire. The specific sections of the literature review concerned are noted throughout Chapter Four. Appendix E provides a summary of how the questionnaire is used to address the research questions.

Further, the literature review, Section 2.10, shows that it is common practice for web site usability questionnaires is to have respondents perform predefined tasks on a web site and then complete a usability questionnaire. Section 2.10 also indicates that usability questionnaires can gather both demographic, factual data; and subjective, usability data, which is data about a respondent's experiences on a web site. The Website Effectiveness Review questionnaire also meets these general criteria. The preceding criteria attest to the suitability of the Website Effectiveness Review questionnaire for this research.

### **3.6 Questionnaire validation**

Questionnaire validity can be separated into content and construct validity (Oates, 2006: 227-228). Content validity relates to whether the content of the questionnaire sufficiently covers the domain of the research. Construct validity relates to whether the items in the questionnaire are measuring what they are expected to measure. Questionnaire reliability relates to whether the questionnaire will provide the same results if given repeatedly to the same respondents. It is extremely important that the questionnaire is both valid and reliable, so that any inferences and conclusions about the data are relevant and appropriate.

No dry run, fine tuning, pre-test, or pilot test was done on this questionnaire. The reason is that any changes made to this questionnaire may affect the questionnaire's reliability and validity. Therefore no changes can be made to this questionnaire, so any pilot test problems would be for interest only, and not part of this research; this negated the need for pilot testing.

### **3.7 Ethics**

Apart from questionnaire validation and reliability, ethics is an important consideration. Ethics is concerned about how people, such as the respondents, are affected by the research. It is ethical that no one is harmed and that each person is treated fairly and with dignity. This is described in terms of respondents' rights, being the right not to participate, the right to withdraw, the right to give informed consent, the right to anonymity, and the right to confidentiality. Ethics is also described in terms of the researcher's responsibilities, being no unnecessary intrusion, behave with integrity, and follow appropriate professional codes of conduct (Oates, 2006: 55-61). This research was submitted to the Ethics Committee at UNISA, and their approval was obtained.



### 3.8 Population and sample size

The sample is restricted to all the 2008 postgraduate students that are studying towards a Master of Science (MSc) in Computer Science or Information Systems, at UNISA. The reasons for selecting this particular sample include the impracticability of accurately defining the Internet user population for this study. The difficulty in accurately defining Internet web site populations is noted in Wolcott, Press, McHenry, Goodman and Foster (2001); and in Section 2.6.3 of this research referring to Agarwal and Venkatesh (2002) and Faulkner (2003). Further, this sampling technique is feasible for the researcher's economic and time constraints.

The disadvantages of using this sampling technique include not being able to depend on the rationale of probability theory for the purposes of generalising the results to a wider population (Oates, 2006). However, using this sampling technique does not necessarily mean that the sample respondents are not representative of the wider population, just that probability statistics cannot be used to prove it. To mitigate the risk that the sample is not representative and to provide generalisable results, method triangulation with the data from the Delphi method is used. The Delphi method requires non-representative, knowledgeable persons, instead of requiring participants representative of a larger population as needed by statistically based studies (Fomin et al., 2008).

The advantages of using this sampling technique include these respondents having an understanding of the questionnaire computer related item terminology, because these students are postgraduate computer and information systems students, and this increases the response rate (Olivier, 2004: 82). Also, the respondents require access to a computer and the Internet to complete the questionnaire, and these postgraduate students are expected to have access to both. Too, the MSc courses are full year courses so these students were available throughout the middle of the year, during the period when the researcher planned to send out the questionnaires. In addition, the researcher has access to the sample's contact details, because the researcher is also a student at UNISA. In addition, the semi expert nature of the respondents is an advantage for generalising results.

Further, the questionnaire is very long; and the expected completion time is approximately two and a half hours, excluding the time required for those questionnaire items where responses from the web sites are required. It is expected that since these students are also required to complete research as part of their research degrees, they would be more inclined to participate and complete the questionnaire. Even so, long questionnaires adversely affect the response rate (Olivier, 2004: 82; Mouton, 2001: 104; Oates, 2006: 226). In order to reduce the non-response rate, the researcher offered each respondent one hundred Rand for a completed questionnaire. However, the researcher's budget would only allow for the payment of thirty respondents.

It is important to ensure that the non-respondent rate is as small as possible, because non-respondents introduce bias into the sample selected from a population. It is the unknown characteristics and attitudes of non-respondents that can cause inaccuracies in any inferences made or conclusions drawn about the population from the sample (Bosnjak & Tuten, 2001). Non-response can be categorised into unit non-response or item non-response. Unit non-response occurs when a respondent does not return the questionnaire, due to inaccessibility, volitional refusal, or inability to respond. Item non-response occurs

when there are missing responses to individual questions, such as when surveys are partially completed and returned.

To obtain the complete sample list, the researcher made a request by e-mail and telephone with the Manager of Administration for the School of Computing at UNISA. The request was for a complete list, names and contact details, of all the 2008 UNISA postgraduate students that are studying towards a Master of Science (MSc) in Computer Science or Information Systems. The list contains thirty one students, one of which is the researcher. Therefore, the total sample size is thirty.

In contrast, if the sampling technique had been probabilistic, then the sample size from the population could be determined as follows. A sample size of thirty will satisfy the central limit theorem (Lind *et al.*, 2005: 263-270). Most statisticians consider a sample of thirty or more to be large enough for the central limit theorem to be used (Lind *et al.*, 2005: 263-270). When the central limit theorem applies, the normal probability distribution can be used to create confidence intervals for the population mean and perform tests of hypotheses. In addition, the researcher's budget allows for payment of thirty respondents.

Further, Krejcie and Morgan (1970) present a relationship between the population size and the size of a representative sample. They indicate that for a population size of thirty, a sample size of twenty eight is required in order for that sample to be representative of the population. A representative sample is critical for inferences and conclusions to be generalised or extended from the sample to the population. If the sample is not picked statistically correct then findings then cannot be generalised beyond the sample.

To ensure that the sample is picked statistically correct, the sampling method must ensure that the sample is representative of the population. Random sampling is a technique of probability sampling that provides a representative sample of the population (Oates, 2006: 96). Random sampling uses random numbers to select the sample from the population. Using random numbers eliminates bias from the selection process, because each person in the population has an equal chance of being selected (Lind *et al.*, 2005: 253).

The procedure to perform random sampling on the chosen population is to number each of the students in the sample frame, for example from one to sixty if the total population size is sixty. If the total population size is sixty, then the size of a representative sample will be fifty two (Krejcie & Morgan, 1970). Then using a table of random numbers, such as in Lind *et al.* (2005: 720), choose any random number in the table, without studying any of the numbers. One way to select a starting point is to observe the time, and use the second digit of the hour number plus one to select the starting column; and use second digit of the minute number plus one to select the starting row; the intersection of the selected column and row is the starting random number. The first two digits of the selected random number will be the number of the first sample respondent, for example the random number 03759 will result in student number three being selected for the sample. Then move one random number in any direction to determine the next student to select; also using the first two random number digits only. Repeat this process until fifty two respondents are in the sample, without re-selecting any random numbers already selected, and if the first two digits of any random sample is zero, greater than sixty, or the same number as an already selected respondent, then simply move to the next random number.

### 3.9 Data handling

This research requires a complete list, names and contact details, of all the UNISA postgraduate students that are studying towards a Master of Science (MSc) in Computer Science or Information Systems. This information is confidential, and required the appropriate permission from UNISA. The Manager of Administration for the School of Computing, at UNISA, granted this permission. The researcher's course supervisor also approved obtaining these student details for the purpose of this research.

The questionnaire was to be delivered primarily using e-mail, and if the respondent did not use e-mail, then facsimile transmission would be used, thereafter courier or postal service or hand delivery would be used by the researcher. The questionnaire collection method could be any of these delivery methods.

The questionnaire was self-administered, where each respondent completed the questionnaire without the researcher being present. This method of administration is contrasted with a researcher-administered questionnaire, which is a type of structured interview, where the researcher asks the respondent each question in turn and writes down the respondent's responses (Oates, 2006: 219). The self-administered questionnaire fits the researcher's cost and time constraints, requires no special social skills on the part of the researcher, and is suitable for literate respondents of this nature.

Bias is a term that can be used to describe an unfair situation, where some parties are favoured over others. When this term is applied to surveys, bias occurs when the survey sample does not accurately represent the survey population. This type of bias is called selection bias. Selection bias can be caused by undercoverage, non-response bias, or voluntary response bias (AP Statistics Tutorial, n.d.). Undercoverage bias occurs when some members of a population are not sufficiently represented in the sample. Non-response bias occurs when there are sample respondents who do not respond or partially respond to the survey, and these non-responding respondents differ in meaningful ways to the responding sample respondents. The result is that the inferences made and conclusions drawn from the sample do not reflect the actual population, because only certain members of the population are represented by the sample data. Voluntary response bias occurs when the sample members are self-selected volunteers; the result is an over representation of those members of the population with very strong views (AP Statistics Tutorial, n.d.).

This research was not expected to suffer from selection bias due to the method triangulation with the data from the Delphi method. The Delphi method requires non-representative, knowledgeable persons, instead of requiring participants representative of a larger population as needed by statistically based studies (Fomin et al., 2008).

Bias in surveys can also be the results of a poor measurement process, this is called response bias. Leading questions and social desirability can lead to response bias (AP Statistics Tutorial, n.d.). Leading questions are loaded in a way that favours one response to a question over another response to the question. Social desirability occurs when respondents provide answers that they think are socially acceptable instead of the truth. This research relies on the questionnaire's validity and reliability to mitigate response bias.

Lastly, research ethics dictates that respondents have the right not to participate, so there are no guarantees that every respondent will respond. Non-response is only a problem

when the non-respondents differ in meaningful ways to the responding sample respondents. For non-respondents, the researcher attempted to obtain the demographic details of the non-respondents in order to determine how they differ to the responding sample respondents, and if these differences are meaningful. If the differences are not meaningful, then the non-respondents do not introduce bias into the results of this research. If the differences are meaningful then bias is introduced into the results of this research.

### **3.10 The Delphi Method – method triangulation**

This research uses data generation, method triangulation. Data generation, method triangulation means that data generated from more than one data generation method is used. This research uses an e-mail questionnaire survey as the primary data generation method. A further data generation method, called the Delphi Method is used. The benefits of method triangulation include better validity of the research findings and it allows the data from the one method to be corroborated or refuted by the other method. The data generated by the e-mail questionnaire survey was corroborated or refuted by the data generated by the Delphi Method.

### **3.11 The Delphi Method literature review**

The literature reviewed in this sub section was obtained from Academic and other sources as indicated by the literature references. The same six keywords were used in three separate search engines, being the Google search engine, the Association for Computing Machinery (ACM) digital library search engine, and the Association for Information Systems elibrary search engine. The keywords that were used are, Delphi, Delphi and evaluation, Delphi and usability, Delphi and usability and web, Delphi method, and Delphi technique.

The sub sections that follow present the themes emerging from the Delphi method literature. These themes or concepts are produced in a literature matrix which maps the individual literature papers to each theme or concept, shown in Appendix B (Oates, 2006: 87; Webster & Watson, 2002). These themes are the definition of the Delphi technique/method; history of the Delphi technique/method; specific purpose and uses of the Delphi technique/method; specific Delphi technique/method procedures; benefits of the Delphi technique/method; and disadvantages/problems of the Delphi technique/method. Thereafter, the researcher draws conclusions from the literature review.

#### **3.11.1 Definition of the Delphi technique/method**

The literature provided a number of definitions, there are similarities and differences among the definitions that follow. The Delphi method is a structured multi-step process that uses a group of experts to achieve a consensus opinion (Goldman, Gross, Heeren, Herman, Kaczmarczyk, Loui & Zilles, 2008).

The Delphi method is applied when a community of experts is required to reach a consensus and to deliver an answer (Garcia-Magarino, Gomez-Sanz & Perez-Aguera,

2008). Furthermore, the experts must dialogue, interchange ideas, and change their minds as the discussion progresses.

The Delphi method is a method of bringing about consensus in forecasting (Simon, Carbone, de Raadt, Lister, Hamilton & Sheard, 2008). It shows a group of forecasters a summary of their forecasts, along with brief justifications, then effectively invites them to reconsider their forecasts in the light of what the others have said.

The Delphi method is an information collection strategy particularly suited for evaluations that focus on what is needed (Gamon, 1991). The essential components are sequential questionnaires, continual feedback, and anonymous experts. The Delphi method is a systematic, interactive method of forecasting based on independent inputs regarding future events (The Delphi method: General background., n.d.).

The Delphi method is an iterative process to collect and distil the anonymous judgments of experts using a series of data collection and analysis techniques interspersed with feedback (Skulmoski, Hartman & Krahn, 2007). The Delphi method is well suited as a research instrument when there is incomplete knowledge about a problem or phenomenon; however it is not a method for all types of Information Systems (IS) research questions.

Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone & Turoff, 2002). The structured communication is accomplished by feedback of individual contributions of information and knowledge; assessment of the group judgment or view; opportunity for individuals to revise views; and some degree of anonymity for the individual responses.

The Delphi method is a group communication structure used to facilitate communication on a specific task (Delphi method, n.d.b). The method involves anonymity of responses, feedback to the group as a whole of individual or collective views and the opportunity for any respondent to modify an earlier judgment.

The Delphi method is a technique that can be used to structure a group communication process to deal with a complex problem (Gordon, Helmer & Dalkey, 2008). The Delphi method is a communication structure aimed at producing detailed critical examination and discussion, not at forcing a quick compromise (Turoff & Hiltz, n.d.).

### **3.11.2 History of the Delphi technique/method**

Many of the articles indicate that the first Delphi method was developed by the RAND Corporation for the United States Air Force, in the early 1950's (Tetzlaff, 1981; Chang, Gable, Smythe & Timbrell, 2000; Ketchel & Dolan, 1974; Elmaghraby, 1988; Skulmoski *et al.*, 2007; Gordon *et al.*, 2008; Linstone & Turoff, 2002) or 1960's (McCubbrey & Taylor, 2005; Cline, 2000; The Delphi method: General background., n.d.). The Delphi method was used in order to assess the defence system from the perspective of the Soviet Union (Tetzlaff, 1981).

The RAND Corporation's Delphi method consisted of a series of questionnaires with controlled opinion feedback to reach a consensus of opinion within a group of experts

(Elmaghraby, 1988; Gordon *et al.*, 2008). McCubbrey and Taylor (2005) adds that this Delphi method negated the group practice of allowing the single most respected or loudest voice to dominate, which resulted in an individual's opinion and not a group opinion.

Tetzlaff (1981) also provides a historic account of the RAND Corporation using a group of experts to forecast dates for various technological inventions, during 1963 to 1964. Tetzlaff (1981) continues to describe a second Delphi method used by the American Federation of Information Processing Societies (AFIPS) and Time magazine in 1971, also to forecast dates for various technological inventions.

Cline (2000) notes that, after the RAND Corporation's first use, a United States government project called HINDSGHT established a factual basis for using the Delphi method. Project HINDSIGHT produced a tool for group opinion consensus when the decisive factors were subjective, not knowledge-based.

Ketchel and Dolan (1974) list the three key elements of the 1950 RAND Corporation's Delphi method. The first key element is a group of experts that provide anonymous replies to set questions. The second element is a coordinator who summarizes all the replies and returns the summary back to the group of experts for further feedback. The third element is a consensus of opinion obtained from several rounds of replies, feedback by the coordinator, and reconsidered replies.

Rowe and Wright (1999) *cited* in Skulmoski *et al.* (2007) present four similar key features of the 1950 RAND Corporation's Delphi method. The first key element highlights that decisions are based on the quality of the expert opinions not social pressures, due to the anonymity of each group member. The second key element is the refinement of opinion as the rounds progress, based on prior round opinion. The third key element is the controlled feedback, which allows the experts to clarify their opinions. The fourth element is the allowance of quantitative analysis and interpretation based on the statistical aggregation of responses.

The Delphi method (n.d.) and Linstone and Turoff (2002) provide an account of a 1959 paper called "The epistemology of the inexact sciences" by Helmer and Rescher, which argues that Delphi method expert opinion is acceptable for domains where there are no scientific laws. Such domains included forecasting long-term trends in science and technology, and their effects on society.

Turoff and Hiltz (n.d.) explain that early work with the Delphi method shows that experts vary in knowledge about sub domains of a given area of expertise, and that weighting the expert estimates provided greater accuracy of estimates.

### 3.11.3 Specific purpose and uses of the Delphi technique/method

In the study by Tetzlaff (1981), the Delphi method's purpose was to obtain forecasts about specific technology. Many studies have used the Delphi method to forecast technological developments (Gamon, 1991; Turoff & Hiltz, n.d.; The Delphi method, n.d.; Gordon *et al.*, 2008) write that the Delphi method is suitable for forecasting a specific, complex, single dimension subject. Stuter (1998) indicates that the Delphi method involves a continual evolution to consensus for a group of people.

The Delphi method has facilitated the elicitation of essential concepts and constructs in specific problem domains (Roth & Wood II, 1990). In addition, the Delphi method has facilitated understanding of the structure and relationships in the complex problem domains, in the natural domain terminology. The Delphi method has enabled major computer-system implementation issues to be systematically identified (Chang *et al.*, 2000). The Delphi method also enabled constructive discussion and interaction on the identified issues.

The Delphi method has gained consensus on the criteria and their relative importance in the specific problem domains (Schonberger, 1979; Delphi method, n.d.b; Turoff & Hiltz, n.d.; Delphi method, n.d.a). The Delphi method has gained consensus on the constructs used to populate repertory grids (Harrison & Datta, 2007). Cline (2000) used the Delphi method to reach opinion consensus among a group of experts, because the decisive factors were subjective and not knowledge based. The Delphi method has provided valuable guidelines for establishing the particular work programs, as well as establishing minimum competency criteria for the success of the work program instructors (Chen, 1989).

The Delphi method has presented alternative approaches to building systems (Elmaghraby, 1988). The Delphi method has been used to ascertain perceptual similarities and differences among stakeholder groups (Worrell & Bush, 2007). The Delphi method was used as an effective way to identify and prioritise pertinent issues and avoid researcher bias (Cumbie, 2007). The Delphi method has been used to generate and cluster significant subject attributes (Treiblmaier & Pinterits, 2005).

Fomin, Pedersen and de Vries (2008) used the Delphi method to focus on gaining explained disagreement, and less on obtaining consensus. The results present the dilemmas in the problem domain. The results also explored and validated the findings of other related studies. Winters, Story, Barnekow, Premo, Kailes, Schwier and Winters (2004) used the Delphi method to develop a survey instrument. The Delphi method allowed Zhengjie, Smith and Röse (2008) to identify the most suitable and widely used system methods and toolboxes.

Skulmoski *et al.* (2007) indicate that the Delphi method was used in research to develop, identify, forecast, and validate many different research areas, including Information Systems (IS) and Information Technology (IT) research. IS researchers have used the Delphi method to select projects, project requirements, prototyping decision criteria, rank technology management issues in new product development projects, and to develop a descriptive framework of knowledge manipulation activities. Other uses of the Delphi method include developing a taxonomy of knowledge creation mechanisms, developing principle legal issues facing the computer forensics discipline, developing the characteristics and metrics of a flexible IT infrastructure, investigating the traits and behaviours of top

performing software developers, identifying software development risks, and forecasting key issues in IS management.

Linstone and Turoff (2002) present many alternative uses of the Delphi method. These include gathering previously unknown data, examining the significance of events, evaluating alternatives, exploring different plans, planning developments, structuring models, eliciting the pros and cons of different policies, developing causal relationships in complex economic or social phenomena, distinguishing and clarifying real and perceived human motivations, and exposing priorities of personal values and social goals.

The purpose of the Delphi method is to enable the reliable and creative exploration of ideas or the production of useful information for decision-making (The Delphi method, n.d.). Delphi technique (1994) explains that the Delphi method is a way of obtaining input for ideas and problem solving.

#### **3.11.4 Specific Delphi technique/method procedures**

Tetzlaff (1981) acknowledges that Delphi methods are significantly different from implementation to implementation. Tetzlaff (1981) presents that Delphi methods can have questions produced entirely from the participants or questions produced entirely from the coordinator. In this study the latter occurred. In addition, this Delphi method used the same question throughout and only two rounds of feedback were done. Participants were asked to provide reasons for any responses that were more than one unit of measurement from the mean group response.

Roth and Wood II (1990) conducted a different Delphi method. This study consisted of three rounds, and each round required responses to a questionnaire that was constructed from the prior round. Round one was used to identify key decision factors and concepts, round two was used to gain understanding about how these factors were used in decisions, and round three concerned verification and consensus of the previous rounds' information. The study had twenty individuals as participants in the study.

Chang *et al.* (2000) describe a further variation of the Delphi method. This study also consisted of three rounds; however, the responses were non-anonymous using personalized e-mail. Round one listed the major issues, round two confirmed the round one issues and obtained further comments, and round three obtained scores on the relative importance of the major issues. The study had sixty-one individuals as participants.

In the Delphi method used by Goldman *et al.* (2008), the Delphi method had four phases and the twenty expert participants remained anonymous. The expert participants were chosen because they had published textbooks or accepted articles on the subjects, and were diverse from the other experts in terms of race, gender, geography, and institution. Round one identified the concepts and round two provided initial ratings on the importance and difficulty of the concepts listed in round one. Round three again asked for ratings on the importance and difficulty of the concepts based on the responses of round two, and any responses outside the inter quartile response range required justifications. Round four also asked for ratings on the importance and difficulty of the concepts based on the responses and justifications of round three, and these results were used for the final ratings.



In another study, the Delphi method used two rounds, round one obtained questionnaire criteria from the experts and round two obtained the importance of each criterion from the experts (Schonberger, 1979). More rounds were considered unnecessary because only a moderate amount of consensus was required. Nah and Benbasat (2004), in their study, likewise used a two round Delphi method.

Chen (1989) indicates that the number of rounds in a Delphi method will vary depending on how quickly consensus is achieved. Elmaghraby (1988) also states that information feedback continues until consensus is achieved. Harrison and Datta (2007) noted that it took them an average of 3.2 rounds to achieve consensus for all the criteria in their Delphi method. In the Delphi method by Winters *et al.* (2004), only one round was used because sufficient consensus was achieved. This study used expert opinion which was anonymous between experts.

In the study by Worrell and Bush (2007), the first round of the Delphi method consisted of a predefined list of criteria, and the experts were subjected to subsequent criteria importance ranking rounds until consensus was achieved. The experts were selected based on their expertise and years of experience in the relevant industry. The experts were also chosen to be diverse so that a variety of perspectives would be available.

Cumbie (2007) used a three round Delphi method where experts provided independent and anonymous feedback. Round one consisted of brainstorming, round two narrowing down, and round three ranking. The researcher acted as a liaison to solicit, compile responses, and calculate a statistical measure of consensus. The Delphi method used by Treiblmaier and Pinterits (2005) used two rounds. Round one was used to brainstorm the criteria and round two was used for criteria consensus. Seven experts with varied backgrounds and suitable knowledge were chosen.

McCubbrey and Taylor (2005) describe their Delphi method as consisting of three rounds, starting with a predefined questionnaire in round one, and obtaining expert opinion based on feedback from the previous rounds in the form of averaging statistics. The experts were knowledgeable and never met face to face.

A further Delphi method, by Fomin *et al.* (2008), used anonymity and feedback in three rounds, with a predefined starting questionnaire. Each successive round provided statistical summaries of the expert judgments from the previous round for further judgment by the experts. Thirteen experts participated in the final round. Data collection was done efficiently with a web-based survey tool.

Gamon (1991) provides an account of a typical Delphi method, indicating that it consists of three or four rounds of questionnaires. Experts provide open-ended answers in round one and then respond to the group feedback from the previous rounds. The expert opinions are independent and anonymous, and those experts with opinions that deviate from the majority are asked to provide reasons.

Zhengjie *et al.* (2008) used a three round Delphi method. Experts gave input into the criteria during round one, while round two and three were criteria ranking rounds. The Delphi method: General background. (n.d.) emphasizes the careful selection of expert participants. The responses were coded to ensure anonymity. The Delphi method must also include several rounds of questioning and earlier round feedback.

Linstone and Turoff (2002) present the Delphi method as existing in two distinct forms. The first is the paper and pencil version, where a small monitor team defines a questionnaire for a large group response. The responses are summarized by the monitor team and the large group is given another opportunity to re-evaluate their answers based on the first responses summary, and then the new questionnaire was developed from the first responses. The second form is very similar to the first except a computer system replaces the monitor group. The benefit is efficiency and the disadvantage is a reduced monitor ability to adjust the Delphi method. They indicate that both forms have four phases. Phase one is an exploration of the subject; the second phase clarifies the ranking or rating terms relating to the subject; the third phases explores and evaluates any disagreement from the second phase; and the fourth phase is a final evaluation of all the phases and their feedback.

Gordon *et al.* (2008) present a procedure for the Delphi method that starts with forming a monitoring team and selecting a panel of experts. The monitoring team develops a questionnaire and submits it to the experts, and then they analyse the responses. A second round questionnaire is prepared based on the first round responses and then submitted to the panel, after which the second round responses are analysed again. This process of questionnaire submission, expert response, response analysis, and questionnaire rework based on the response analysis continues until stability is achieved in the responses. A final report by the monitoring team is completed to provide conclusions. Delphi method (n.d.b) specifies the Delphi method as involving anonymity of responses where initial questioning is followed up with subsequent rounds of questioning in light of previous responses. A group response position is determined by averaging after only two or three rounds.

Turoff and Hiltz (n.d.) focus on several aspects of the Delphi method. The first is the asynchronous interaction of the experts, allowing them to participate when their lives allow. The second is anonymity, which negates normal group opinion biases. The third is moderation and facilitation, which is required to co-ordinate the group communication. The fourth is structure that reflects continuous operation and contributions, the structure will dictate the number of rounds, the content and purpose of each round. The fifth is analysis, which determines the scaling methods for measuring human judgement.

Delphi method (n.d.a) indicates a series of steps for the Delphi method. The first is preparing the question/s, and then recruiting the experts, thereafter collating the responses to the question/s. The collated and analysed responses are then returned to the experts for further responses. This process is repeated as is deemed appropriate. The Delphi method (n.d.) describes the Delphi method as comprising of a series of questionnaires to a pre-selected group of experts. The key aspects are the iterative response feedback rounds and the anonymity of the experts.

Cline (2000) lists a procedure for the Delphi method. Pick a facilitation leader and a panel of experts. Have a first round brainstorming session to determine the criteria to evaluate. Then hold further rounds, and analyze the responses between rounds, then feed those analyses back into subsequent rounds. A conclusive report is drawn up once the responses have stabilised to the required level, at which time no more rounds are required.

Delphi technique (1994) uses a Delphi method where the initial questionnaire is defined and the expert group is selected. The expert group provides answers to the questionnaire

during a first round. The coordinators summarise the responses and start a second round using the response summary from the first round. Successive rounds follow the same pattern until the coordinators determine that the response positions are firm.

Skulmoski *et al.* (2007) state that there is no typical Delphi method, each study modifies the Delphi method to suit the circumstances and research question. They continue that the initial Delphi method question is usually broad and open-ended. This obtains a broader range of responses but requires time-consuming analysis. The experts should meet four expertise criteria for selection, being relevant knowledge and experience; capacity and willingness to participate; sufficient time to participate; and effective communication skills. The sample size of the expert group is a practical consideration, involving decisions about a heterogeneous or homogeneous sample; a trade-off between decision quality and Delphi method manageability with a large sample and small sample respectively; and internal or external verification with research methods such as interviews or surveys. Two to three round Delphi methods appear to be used; however, more or less rounds may be sufficient. More than three rounds can result in a response rate decrease. Modes of interaction for the Delphi method range from pen and paper mailing to e-mail and Internet web sites. E-mail is beneficial because it provides a quick turnaround times and digital data. Quick turnaround times keep enthusiasm alive and participation high. Appropriate Delphi method analysis techniques are also critical.

Further reference to a multi-round Delphi method, where each round incorporates questionnaire results from previous rounds, giving the experts opportunity to reconsider their decisions, is given by Garcia-Magarino *et al.* (2008). Additional reference is made to the importance and purpose of the raters' anonymity, which is to prevent group influence by the most knowledgeable (Simon *et al.*, 2008).

Stuter (1998) describes a Delphi method where the facilitators worked toward a preset conclusion, fabricating the multi-round feedback responses in an attempt to disenfranchise citizens. The obvious problems with this implementation of the Delphi method is the unethical and dishonest behaviour by the facilitators, the use of ordinary citizens in the place of experts, and the discarding of anonymity.

### **3.11.5 Benefits of the Delphi technique/method**

One of the Delphi method's benefits is that it is suitable for decision making when the problem does not lend itself to a precise solution or the problem is very complex (Tetzlaff, 1981; Garcia-Magarino *et al.*, 2008; Skulmoski *et al.*, 2007; Turoff & Hiltz, n.d). The Delphi method enables expert judgment to draw conclusions in the absence of full scientific knowledge (Goldman *et al.*, 2008). The Delphi method has the benefit of providing insight into undeveloped subject areas and is a powerful forecasting tool (McCubbrey & Taylor, 2005; Gamon, 1991). The Delphi method is beneficial because it harnesses the judgment of knowledgeable experts (The Delphi method: General background., n.d.; Delphi technique, 1994). Cline (2000) suggested that the Delphi method has a benefit of working as an informal, subjective model but can be directly converted to a formal model when data is more knowledge based. Gordon *et al.* (2008) present that the Delphi method is particularly beneficial in forecasting a specific, single-dimension question.

Linstone and Turoff (2002) re-iterate by stating that the Delphi method is beneficial where there are dominating subjective input parameters in evaluation models, unavailable accurate information, or information that is just too costly to produce. The Delphi method appears incompatible with controlled experimentation or academic investigation, however, it is responding to a great demand for improved communications among geographically dispersed groups where there are no other suitable techniques.

The anonymity of the participants in the Delphi method is beneficial because it prevents any potentially destructive emotional involvement that often characterizes group decision making, or any disproportionate effect that a dominating participant can have on the outcome (Tetzlaff, 1981; Goldman *et al.*, 2008; McCubbrey & Taylor, 2005; Winters *et al.*, 2004; Linstone & Turoff, 2002; Gordon *et al.*, 2008; Cline, 2000; The Delphi method: General background., n.d.; Delphi method, n.d.a; The Delphi method, n.d.; Delphi technique, 1994).

The usually written-communication of the Delphi method provides further benefit by forcing the participants to focus on the content and logic of the questions and arguments (Tetzlaff, 1981; Goldman *et al.*, 2008; Delphi technique, 1994). The Delphi method is beneficial because it allows participants to defend those opinions that have greatly value, and then yield to majority opinion where their opinion is weak. This characteristic is what enables a group opinion to emerge, both consensus and dissensus (Tetzlaff, 1981).

The iterative nature of the Delphi method produces the benefit of overall opinion convergence for the group, usually evidenced by a decrease in the standard deviation (Tetzlaff, 1981; Goldman *et al.*, 2008; Garcia-Magarino *et al.*, 2008; Schonberger, 1979; Harrison & Datta, 2007; Treiblmaier & Pinterits, 2005; Linstone & Turoff, 2002; Gordon *et al.*, 2008). Elmaghraby (1988) states that the Delphi method is beneficial because it provides an upgraded solution rather than an average solution or the first possible solution. This is brought about by the Delphi method's iterative and controlled feedback characteristics.

The Delphi method is beneficial because it mitigates the difficulty and costs to bring a large number of experts together in one location for a given time period (Roth & Wood II, 1990; Linstone & Turoff, 2002; Delphi technique, 1994). The Delphi method is an efficient way to manage a large group of experts. The Delphi method enables experts that have no history of working together to contribute to solving complex problems (Roth & Wood II, 1990; Linstone & Turoff, 2002). The communication method, which is not face-to-face, provides the benefit that many more experts can communicate creating a larger knowledge base (Tetzlaff, 1981; Linstone & Turoff, 2002; Gordon *et al.*, 2008).

The Delphi method allows each expert to follow her/his own criteria and sources of knowledge in reaching her/his opinion. This gives the wide base of knowledge required to evaluate the complex problems (Garcia-Magarino *et al.*, 2008; Harrison & Datta, 2007; Gordon *et al.*, 2008; Delphi technique, 1994). The Delphi method also allows gradual solution formation (Delphi technique, 1994). Ketchel and Dolan (1974) indicate that the benefit of the Delphi method is the production of an aggregate opinion, which is free of individual biases and irrelevancies.

The Delphi method is beneficial because reasonable results can be achieved with small panels of ten to fifteen informed experts. In addition, the Delphi method is suited to the

clarification and refinement of constructs, resulting in constructs that are consensual and comprehensive (Harrison & Datta, 2007; Cumbie, 2007). The Delphi method requires non-representative, knowledgeable persons, instead of requiring participants representative of a larger population as needed by statistically based studies (Fomin *et al.*, 2008). Roth and Wood II (1990) indicate that the Delphi method used in their study was beneficial because it elicited a large number of key concepts and factors in the problem domain. The Delphi method developed consensus on a core set of issues, and areas of disagreement were revealed providing an agenda for further analysis.

McCubbrey and Taylor (2005) found the Delphi method to be beneficial as a predictor. The Delphi method's combination of qualitative and quantitative data is a benefit (Gamon, 1991; Skulmoski *et al.*, 2007). Skulmoski *et al.* (2007) write that the Delphi method is beneficial for academic research because it is a flexible, effective, and efficient technique used successfully within the Information Systems body of knowledge.

A benefit of the Delphi method is that it can be used where disagreements among experts cause great conflict, such as politics, because the experts are anonymous and the communication is controlled (Linstone & Turoff, 2002; Cline, 2000; Delphi technique, 1994). Turoff and Hiltz (n.d.) list asynchronous communication as being another benefit of the Delphi method. Asynchronous communication allows participants to contribute when they feel they want to and to contribute to the particular aspect of the problem they feel best able to. In addition, communication can happen at any time of day or night. Apart from asynchronous communication, Turoff and Hiltz (n.d.) suggest that the Delphi method directly improves the performance of human groups.

### **3.11.6 Disadvantages/problems of the Delphi technique/method**

Tetzlaff (1981) listed that the iterative nature of the Delphi method can be a problem, because participants drop out. It is also mentioned that most of those dropping out gave themselves a low expertise rating and the length of the second round was greater than the first round. A second problem is the non-uniform interpretation of the questions among participants; this can be evidenced in the free form portion of the answers. Linstone and Turoff (2002) also indicate this as a potential problem. A third problem is the lack of generality of the results due to a relatively small participant group size; this is also listed by Delphi technique (1994).

In the study by Roth and Wood II (1990), using the Delphi method, they identified the following as problems: a poorly designed initial questionnaire; lack of knowledge and understanding on the part of the participants; and a domain problem that lacks depth and complexity. Of the three problems they found that the domain problem lacking in depth and complexity to be the most serious, the other two problems were minor.

Chang *et al.* (2000) stated that their difficulty with using the Delphi method was that they could not find any literature describing how to deal with the large amounts of non-numerical, unstructured rich data; how to select between the alternative coding or indexing systems; how to ensure that those issues identified accurately reflect the participants' intentions; nor how approach qualitative concept building and theory development.

A problem with the Delphi method is that it can be highly time-consuming (Simon *et al.*, 2008; Delphi technique, 1994). The time involved in a pen and paper traditional mailed Delphi method can be particularly time consuming (Gamon, 1991). The demanding nature of the Delphi method must not be underestimated, and participants must be compensated for their time (Linstone & Turoff, 2002; Gordon *et al.*, 2008).

Simon *et al.* (2008) presented two minor weaknesses of their Delphi method. The first was that some participants declined to provide reasons for their classifications when required to do so. The second was that some participants provided more than the one required classification per category. This can have the effect of the facilitator making the participants' choices for them. The Delphi method will be problematic when the facilitator imposes her/his opinions or preconceptions on the proceedings (Tetzlaff, 1981; Linstone & Turoff, 2002; Gordon *et al.*, 2008). Stuter (1998) states that the Delphi method is unethical because facilitators deliberately manipulate participants in order to reach predefined conclusions.

A problem with the Delphi method is that it may force participants towards achieving consensus, by the emphasis on iterative clarification and agreement. Forcing will prevent true argument and results (Harrison & Datta, 2007; Delphi technique, 1994). Artificial consensus may also be gained by ignoring any contra-arguments (Linstone & Turoff, 2002; Gordon *et al.*, 2008). Cumbie (2007) states the three goals of research are generalisable results, precise measures, and realistic content. The problem with the Delphi method is that only provides realism.

The selection of the expert participants is critical to the success of the Delphi method, a poor selection of experts and result in a problematic Delphi method (McCubbrey & Taylor, 2005; Linstone & Turoff, 2002; Gordon *et al.*, 2008; The Delphi method, n.d.). Success criteria for expert selection include experts that understand the issues, have vision, and represent a variety of viewpoints (Fomin *et al.*, 2008). Participants in a Delphi method are disadvantaged because they do not have face-to-face stimulation (Gamon, 1991).

Linstone and Turoff (2002) provide a number of problems that can arise when using the Delphi method. The first is assuming that the Delphi method can be substituted for all group communication. The second is poor analytical, summarizing, and presenting techniques on the part of the monitor; in addition to different interpretations of the evaluation scales by the participants. The third is assuming that all Delphi methods must be conducted in the same way as a previous Delphi method. The fourth is the choice between requesting broad answers and keeping the process efficient.

Turoff and Hiltz (n.d.) state that the most difficult part of the Delphi method is designing the communication structure so that an accurate group view is obtained while ensuring an efficient communication process. Ketchel and Dolan (1974) indicated that the only problem with their use of the Delphi method was the structure of their questionnaire. The Delphi method can be problematic because in the later rounds, participants tend to respond more slowly and provide careless responses or drop out (Schonberger, 1979; Cumbie, 2007). Delphi technique (1994) indicates that the Delphi method must not be viewed as a total solution to forecasting and that it requires skill in written communication.

Gordon *et al.* (2008) mentions that the Delphi method does not accommodate cross impact analysis well, nor does it cope well with paradigm shifts. The Delphi method (n.d.)

presents arguments that the Delphi method is unscientific, inaccurate, and unreliable. The Delphi method is not useful for complex forecasts concerning multiple factors.

Skulmoski *et al.* (2007) warn that researchers must take into account many Delphi method design considerations for successful use; otherwise the Delphi method can yield poor results. The more innovative the Delphi design, the more validation that may be required using other research methods.

### **3.11.7 Conclusions from the Delphi technique/method literature**

In summary, the previous sub sections describe the Delphi method and present its uses and use contexts. The previous sub sections also list the benefits and disadvantages or problems with the Delphi method. The literature provides the background for the use of the Delphi method in this study. The Delphi method research methodology used in this research is derived from the Delphi method implementations described in the literature.

In conclusion, the Delphi method literature shows that there is no standard implementation of the Delphi method. The uses or purposes for each of the Delphi method implementations are different too. There are many Delphi method design considerations that must be carefully synthesized to produce a successful Delphi method. One of the most important of these considerations is the specific application domain context.

The Delphi method provides considered and discussed expert opinion. This, together with the survey results, provides generalisable results in the absence of an accurately definable Internet user population, for this study. The difficulty in accurately defining Internet web site populations is noted in Wolcott *et al.* (2001); and in Section 2.6.3 of this research referring to Agarwal and Venkatesh (2002) and Faulkner (2003). The value of this study to both the web site owners and the web site users will be enhanced web site goal achievement and user experience, respectively.

## **3.12 Delphi Method research methodology**

This research uses a specific implementation of the Delphi Method, considering the applicability of the themes presented in the Delphi Method literature review. Again, the purpose of the Delphi Method is to corroborate or refute the data generated by the e-mail questionnaire survey. The Delphi Method research methodology has been structured optimally for this purpose, given the resource constraints in this research.

Seven experts were selected to participate in the Delphi method. A maximum of seven experts are selected due to the researcher's money and time constraints. The researcher's time and money resources are limited, there is no research sponsor. Survey respondents have already been paid R1,300.00. The researcher offered each of the seven Delphi method participants R300.00 as an incentive to participate, totalling another R2,100.00. Also, the number seven is an odd number in order to provide a majority of consensus or dissensus if there is a 3/3 split of opinion. Seven experts have been used in a previous Delphi method to successfully achieve consensus (Treiblmaier & Pinterits, 2005). The selection of the seven experts is based on the researcher's personal reference, with complete emphasis on their

level of relevant knowledge. Each participant is also asked for references to other suitable candidates to increase the selection pool.

The participants were anonymous to each other, their responses were made under aliases, such as participant number one, participant number two, participant number three, and so on. The anonymity of the participants in the Delphi method is beneficial because it prevents any potentially destructive emotional involvement that often characterizes group decision making, or any disproportionate effect that a dominating participant can have on the outcome (Tetzlaff, 1981; Goldman *et al.*, 2008; McCubbrey & Taylor, 2005; Winters *et al.*, 2004; Linstone & Turoff, 2002; Gordon *et al.*, 2008; Cline, 2000; The Delphi method: General background., n.d.; Delphi method, n.d.a; The Delphi method, n.d.; Delphi technique, 1994).

The Delphi method consists of three rounds. An average of three rounds has been used in previous Delphi methods to successfully achieve consensus (Harrison & Datta, 2007). The time cost to each of the participants was one hour for the semi-structured interview, and about another thirty minutes each for round two and round three, totalling an estimated two hours. The participants were welcome to view the web sites on the Internet during any of the rounds, but the semi-structured interview was restricted to one hour per participant.

Round one was a semi-structured interview, which had a set of predefined questions but also allowed for free discussions of other relevant issues, question clarification, or further explanations. Semi-structured interviews are suitable because their purpose is both one of questionnaire type completion and one of discovery (Oates, 2006: 187-188); the Delphi method has the same purposes in this research. A further reason for round one being the only interview round is the researcher's office hour time limitations.

After round one, the researcher analysed and collated the responses into a single document. Unless there was complete consensus or dissensus, a second round began where the researcher submitted that same document via e-mail to all seven of the participants so that each participant could reconsider their initial responses in the context of the other participants' responses. The Delphi method is beneficial because it allows participants to defend those opinions that have greater value, and then yield to majority opinion where their opinion is weak. This characteristic is what enables a group opinion to emerge, both consensus and dissensus (Tetzlaff, 1981). A final third round took place only if there was incomplete consensus or dissensus following round two. Round three followed the same format as round two.

All the Delphi method rounds were based on the semi-structured interview. In the semi-structured interview there was a section for each of the eleven retained factors from research question three. For each of these eleven sections or factors, the constituent sub-criteria are listed and two agree/disagree questions are posed, together with a factor-applicable screen print of the first ranking and last ranking web site.

The first question asks whether the participant agrees or disagrees with the mean score for the web site ranking first and the web site ranking last in that factor. The score is a percentage score, and is calculated by dividing the mean value achieved in the e-mail questionnaire survey, for that major usability category, by the highest possible score achievable in that major usability category. Percentage numbers are commonly used for



measuring, so it is expected to be suitable for the participants to work with. Percentage numbers are also easy to convert back to a reference to the research question benchmarks.

Consensus in the first question corroborates the mean scores and relative ranking of the first and last place web sites obtained in the e-mail questionnaire survey. This consensus does not directly confirm the means scores and relative rankings of the second, third and fourth place web sites; the corroboration of the first and last place web sites is reasonably extendable to the corroboration for the second, third and fourth place web sites, if the corroboration of the first and last place web sites is accurate.

The second question asks the participants to agree or disagree with an improvement recommendation for the web sites with the first place relative ranking in each major usability category. The improvement recommendation is based on the researcher's opinion, and its purpose is to check whether the web sites in first place can still be improved upon. If there is consensus, and the first question corroborates the first place relative ranking web sites, then the need for improvement is also reasonably extendable to the web sites with second, third, fourth, and fifth place relative rankings, because these web sites have poorer usability scores than the first place relative ranking web sites, which need improvement. Consensus in the first question, to corroborate the first place relative ranking web sites, is a prerequisite for the application of consensus in the second question, which is based on the first place relative ranking web sites.

### **3.13 Conclusions**

In this chapter, the research strategy was presented and motivated, namely the survey research strategy. Thereafter, analyses of types of survey data, the Likert scale, survey data collection methods, and types of survey questions were provided. Following this, the questionnaire question types and validation were explained. Then the population definition and size was explained, the sample definition and size was determined, and the data handling was described. Lastly, the method triangulation with the Delphi Method was explained, the themes from the Delphi Method literature were shown, and the Delphi Method research methodology was detailed.

In conclusion, Chapter Three presents the advantages and disadvantages of using a questionnaire survey to evaluate web site usability. Although this research is constrained by low resource availability, and the sample is very small and specific, the methodology chosen for this research is shown to be an appropriate research methodology for this type of research. Further, the method triangulation with the data from the Delphi method negates any bias introduced by a low response rate. The Delphi Method also corroborates or refutes the e-mail questionnaire survey data to provide generalisable results, given the difficulty of accurately defining Internet populations (Wolcott *et al.*, 2001).

This chapter shows the value that each methodology contributes to this research and the value that the method triangulation contributes to this research. Both these research methodologies provide a direct measure of the usability of these web sites. The research methodologies provide answers to the research questions, which, in turn, address the research problem statement.

Chapter Three detailed the research methodology theory for this research, while the next chapter, Chapter Four describes how that research methodology theory was employed in

practice for this research. Chapter Four is also a detailed discussion and statistical analysis of the data gathered from the e-mail questionnaire survey and the Delphi Method, which were both described in Chapter Three. In Chapter Four, the data from both methods are analysed separately and then analysed together so that the methods are triangulated. Thereafter, Chapter Four is concluded by presenting the effect of the method triangulation.

## **Chapter 4: Presentation and Discussion of the Data**

### **4.1 Introduction to the presentation and discussion of the data**

Chapter Four is the presentation and discussion of the data gathered by the research methodologies described in Chapter Three, these being the e-mail questionnaire survey and the Delphi Method. The presentation and discussion of the data is both an analysis of the actual data generation process and the data itself. The data generated from the e-mail questionnaire survey is quantitative, while the data generated from the Delphi Method is quantitative and qualitative.

The presentation and discussion of the data aims to provide statistical evidence to apply to the problem statement by answering each of the three research questions. The problem statement states that, the five South African Super 14 Rugby franchise web sites do not have good usability consistency, within each web site, and across all five web sites. The three research questions that address the problem statement are:

Research question one: How good or poor are the web sites' overall usability scores, in isolation and relative to one another?

Research question two: Are the web sites' usability criteria scores good and consistent, in isolation and relative to one another?

Research question three: What are the most important factors to focus on in order to achieve good and consistent usability?

Chapter Four first provides a detailed account of the actual e-mail questionnaire survey process, which was described in Chapter Three. Thereafter, the data gathered from the e-mail questionnaire survey is presented and discussed. The data from the e-mail questionnaire survey is then used to answer each of the three research questions. Chapter Four continues by providing a detailed account of the Delphi method process, followed by a presentation and discussion of the data gathered from the Delphi Method. Lastly, the data from both methods are presented and discussed, providing method triangulation, this enhances the data validity and corroborates inferences made from both data sets (Oates, 2006: 37).

### **4.2 Detailed account of the actual e-mail questionnaire survey process**

The e-mail questionnaire survey expected completed questionnaires from all thirty of the 2008 UNISA postgraduate students that were studying towards a Master of Science (MSc) in Computer Science or Information Systems. This approach was taken due to the inherent difficulty in accurately defining Internet web site populations, as noted in Wolcott *et al.* (2001); and in Section 2.6.3 of this research referring to Agarwal and Venkatesh (2002) and Faulkner (2003).

The contact details of all thirty 2008 UNISA postgraduate students, that were studying towards a Master of Science (MSc) in Computer Science or Information Systems, was obtained on 6<sup>th</sup> June 2008. Two of the people in the list did not have e-mail addresses. The researcher sent out individually addressed e-mails to each of the remaining twenty eight

people, forty four days later. All were offered one hundred Rand if the questionnaire was returned by the 31<sup>st</sup> August 2008, giving each person forty two days to complete the questionnaire from date that they received the questionnaire. Only three questionnaires were returned, and none of the respondents requested any compensation. Reminder e-mails were sent but no more questionnaires were returned. Non-response reasons were provided by three people, the reasons being no time and the web sites cannot be located. Two of the three respondents provided the following comments: The questionnaire was long and difficult to understand and complete; and that the web sites were difficult to find. The Response rate was 10.71% and there was no cost.

The researcher attempted to increase the number of completed questionnaires by obtaining contact details of seven additional samples. The sampling method for these additional samples is the same as the initial sample, they have the same advantages and disadvantages, and are also non probabilistic, as described in Section 3.8. These seven additional samples only aim to increase the data set using the same sampling method. The second sample was the contact details for all one hundred of the 2008 Honours Human Computer Interaction students at UNISA, and was obtained on 24<sup>th</sup> July 2008. Six of the people in the list did not have an e-mail address. The researcher sent out individually addressed e-mails to each of the remaining ninety four people over the next nineteen days. Half were offered one hundred Rand and the other half were offered two hundred Rand, if the questionnaire was returned by the 31<sup>st</sup> August 2008. This gave each person a maximum of thirty three days and a minimum of nineteen days to complete the questionnaire from date that they received the questionnaire. Only three questionnaires were returned, and all of the respondents requested compensation. Non-response reasons were provided by four people, the reasons being invasion of privacy, no time, and the questionnaire is too long. One of the three respondents provided general observations about the web sites. The Response rate was 3.19% and the cost was five hundred Rand.

The third sample was the contact details for sixteen friends of one of the second sample's respondents. The contact details of all sixteen were obtained on 28<sup>th</sup> August 2008. The researcher sent out one bulk e-mail to all of the sixteen people on the same day. All were offered two hundred Rand if the questionnaire was returned by the 5<sup>th</sup> September 2008, giving each person eight days to complete the questionnaire from date that they received the questionnaire. Only three questionnaires were returned, and two of the respondents requested compensation. No non-response reasons were provided. No respondents provided any comments. The Response rate was 18.75% and the cost was four hundred Rand.

The fourth sample was the contact details of nine of the researcher's wife's work colleagues. The researcher's wife sent out one bulk e-mail to all of the nine people on the 28<sup>th</sup> August 2008. All were offered one hundred Rand if the questionnaire was returned by the 5<sup>th</sup> September 2008, giving each person eight days to complete the questionnaire from date that they received the questionnaire. Three questionnaires were returned, and none of the respondents requested compensation. No non-response reasons were provided. No respondents provided any comments. The Response rate was 33.33% and there was no cost.

The fifth sample was the contact details for sixty five of the 2008 Honours Research Methodology students at UNISA, and was obtained on 2<sup>nd</sup> September 2008. Thirty of the people in the list were excluded because they were a repeat of sample two, international

students to which payment will be problematic, or did not have an e-mail address. The researcher sent out individually addressed e-mails to each of the remaining thirty five people over the next one day. All were offered two hundred Rand if the questionnaire was returned by the 12<sup>th</sup> September 2008, giving each person a maximum of ten days and a minimum of nine days to complete the questionnaire from date that they received the questionnaire. Only two questionnaires were returned, and one of the respondents requested compensation. No non-response reasons were provided. One of the two respondents provided a comment that the web sites were difficult to access. The Response rate was 5.71% and the cost was two hundred Rand.

The sixth sample was the contact details of two friends of the researcher, obtained on 3<sup>rd</sup> September 2008. The researcher sent out individually addressed e-mails to each of the two people on the same day. Both were offered two hundred Rand if the questionnaire was returned by the 12<sup>th</sup> September 2008, giving each person nine days to complete the questionnaire from date that they received the questionnaire. No questionnaires were returned. No non-response reasons were provided. The Response rate was 0.00% and there was no cost.

The seventh sample was the contact details for sixteen friends of one of the third sample's respondents. The contact details of all sixteen were obtained on 4<sup>th</sup> September 2008. The researcher sent out one bulk e-mail to all of the sixteen people on the same day. All were offered two hundred Rand if the questionnaire was returned by the 12<sup>th</sup> September 2008, giving each person eight days to complete the questionnaire from date that they received the questionnaire. Only one questionnaire was returned and that respondent requested compensation. No non-response reasons were provided. No respondents provided any comments. The Response rate was 6.25% and the cost was two hundred Rand.

The eighth sample was the contact details for two thousand eight hundred and fifty four of the UNISA 2008 1st year Computer Science students that were studying the following courses: Theoretical Computer Science 1, Introduction to Programming 2, Computer Systems: Fundamental Concepts), and Human-Computer Interaction I. The contact details were obtained on 17<sup>th</sup> September 2008. The researcher only sent out several bulk e-mails to the first one hundred and forty people, because the researcher could not afford to compensate such a large group. The e-mails were sent out over the next eight days. All were offered two hundred Rand if the questionnaire was returned by either the 19<sup>th</sup> September 2008, 26<sup>th</sup> September 2008, or the 3<sup>rd</sup> October 2008, depending on which bulk e-mail they were in. This gave each person a maximum of nine days and a minimum of two days to complete the questionnaire from date that they received the questionnaire. No questionnaires were returned. One non-response reason was provided, being that the person did not want to participate. The Response rate was 0.00% and there was no cost.

To summarise, over the period from 6<sup>th</sup> June 2008 to 17<sup>th</sup> September 2008 a total of three hundred and forty e-mails were sent out and only fifteen questionnaires were returned, being a response rate of 4.41% and a cost of one thousand three hundred Rand. Table 1 presents a summary of the response rates experienced. The low response rates were experienced even with incentives of one hundred or two hundred Rand for a completed questionnaire.

Sample Number	Total Number of Questionnaires Sent	Minimum Compensation Offer	Number of Returned Questionnaires	Response Rate	Total Compensation Paid
1	28	R 100.00	3	10.71%	R -
2	94	R 100.00	3	3.19%	R 500.00
3	16	R 200.00	3	18.75%	R 400.00
4	9	R 100.00	3	33.33%	R -
5	35	R 200.00	2	5.71%	R 200.00
6	2	R 200.00	0	0.00%	R -
7	16	R 200.00	1	6.25%	R 200.00
8	140	R 200.00	0	0.00%	R -
TOTAL	340		15	4.41%	R 1,300.00

*Table 1: Summary of the e-mail questionnaire response rate*

Non-response is only a problem when the non-respondents differ in meaningful ways to the responding sample respondents. The researcher has no way to determine if the non-respondents differ in meaningful ways to the responding sample respondents, therefore the non response may introduce bias into the results of this research. The low, e-mail questionnaire response rates necessitate a method triangulation, to enhance the data validity and corroborate inferences made from the e-mail questionnaire survey (Oates, 2006: 37).

### 4.3 Characteristics of the e-mail questionnaire survey respondents

The e-mail questionnaire survey respondents were asked six factual questions about themselves in addition to the actual web site questions. These six are age, gender, place grew up, South African ethnic classification, most liked team, and if the respondent is a fan of Rugby.

The respondent age range is 26 years, with the maximum respondent age being 49 years, and the minimum age being 23 years, and the average age is 29 years. 60% or 9 of the respondents are male and 40% or 6 are female. 93% or 14 of the respondents grew up in South Africa while 7% or 1 grew up abroad.

In terms of South African ethnic classifications, 33% or 5 of the respondents are African, 13% or 2 are Coloured, 13% or 2 are Indian, 33% or 5 are White, and 7% or 1 indicated another group. In terms of Rugby team support, 13% or 2 of the respondents like the Bulls team the most, 7% or 1 like the Cheetahs the most, 13% or 2 like the Lions the most, 27% or 4 like the Sharks the most, 20% or 3 like the Stormers the most, 13% or 2 like none of the teams the most, and 7% or 1 indicated that they did not wish to answer this question. In terms of Rugby support, 47% or 7 of the respondents indicated that they are not fans of Rugby and 53% or 8 indicated that they are fans of Rugby. The spread of Rugby team support and being a Rugby fan or not, reduces the expectation of bias in the questionnaire survey results.

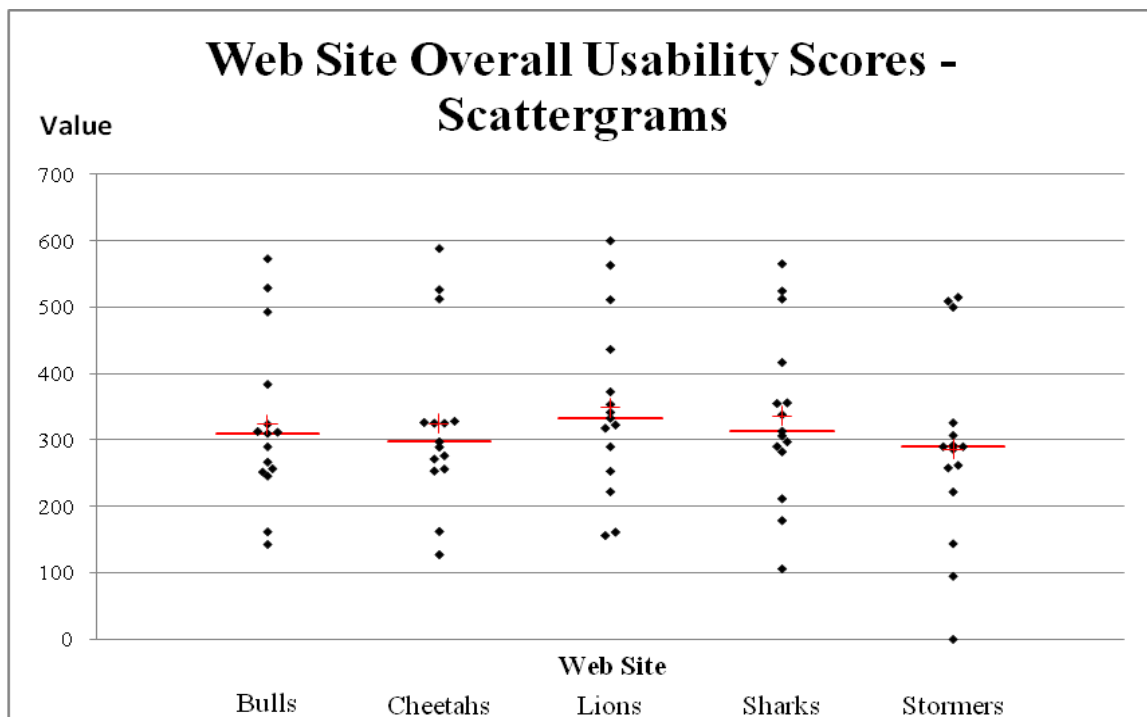
#### 4.4 Presentation and discussion of the e-mail questionnaire survey data

The researcher added a zero to any blank fields in a returned questionnaire. This was done because the questionnaire instructions indicate that a “0 means that the criteria is not available at all to score”.

#### 4.5 Presentation and discussion of research question 1

The first research question is: How good or poor are the web sites' overall usability scores, in isolation and relative to the one another?

Overall usability is mentioned as a relevant measure in Section 2.7.2 (Agarwal & Venkatesh, 2002); Section 2.9 (Chiravuri & Peracchio, 2003); Section 2.9 (Hu & Chang, 2006); Section 2.10.2 (Ssemugabi, 2006); and Section 2.13 (Djamasbi *et al.*, 2007). Figure 1, extracted from XLSTAT, provides a visual aid of the distribution of the sample overall usability scores obtained from the e-mail questionnaire survey. This figure provides the context for answering research question one.



*Figure 1: Scattergrams of the sample overall usability scores*

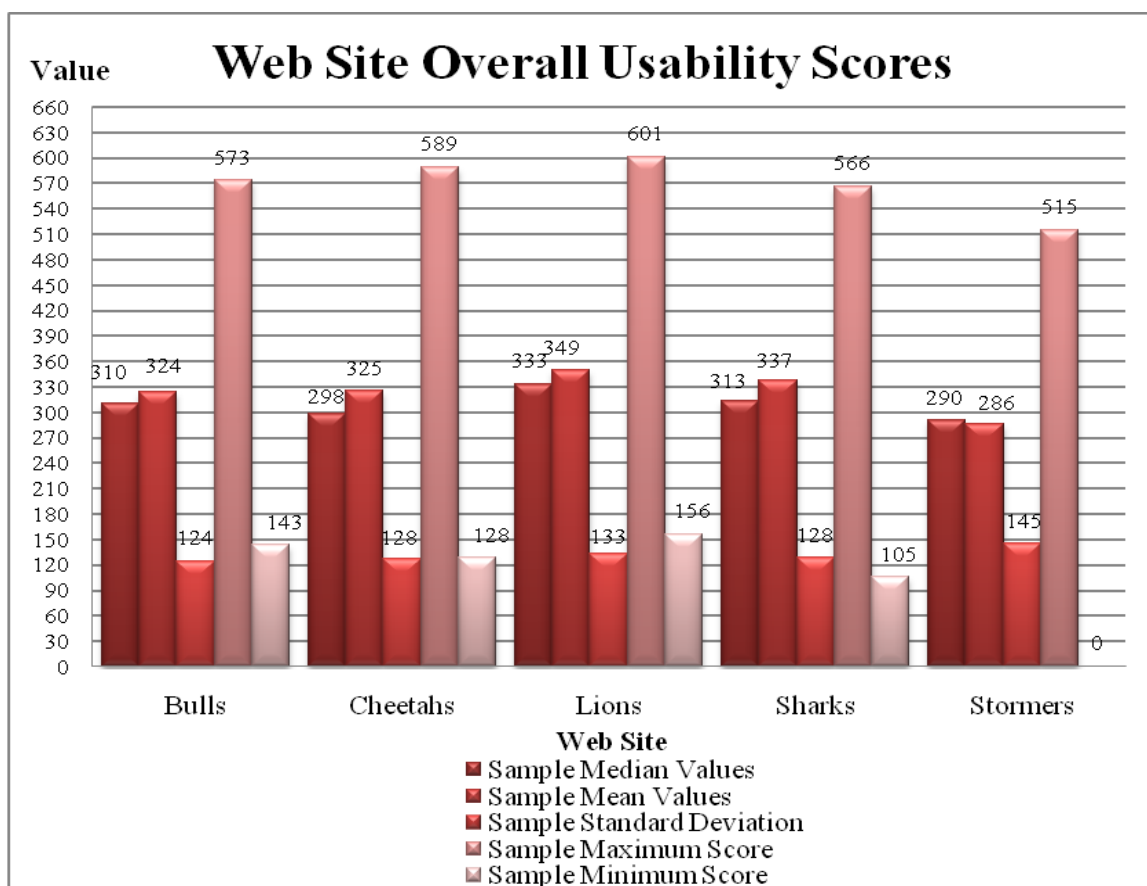
This research question is answered in two parts. Part one answers how good or poor are the web sites' overall usability scores in isolation. Part two of this research question answers how good or poor are the web sites' overall usability scores relative to one another.

To answer part one; the researcher measured each of the web sites against a benchmark. The benchmark is a score of at least 375 and a web site must obtain at least this score in order for that web site to be regarded as having a good overall usability score, else the web site has a poor overall usability score. This is the midpoint score on the questionnaire. This number is calculated by entering a 5, the positive mid point score, for all the positive

questions and -5, the negative mid point score, for all the negative questions on the questionnaire.

This calculation is done because the questionnaire instructions state that the positive questions are questions that require scores from +1 to +10 relating to the how well the criterion is being represented, and +1 indicates that the criterion is extremely poorly represented and +10 indicates that the criterion is extremely well represented. The negative questions are questions that require scores from -10 to -1 relating to how distracting or irritating the criteria is, and -10 indicates a major distraction or irritant and -1 indicates a minor distraction or irritant.

Figure 2 shows summary statistics for the sample overall usability scores. It shows measures of central tendency and measures of dispersion. The measures of central tendency are where the majority of values tend to be found. These measures are the arithmetic mean (mean) and median. The mean can be distorted by extreme values but the median is not affected by extreme values (Oates, 2006: 254). The mean and median both lie close together for all the web sites, and below the 375 benchmark value. To conclude, in isolation, all of the web sites in the sample have poor overall usability scores because all the mean and median scores lie below the 375 benchmark value.



**Figure 2: Summary statistics bar chart of the sample overall usability scores**

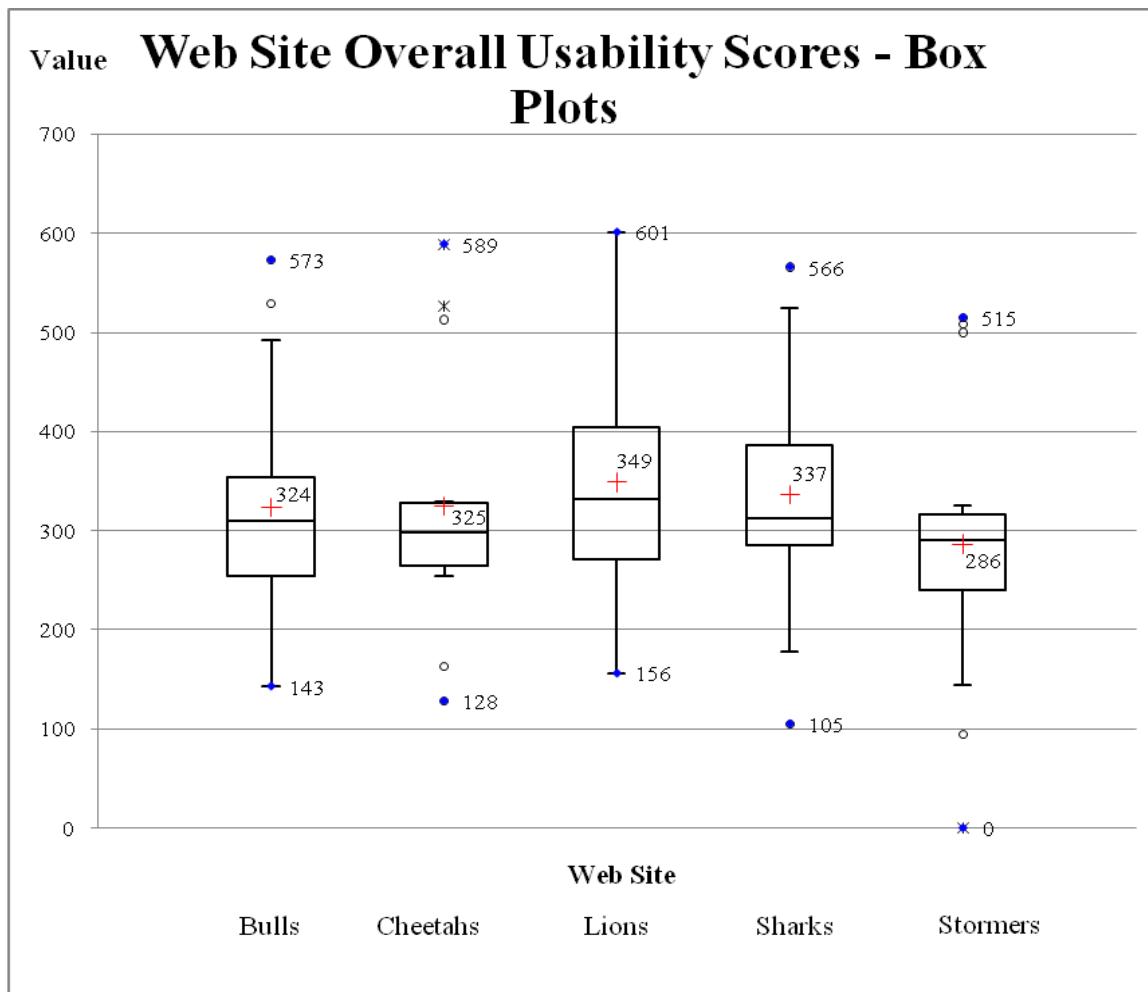
To answer part two of the question, summary statistics are compared among the web sites. Both measures of central tendency and measures of dispersion are used. The measures of central tendency have been presented in the first part of this question. The measures of dispersion are the range and inter quartile range. The range is the difference between a



maximum score and a minimum score; it tells one how far apart the highest and lowest values are and is affected by extreme values. The inter quartile range is where the middle 50% of the data values lie. The standard deviation is another measure of dispersion or spread of the data. The standard deviation measures how the scores are clustered around the mean. Since the standard deviation uses the mean it can also be distorted by extreme values (Oates, 2006: 256). The coefficient of variation is the ratio of the standard deviation to the mean, expressed as a percent, and allows comparison of dispersions (Lind *et al.*, 2005: 112).

Part two of this question is answered by a ranking of the web sites from best to poorest. A good web site is expected to score high in the measures of central tendency and low in the measures of dispersion, that is, the majority of the scores are high and those scores are closely or consistently grouped around that high score.

A further figure, Figure 3, extracted from XLSTAT, provides a different view of the summary statistics in a manner conducive to relative comparison. The boxes in Figure 3 highlight the inter quartile range. It also shows various ranges, such as the whisker lines to outlier data values 1.5 times the inter quartile range. Extreme outliers are left as data points.



**Figure 3: Box plots of the sample overall scores**

Table 2 summarises the rankings based on four measures. To conclude, from a relative point of view, the Lions web site appears in the top two ranks in all four sample measures, while the Stormers web site ranks last in all four sample measures. This indicates that the Lions web site has the best overall usability scores and the Stormers web site has the poorest overall usability scores. The other web sites fit in between these two, without any obvious ranking pattern.

Web Site	Means Scores Ranking	Median Scores Ranking	Range Scores Ranking	Coefficient of Variation Scores Ranking
Bulls	4	3	1	3
Cheetahs	3	4	3	4
Lions	1	1	2	2
Sharks	2	2	4	1
Stormers	5	5	5	5

**Table 2: Sample overall usability score rankings**

These conclusions hold for the sample only. In order to determine how the sample overall usability scores relate to the entire population of users who use these web sites, inferential statistical techniques are used. The *t* distribution to test for a population mean is a

statistical, inferential measure that can be meaningfully applied to small samples (Lind *et al.*, 2005: 335-339). The *t* distribution is based on the assumption that the population is normally distributed or nearly normally distributed. The method triangulation with the Delphi method will mitigate any risks associated with this assumption.

<b>One-sample t-test / Two-tailed test</b>	<b>Bulls</b>	<b>Cheetahs</b>	<b>Lions</b>	<b>Sharks</b>	<b>Stormers</b>
Significance level (%):	1.00%	1.00%	1.00%	1.00%	1.00%
Null hypothesis: H <sub>0</sub> : The difference between the population mean and sample mean is not significantly different from zero. The population mean is.	324	325	349	337	286
Alternative hypothesis: H <sub>a</sub> : The difference between the population mean and sample mean is significantly different from zero. The population mean is.	324	325	349	337	286
99% confidence interval on the mean-Lower Bound:	228.24	227.05	246.97	238.46	175.02
99% confidence interval on the mean-Upper Bound:	419.10	423.08	451.57	435.14	397.78
t (Observed value)	-0.010	0.002	0.008	-0.006	0.011
t (Critical values)	-2.977; +2.977	-2.977; +2.977	-2.977; +2.977	-2.977; +2.977	-2.977; +2.977
DF	14	14	14	14	14
p-value (Two-tailed)	0.9919	0.9984	0.9939	0.9953	0.9916
alpha	0.01	0.01	0.01	0.01	0.01
Test interpretation:	As the computed p-value is greater than the significance level alpha=0.01, <b>one should accept the null hypothesis H<sub>0</sub>.</b>	As the computed p-value is greater than the significance level alpha=0.01, <b>one should accept the null hypothesis H<sub>0</sub>.</b>	As the computed p-value is greater than the significance level alpha=0.01, <b>one should accept the null hypothesis H<sub>0</sub>.</b>	As the computed p-value is greater than the significance level alpha=0.01, <b>one should accept the null hypothesis H<sub>0</sub>.</b>	As the computed p-value is greater than the significance level alpha=0.01, <b>one should accept the null hypothesis H<sub>0</sub>.</b>

**Table 3: Summary of the Student's *t* test**

Table 3, with data extracted from XLSTAT, presents a summary of the Student's *t* test. The Student's *t* test is used to test whether there are statistically significant differences between the sample mean overall usability scores and population mean overall usability scores. This test is done by way of hypothesis testing. A hypothesis is a statement or assumption about a population parameter, such as the population mean overall usability score. Hypothesis testing requires a null hypothesis to be disproved, and it is always a

statement of no difference. The null hypothesis, depicted as  $H_0$ , is stated as the difference between the population mean and sample mean is not significantly different from zero. The null hypothesis is true until disproved. Only if the null hypothesis is disproved then the alternative hypothesis is accepted. The alternative hypothesis, depicted as  $H_a$ , is stated as the difference between the population mean and sample mean is significantly different from zero.

The Student's  $t$  test provides a statistical significance level, which is the probability of rejecting the null hypothesis when it is true. In this test there is a 1% probability that the test will indicate that the sample mean overall usability scores and population mean overall usability scores are different from zero when they are actually not different from zero. Stated differently, the test has a 1% level of risk or an alpha of 1%.

The Student's  $t$  test also provides the ranges or confidence intervals that the population mean overall usability scores are likely to be within. Here the Student's  $t$  test indicates that the researcher can be 99% confident that the population mean overall usability scores lie between the 99% confidence interval lower bounds and upper bounds.

Further, the Student's  $t$  test provides an observed  $t$  value which is compared to two critical  $t$  values for a two tailed test. The critical  $t$  values are determined from the Student's  $t$  distribution values table using the significance level and degrees of freedom value (DF) (Lind *et al.*, 2005: 722). Where the observed  $t$  value is inside the two critical  $t$  values on the  $t$  scale the null hypothesis must not be rejected, if the observed  $t$  value is outside the two critical  $t$  values then the null hypothesis must be rejected and the alternative hypothesis accepted. There are also Student's  $t$  test p-values, which give additional insight into the null hypothesis acceptance or rejection decision. Lind *et al.* (2005: 328) defines the p-value as the probability of observing a sample value as extreme as, or more extreme than, the value observed, given the null hypothesis is true. If the p-value is larger than the significance level then the null hypothesis is not rejected.

The interpretation of the test is that the null hypothesis, depicted as  $H_0$ , is not rejected. The conclusion is that the difference between the population mean and sample mean is not significantly different from zero, at a 1% level of significance.

To conclude, in isolation, all of the web sites have poor overall usability scores because all the mean and median scores lie below the 375 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for overall usability scores is: Lions, Sharks, Cheetahs, Bulls, and then Stormers. However, the Student's  $t$  test negates the relative ranking, and this negation will be tested empirically by the Delphi method.

## **4.6 Presentation and discussion of research question 2**

The second research question is: Are the web sites' usability criteria scores good and consistent, in isolation and relative to the one another?

The e-mail questionnaire contains ten major usability categories, and usability sub-criteria within each of these ten major categories. The ten major usability categories are the usability criteria in this research question. Section 2.11 shows that usability is measured

and consists of many different, underlying usability criteria, and these are used to evaluate usability.

This research question is answered in three parts. Part one answers how good or poor are the web sites' scores in isolation, for each of the ten major usability categories. Part two answers how good or poor are the web sites' scores relative to one another, for each of the ten major usability categories. Part three is based on the results of part one and part two, and answers how good and consistent are the web sites' scores, in isolation and relative to one another.

To answer part one, the researcher measures each of the ten major usability categories against a separate benchmark. The benchmark is a score calculated by entering a 5, the positive mid point score, for all the positive questions within a category and -5, the negative mid point score, for all the negative questions within a category. Any score of at least the mid point is regarded as good, while any score less than the mid point is regarded as poor.

Part two of this question is answered by a ranking of the web sites from best to poorest for each of the ten major usability categories. A good web site is expected to score high in the measures of central tendency and low in the measures of dispersion, so that the majority of the scores are high and those scores are closely or consistently grouped around that high score.

The conclusions made in part one and part two for each of the ten major usability categories hold for the sample only. In order to determine how the sample scores relate to the entire population of users who use these web sites, the analysis of variance (ANOVA) test is used (Backhouse, 1967: 157). A further test, the chi-square or goodness-of-fit test, is used to test if the difference in sample means across the web sites is statistically significant (Backhouse, 1967: 130-143).

The ANOVA is based on the assumption that the web site populations are normally distributed, have equal standard deviations, and are independent (Lind *et al.*, 2005: 387-410). The method triangulation with the Delphi method will mitigate any risks associated with these assumptions. ANOVA is more efficient than Student's *t* test for multiple simultaneous comparisons, and does not result in a build up of type one error, which is rejecting the null hypothesis when it is true. ANOVA is done to determine if there is a difference in the mean scores for the population at a 99% confidence level, for each of the ten major usability categories. The null hypothesis states that there is no difference in the mean scores for the population, while the alternate hypothesis states that not all the mean scores are the same for the population. The ANOVA produces a calculated F value for each of the ten major usability categories. The critical F value for each of the ten major usability categories is 3.600, using 4 degrees of freedom in the numerator and 70 degrees of freedom in the denominator. The null hypothesis is not rejected if the calculated F value is less than the critical F value of 3.600.

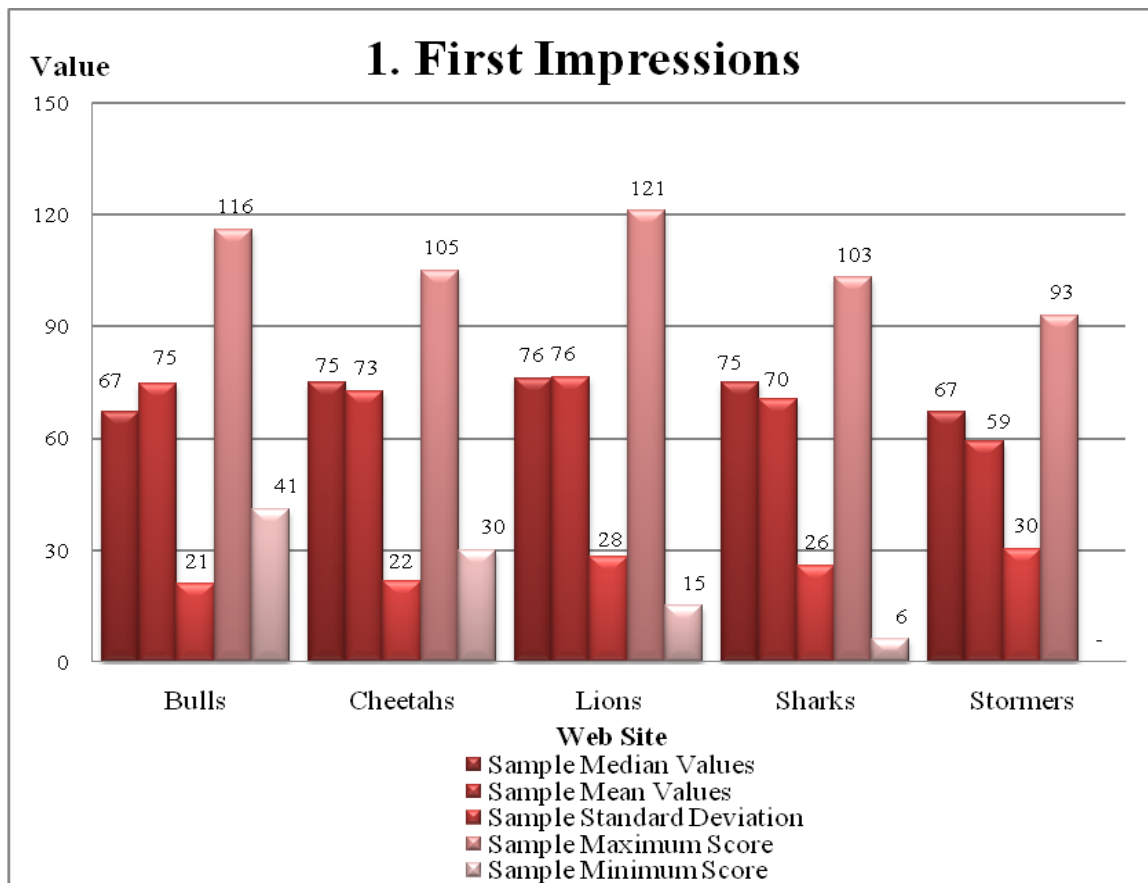
The chi-square or goodness-of-fit tests the sample mean scores against the sample global mean scores, for each of the ten major usability categories. There are no salient assumptions with this test (Lind *et al.*, 2005: 523-532); however, the method triangulation with the Delphi method will mitigate any possible risks. The null hypothesis states that there is no difference in the sample mean scores when they are compared to the sample

global mean score. For each of the ten major usability categories, the global mean is the mean of all the web sites' scores for that major usability category. The alternate hypothesis states that there is a difference. The chi-square test is done at a 99% confidence level and produces a calculated  $\chi^2$  value for each of the ten major usability categories. The critical  $\chi^2$  value for each of the ten major usability categories is 13.277, using 4 degrees of freedom. The null hypothesis is not rejected if the calculated  $\chi^2$  value is less than the critical  $\chi^2$  value of 13.277.

The ten major usability categories in the e-mail questionnaire are: First impressions, navigation, content, attractors, findability, making contact, browser compatibility, knowledge of users, user satisfaction, and other useful information.

The first major usability category is first impressions, and the summary statistics are shown in Figure 4. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, first impressions are always important. If the website does not look professional and if it does not function in an efficient and effective way as well as being attractive, potential clients or users may be lost.

The first impressions major usability category is concerned with the initial subjective reaction of a web site user to a web site. The initial subjective reaction of a user is powerful enough to cause the user to stay on the web or leave the web site, so this measure is a web site's first critical hurdle. The personal, subjective judgements of a user do provide valid measures of usability, as presented in Section 2.7.1 (Agarwal & Venkatesh, 2002); Section 2.9 (Morkes & Nielsen, 1997); and Section 2.11 (Caruana *et al.*, 2004). The first impressions measure is also viewed as the perceived attractiveness of a web site and a measure of web site quality, according to Section 2.11 (Vaidya & Nandy, 2005; Seethamraju, 2004; Aladwani & Palvia *cited in* Seethamraju, 2004). In addition, the first impressions measure provides an evaluation of the trustworthiness of a web site (Corritore *et al.*, 2005). The home page is the page that provides the first impressions for almost all web sites. The home page has been compared to the cover of a magazine, and the home page of a web site has the same effect on potential customers; so this makes evaluating the home page crucial, and it is a relatively inexpensive way of measuring a web site's usability, per Section 2.6.1 (Zhang *et al.*, 2000b); Section 2.9 (Singh & Dalal, 1999); and Section 2.11 (Singh & Dalal, 1999; Zhang *et al.*, 2000b).



*Figure 4: Summary statistics bar chart of the first impressions usability scores*

In isolation, all of the web sites have good first impressions usability scores because all the mean and median scores lie above the 45 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Lions, Bulls, Cheetahs, Sharks, and then Stormers.

The ANOVA produces a calculated F value of 1.079, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 2.671. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

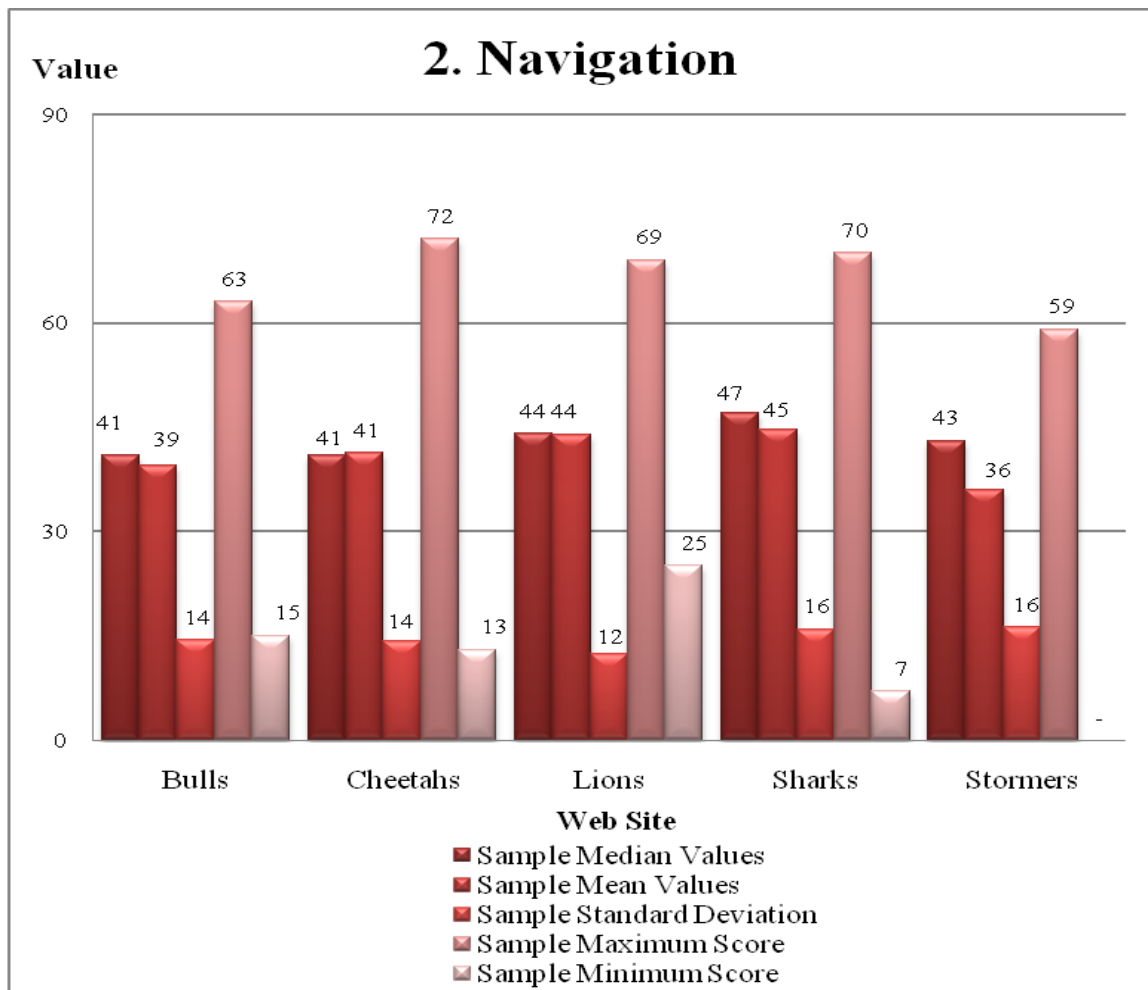
The second major usability category is navigation, and the summary statistics are shown in Figure 5. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, being offered an easy way to find your way around the website is critical to the success of the web site.

Navigation is the web site usability criterion that facilitates the movement of a user through a web site; navigation is the page links and structure of a web site that show a user where to go on a web site. A web site must have good navigation if users are going to stay on the web site and be able to successfully explore a web site. If the navigation of a web site is

poor, users will not be able access all the web site content and users will become frustrated and leave the web site. Understanding the users of a web site is necessary for designing good navigation on a web site, per Section 2.3.2 (Bevan, 2001; Jones & McCoy, 2003; Santosa, 2003). Navigation is a measure of the effectiveness of a web site, or how well the web site achieves its purpose for existing, as shown in Section 2.3.3 (Bentley *et al.*, 2005; Zhang *et al.*, 2000b; Yen *et al.*, 2005; Gehrke & Turban *cited in* Agarwal & Venkatesh, 2002). Designing for good navigation on a web site is an important design principle and important design heuristic, as in Section 2.4.2 (Shneiderman *cited in* Mahfouz, 2000; Barber *cited in* Ssemugabi, 2006). A good hypertext structure will allow for good navigation, per Section 2.4.3 (Morkes & Nielsen, 1997; Bevan, 2001).

Indeed, good navigation on a web site is a measure of the success of a web site, according to Section 2.11 (Aladwani, 2003). Navigation is an important web site quality criterion and web site usability evaluation criterion, as presented in Section 2.11 (Zhang *et al.*, 2000a; Vaidya & Nandy, 2005; Caruana *et al.*, 2004; Seethamraju, 2004; Zo & Nazareth, 2001; Kim, 2002; De Villiers, 2000; Zhang *et al.*, 2000b; Tan & Lee, 2005; Hong & Moriai, 1997; Fisher *et al.*, 2004; Wells *et al.*, 2007; Yen *et al.*, 2005; Koutri & Daskalaki, 2007; Bentley *et al.*, 2005). Navigation is also a determinant of online trustworthiness, as provided by Section 2.11 (Corritore *et al.*, 2005). Navigation problems exist on web sites because good navigation is difficult to achieve, and navigation problems result in under utilised web sites, according to Section 2.12 (Alessi & Trollip *cited in* Ssemugabi, 2006; Hahsler & Simon, 2000; Rumpradit, 1998; Zibell, 2000; Head *cited in* Mariage *et al.*, 2005; Borges *et al.*, 2003).





*Figure 5: Summary statistics bar chart of the navigation usability scores*

In isolation, the Cheetahs, Lions and Sharks web sites have good navigation usability scores because the mean and median scores lie above the 40 benchmark value. The Bulls and Stormers web sites have poor navigation usability scores because the mean scores lie below the 40 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for navigation usability scores is: Sharks, Lions, Cheetahs, Bulls, and then Stormers.

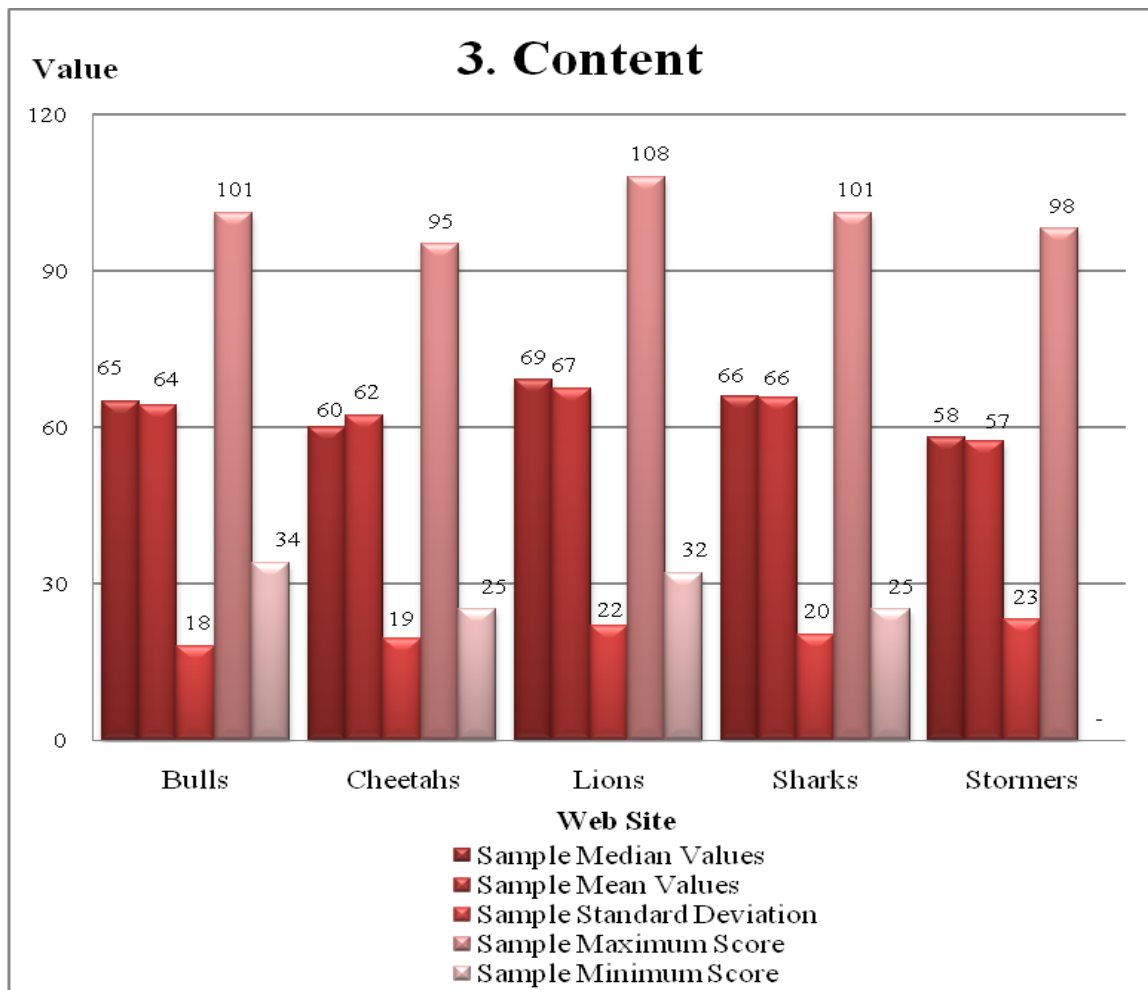
The ANOVA produces a calculated F value of 0.856, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 1.199. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The third major usability category is content, and the summary statistics are shown in Figure 6. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, without valuable and useful

information the website may well fail to achieve its objectives. The key to good content is that it is extensive and original.

Content is a usability factor that measures whether users find the subject matter of a web site worthwhile and meaningful. Content is the substance of a web site; without content a web site has nothing to offer a user. A web site communicates its purpose for being, its value to a user, and its total subject matter through the content. Content is the information that a web site presents and content is the information that a web site user requires. Once a user has accessed a web site and decided to explore the web site, it is the content that determines if the user will stay on the web site or leave the web site. Including content design as part of the design process is necessary for good usability, per Section 2.3.1 (Fisher *et al.*, 2002) and Section 2.3.3 (Agarwal & Venkatesh, 2002; Fisher *et al.*, 2004). A design guideline for content is that it must be appropriate for the type of users accessing the web site, according to Section 2.4.2 (Fisher *et al.*, 2004; Agarwal & Venkatesh, 2002) and Section 2.5 (Zibell, 2000; Calongne, 2001). Content that is textual must adhere to conventional, good writing style; and content must support the user practice of scanning instead of reading, as presented in Section 2.4.3 (Morkes & Nielsen, 1997; Bevan, 2001; Zibell, 2000).

Content has been measured using questionnaire usability evaluation methods, provided in Section 2.10.2 (Davern *et al.*, 2000; Klein, 2002). Content is a key web site usability evaluation criterion, as shown in Section 2.11 (Lee & Kozar, 2004; Aladwani, 2003; Lee, 1999; Zhang *et al.*, 2000a; Vaidya & Nandy, 2005; Fisher *et al.*, 2002; Caruana *et al.*, 2004; Seethamraju, 2004; Corritore *et al.*, 2005; Zo & Nazareth, 2001; Klein, 2003; Klein, 2002; De Villiers, 2000; Agarwal & Venkatesh, 2002; Tan & Lee, 2005; Liu & Arnett, 1998; Hong & Moriai, 1997; Fisher *et al.*, 2004; Xiao & Dasgupta, 2006). Poor content on web sites has resulted in poor usability on those web sites, as noted in Section 2.12 (Morkes & Nielsen, 1997; Alessi & Trollip *cited in* Ssemugabi, 2006; Nielsen, 1994b; Tan & Lee, 2005; Crow & Nelson *cited in* Lam & Lee, 1999; Fisher *et al.*, 2004; Sandhu & Corbitt, 2003; Klein, 2002).



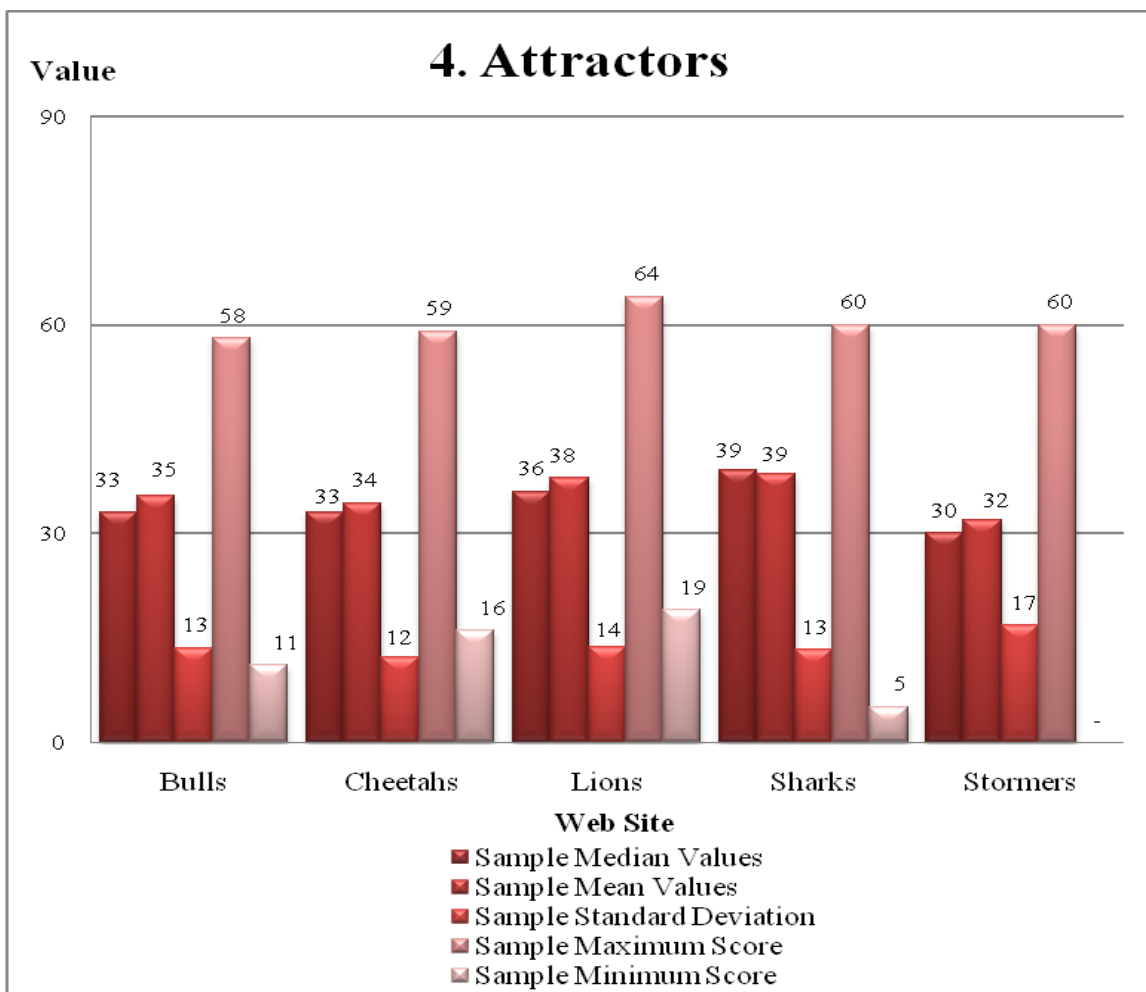
**Figure 6: Summary statistics bar chart of the content usability scores**

In isolation, all of the web sites have poor content usability scores because all the mean and median scores lie below the 70 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Lions, Sharks, Bulls, Cheetahs, and then Stormers.

The ANOVA produces a calculated F value of 0.531, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 0.946. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The fourth major usability category is attractors, and the summary statistics are shown in Figure 7. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, attractors draw individuals and business to the web site.

Attractors is the usability evaluation criterion that measures the implementation of those aspects of a web site with the purpose of stimulating user interest. Stimulating a user’s interest gives a user motivation to explore a web site and it results in greater user satisfaction, so attractors are an important part of web site usability. Good use of attractors will result in an enhanced user experience and enable a web to exhibit good usability. Understanding what web site aspects are attractive to the web site users is vital to designing effective attractors, per Section 2.3.1 (Liu & Arnett, 1998) and Section 2.5 (Mithas *et al.*, 2003). Further, having a web site with effective attractors is an essential design requirement, according to Section 2.3.3 (Fisher *et al.*, 2004). Attractors also have a temporal characteristic; what may be effective at one time may be ineffective at another, so frequent attractor assessment is necessary, as noted in Section 2.3.4 (Davern *et al.*, 2000). Effective use of attractors results in an attractive web site, which contributes to web site quality and usability, as referred to in Section 2.11 (Vaidya & Nandy, 2005; Agarwal & Venkatesh, 2002; Zhang *et al.*, 2000b).



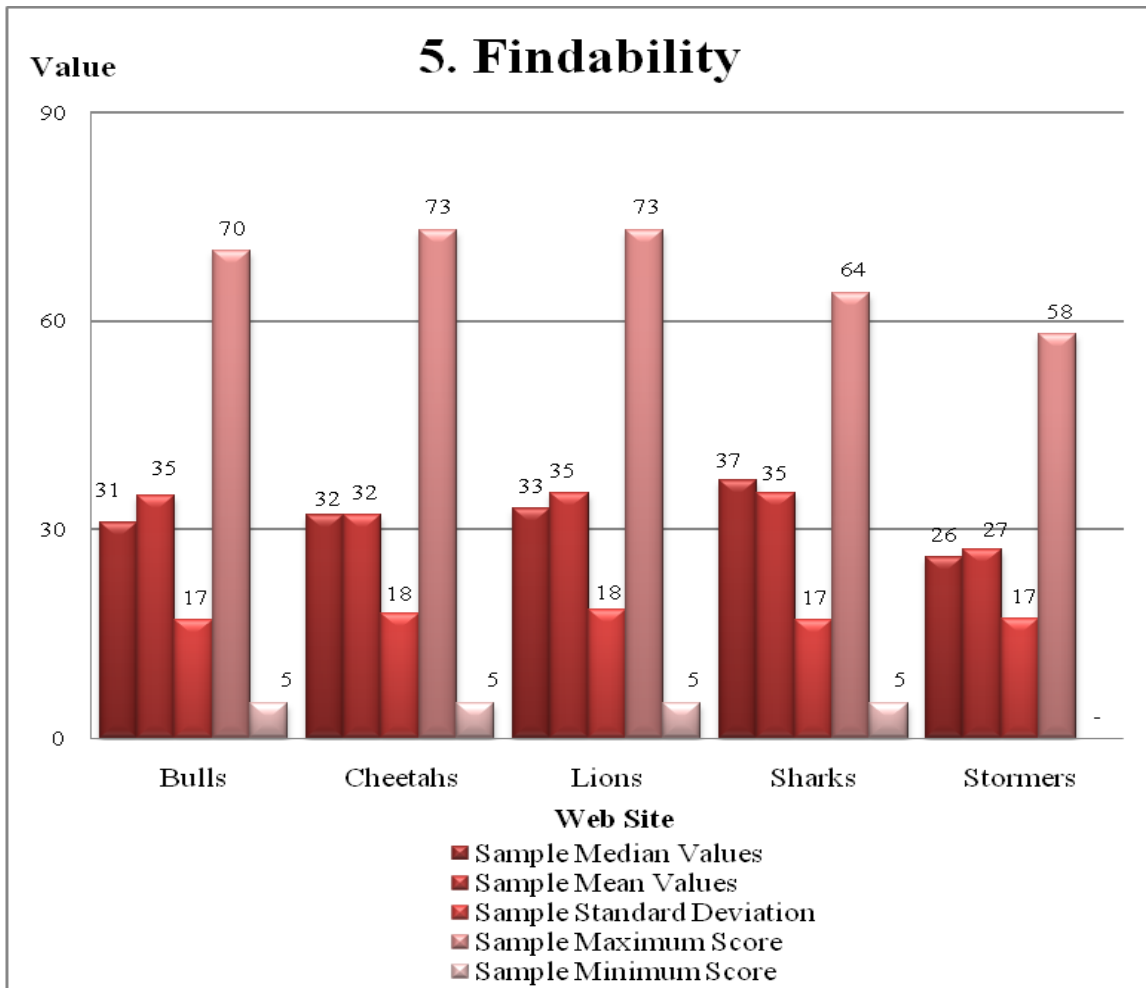
**Figure 7: Summary statistics bar chart of the attractors usability scores**

In isolation, all of the web sites have poor attractors usability scores because all the mean and median scores lie below the 40 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Sharks, Lions, Bulls, Cheetahs, and then Stormers.

The ANOVA produces a calculated F value of 0.576, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 0.844. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The fifth major usability category is findability, and the summary statistics are shown in Figure 8. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, the web site must be easy to find in the first place.

Findability refers to the effort required by a user to locate a web site on the Internet. A web site that is easy to locate on the Internet translates into a good user experience and good web site usability. The goal of findability is to make a web site easy to find for those users wanting to use that web site. A web site that cannot be found cannot be used at all, so findability is critical for usability. Findability is affected by the amount of promotion that a web site receives; a web site that is promoted on the Internet or other media is easy to find and has good findability, as in Section 2.4.2 (Agarwal & Venkatesh, 2002) and Section 2.11 (Kim, 2002). Findability is an important web site usability evaluation criterion, according to Section 2.11 (De Villiers, 2000).



*Figure 8: Summary statistics bar chart of the findability usability scores*

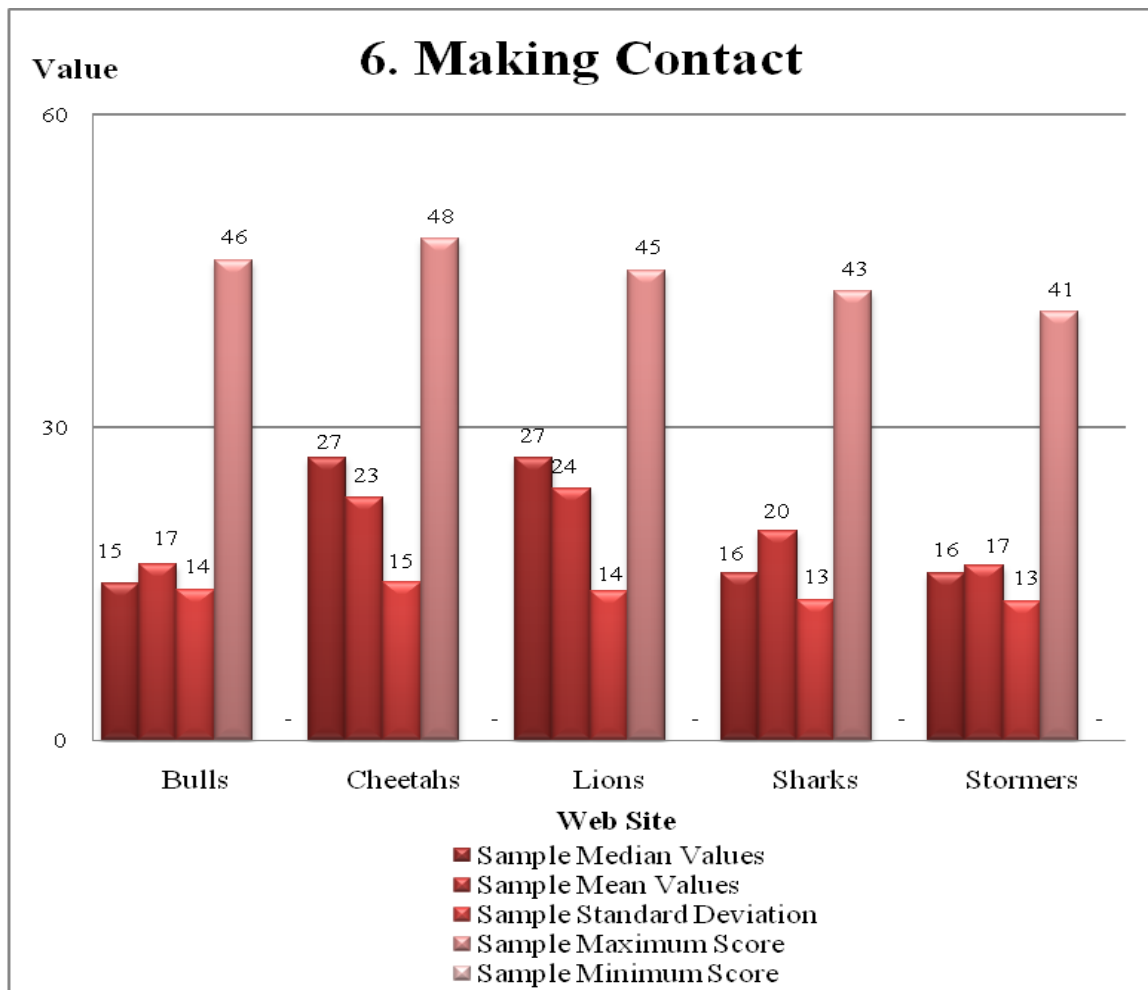
In isolation, the Bulls, Cheetahs, Lions, and Sharks web sites have good findability usability scores because the mean and median scores lie above the 30 benchmark value. The Stormers web site has poor findability usability scores because the mean and median scores lie below the 30 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Lions, Sharks, Bulls, Cheetahs, and then Stormers (the first three are different at the first decimal place).

The ANOVA produces a calculated F value of 0.596, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 1.474. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The sixth major usability category is making contact, and the summary statistics are shown in Figure 9. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, many business transactions

require some level of contact between the parties concerned. Communication from the web site owners provides good client or customer relationship and public relations. It can also provide a source of improvement ideas to the web site based on customer queries and communication.

The making contact criterion presents a measure of the human-to-human interaction provided for, by a web site. A user will have a poor experience on a web site if a user cannot contact the web site owners with questions, inquiries, problems, issues, concerns, or general feedback. It is imperative for good usability that a web site user has a good experience on a web site. Also, the contact details of the web site owners, displayed on the web site, gives users confidence that there are people who will take responsibility for the web site, this enhances a user's experience and the usability of a web site. Telepresence will enable synchronous, verbal, and visual communication between a web site user and a web site owner, as presented in Section 2.11 (Lee & Kozar, 2004). The success of a web site and the effectiveness of a web site are measured by the contact, feedback and support options available to a user, according to Section 2.11 (Aladwani, 2003; Kim, 2002; De Villiers, 2000; Liu & Arnett, 1998). Web sites inadequately cater for interpersonal communication; web sites will lose revenues if users do not receive satisfying or timely responses to queries, as referred to in Section 2.12 (Senger *et al.*, 2002).



**Figure 9: Summary statistics bar chart of the making contact usability scores**

In isolation, all of the web sites have poor making contact usability scores because all the mean and median scores lie below the 30 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Lions, Cheetahs, Sharks, Bulls, and then Stormers (the last two are different at the first decimal place).

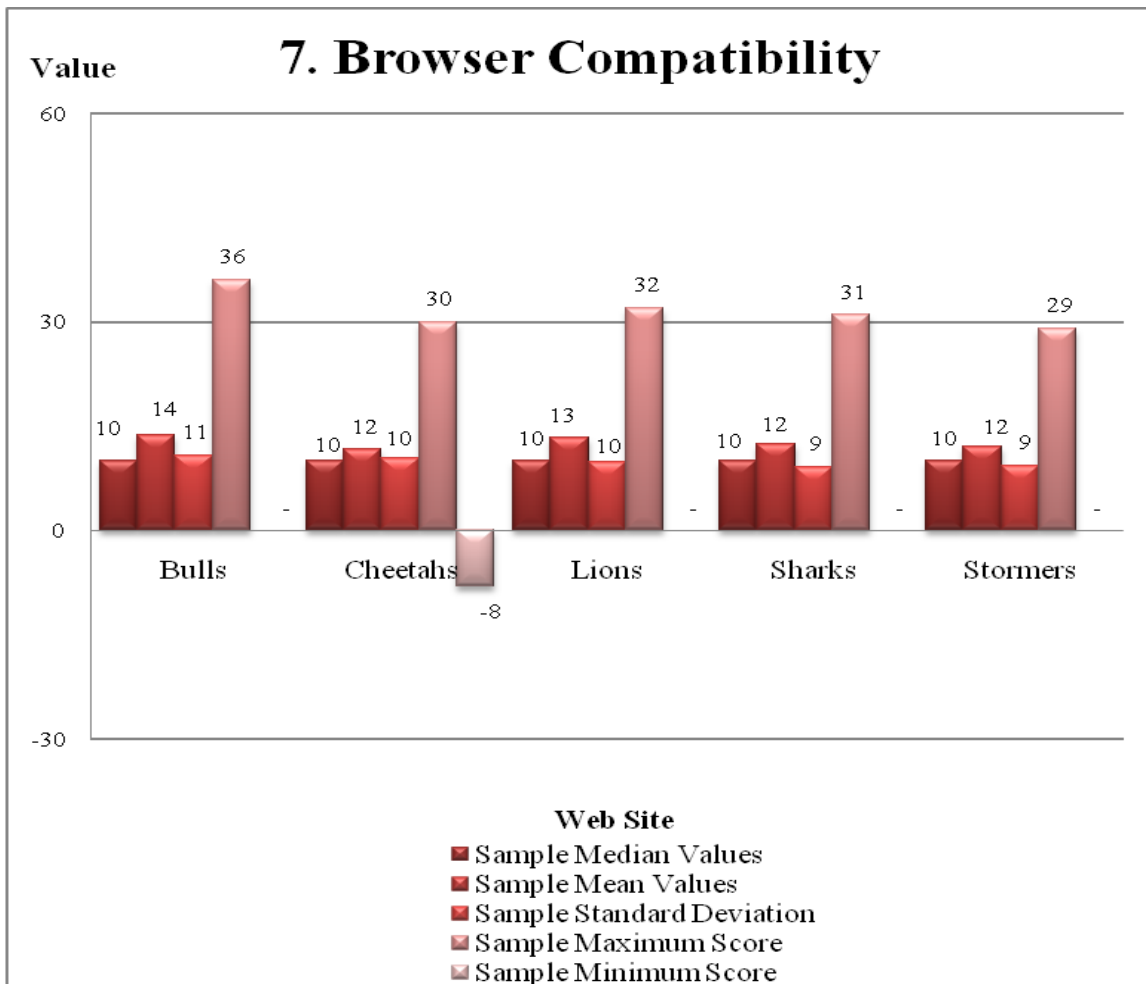
The ANOVA produces a calculated F value of 0.883, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 2.336. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The seventh major usability category is browser compatibility, and the summary statistics are shown in Figure 10. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, there are many variations of browsers and monitors in use today and it is important that the website is



accessible to as many internet users as possible. This will make the web site visit a much more useful and pleasant experience.

Browser compatibility is a measure of how a web site is displayed on different browsers and screens. Web sites are primarily visual entities and a good visual display is a prerequisite for good user interaction and good usability. In addition, if a web site displays on certain browsers only, then all users using other browsers are excluded from using that web site; excluding users in this manner results in poor web site usability. Indeed, ensuring that a web site displays correctly on all commonly used browsers enables both universal web site usability and web site usability, as presented in Section 2.2 (Mahfouz, 2000) and Section 2.4.2 (Mahfouz, 2000). A web site that accommodates all commonly used browsers results in an effective and usable web site, as per Section 2.3.3 (Mahfouz, 2000). User analysis is essential in determining which browsers a web site must support, as noted in Section 2.5 (Bevan, 2001). Browser compatibility is an important web site usability evaluation criterion, as provided in Section 2.11 (De Villiers, 2000). The lack of good browser compatibility is listed as a web site usability problem and a cause of poor web site usability, in Section 2.12 (Starr *cited* in Ssemugabi, 2006; Levi & Conrad, 2003).



**Figure 10: Summary statistics bar chart of the browser compatibility usability scores**

In isolation, all of the web sites have poor browser compatibility usability scores because all the mean and median scores lie below the 20 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first

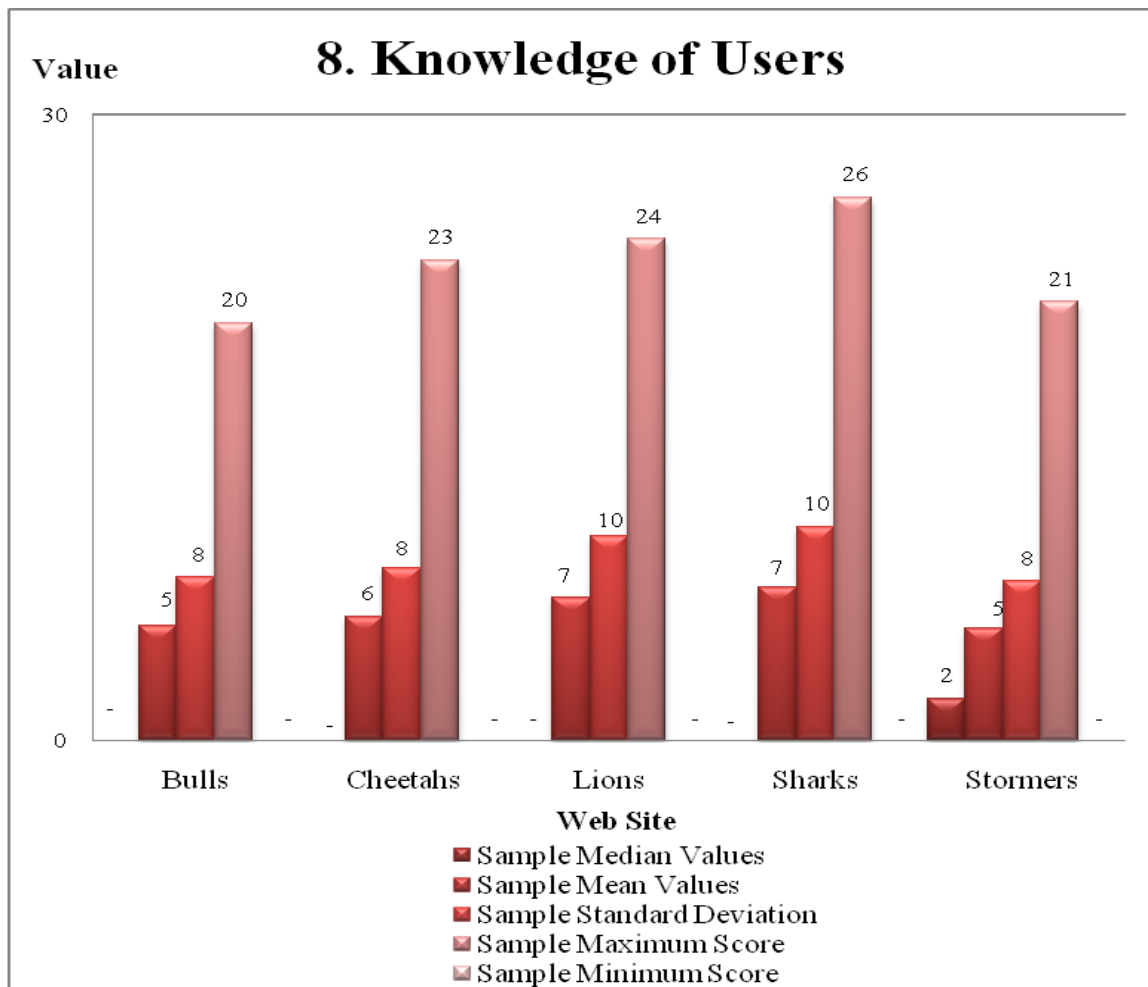
impressions usability scores is: Bulls, Lions, Sharks, Stormers, and then Cheetahs (the last three are different at the first decimal place).

The ANOVA produces a calculated F value of 0.110, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 0.229. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The eighth major usability category is knowledge of users, and the summary statistics are shown in Figure 11. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, the more a website knows about the surfing and buying habits of the users, the more ability it has to fulfil the users' needs.

Knowledge of users is the usability criterion that measures the ability of a web site to learn about its users and adapt itself to each user's particular characteristics. It is very important for a web site to measure well on knowledge of users. The diverse nature of Internet users, results in web site designs that do not suit every user, but an adaptive web site can change itself to suit each user. This adaptation will provide every user with a good experience and the web site will achieve good usability.

Designing a web site for adaptation to different users also supports universal usability, as in Section 2.2 (Horton, 2006). Understanding the needs of each type of user is necessary for the design of web sites to accommodate each use context, according to Section 2.3.1 (Liu & Arnett, 1998). Indeed, rigorous user analysis will provide web site designers with the information they need to build adaptive web sites, per Section 2.5 (Mithas *et al.*, 2003). Web site personalisation enables a web site to accommodate different users' characteristics and behaviours, it makes a web site easier to use, increases web site revenue, and it improves a web site's usability, as presented in Section 2.3.3 (Gang, 2003; Zibell, 2000), Section 2.4.2 (Agarwal & Venkatesh, 2002), and Section 2.11 (Aladwani, 2003). Web site personalisation is noted a significant reason for visitors returning to a web site, in Section 2.11 (Seethamraju, 2004). Web site personalisation is listed as a criterion to measure the success of a web site and the usability of a web site, according to Section 2.11 (Palmer *cited in* Seethamraju, 2004; Agarwal & Venkatesh, 2002; Tan & Lee, 2005; Song & Zahedi, 2001; Liu & Arnett, 1998). Poor knowledge of users is stated as a recognised web site usability problem, in Section 2.12 (Gillenson *et al.*, 1999).



*Figure 11: Summary statistics bar chart of the knowledge of users usability scores*

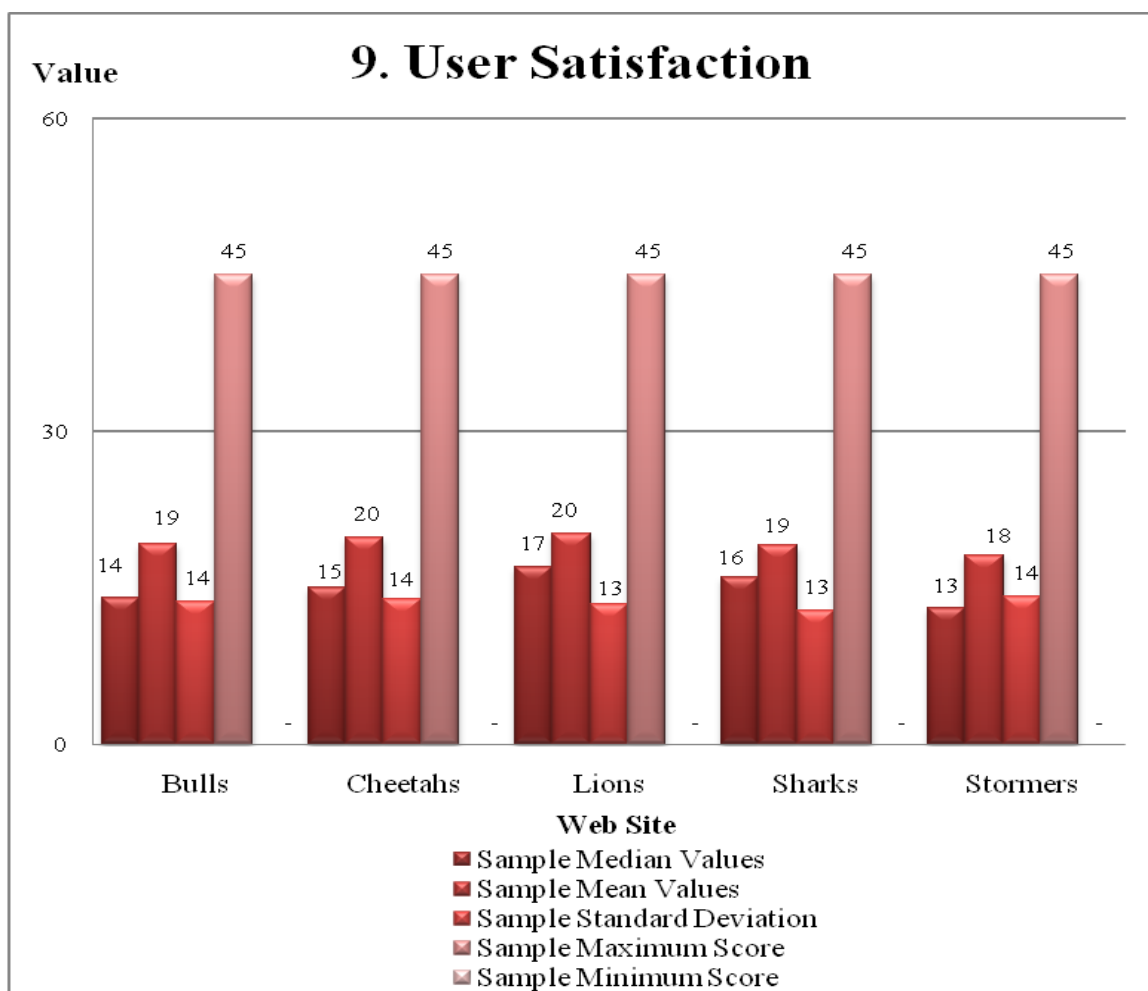
In isolation, all of the web sites have poor knowledge of users usability scores because all the mean and median scores lie below the 15 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Sharks, Lions, Cheetahs, Bulls, and then Stormers (the first two and last two are different at the first decimal place).

The ANOVA produces a calculated F value of 0.146, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 0.486. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The ninth major usability category is user satisfaction, and the summary statistics are shown in Figure 12. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, satisfying users is essential to bringing e-shoppers and e-buyers back to the website.

User satisfaction refers to the experience of a user while transacting on a web site. A user who has a satisfying buying experience on a web site is far more likely to do business again on that web site than a user who has had an unsatisfying buying experience. A satisfied customer is a necessity for a commercial web site's success, existence and good usability.

Web site reliability is critical when users are transacting on a web site, if a web site crashes during a transaction a user will be left frustrated, and this translates into poor usability, referred to in Section 2.2 (Mahfouz, 2000) and Section 2.11 (Seethamraju, 2004). The efficiency of the ordering process on a web site is an important web site usability evaluation criterion and an important web site trustworthiness factor, as per Section 2.11 (Lee, 1999; Corritore *et al.*, 2005). Order tracking during the web site transaction process is also a key component of user satisfaction, as presented in Section 2.11 (Tan & Lee, 2005; Liu & Arnett, 1998).



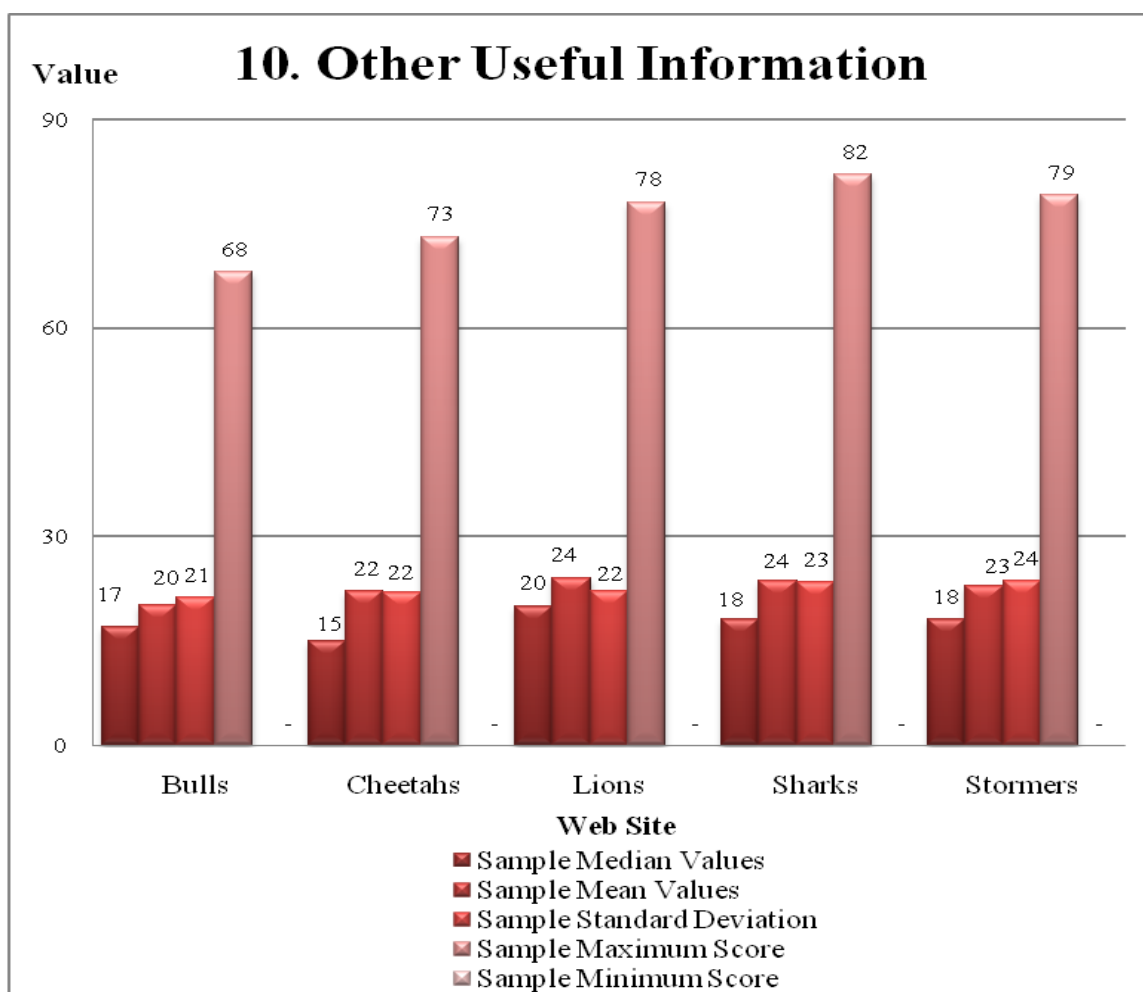
**Figure 12: Summary statistics bar chart of the user satisfaction usability scores**

In isolation, all of the web sites have poor user satisfaction usability scores because all the mean and median scores lie below the 25 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Lions, Cheetahs, Bulls, Sharks, and then Stormers (the first two and the second two are different at the first decimal place).

The ANOVA produces a calculated F value of 0.054, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 0.139. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

The tenth major usability category is other useful information, and the summary statistics are shown in Figure 13. The number on the figure header indicates the number of the major usability category. As indicated on the e-mail questionnaire survey, supplying additional useful information will help build confidence in the e-shopper.

Other useful information measures the extent that a web site provides supplementary information to a user. Supplementary information forms an important part of a user's experience of a web site. Supplementary information improves a web site's credibility, authority, trustworthiness, and professionalism; all these aspects improve a user's experience of a web site, and improve a web site's usability. Web site credibility, trustworthiness, and professionalism are stated as being significant usability evaluation criteria, in Section 2.11 (Lee & Kozar, 2004; Corritore *et al.*, 2005). Other useful information such as company information and objectives on a web site is viewed as an essential web site usability criterion, as per Section 2.11 (De Villiers, 2000). Also, other useful information such as previous customer activity on a web site and bulletin boards are necessary for good web site usability, as presented in Section 2.11 (Tan & Lee, 2005). Irrelevant information on a web site is noted as a cause of poor web site usability, according to Section 2.12 (Fisher *et al.*, 2004).



**Figure 13: Summary statistics bar chart of the other useful information usability scores**

In isolation, all of the web sites have poor other useful information usability scores because all the mean and median scores lie below the 60 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for first impressions usability scores is: Lions, Sharks, Stormers, Cheetahs, and then Bulls.

The ANOVA produces a calculated F value of 0.067, extracted from XLSTAT. The conclusion from this measure is that there is no difference in the means for the population and the actual differences in the means of each web site in the sample are attributed to chance. The chi-square test produces a calculated  $\chi^2$  value of 0.402. The conclusion from this measure is that there is no difference in the in the sample mean usability scores when they are compared to the global sample mean usability score. The ANOVA and chi-square tests negate the relative ranking, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. This negation will be tested empirically by the Delphi method.

Part three can now be answered, based on the results of part one and part two. Part three answers how good and consistent are the web sites' scores, in isolation and relative to one another.

Table 4 presents a summary of the web sites' scores in isolation. The table shows that within each web site a good and consistent score is not achieved on all ten major usability

categories. The table also shows that across all web sites a good and consistent score is only achieved on one of the ten major usability categories, namely the first impressions category.

Ten Major Usability Categories	Bulls	Cheetahs	Lions	Sharks	Stormers
First impressions	Good	Good	Good	Good	Good
Navigation	Poor	Good	Good	Good	Poor
Content	Poor	Poor	Poor	Poor	Poor
Attractors	Poor	Poor	Poor	Poor	Poor
Findability	Good	Good	Good	Good	Poor
Making contact	Poor	Poor	Poor	Poor	Poor
Browser compatibility	Poor	Poor	Poor	Poor	Poor
Knowledge of users	Poor	Poor	Poor	Poor	Poor
User satisfaction	Poor	Poor	Poor	Poor	Poor
Other useful information	Poor	Poor	Poor	Poor	Poor

*Table 4: Summary of the web sites' scores in isolation*

Table 5 presents a summary of the web sites' scores relative to one another. Within each web site, there are good and poor scores or varied rankings for each of the ten major usability categories. The table shows that there is no good and consistent score for any of the web sites because no web site achieved a consistent ranking for all ten major usability categories. The Lions may be considered to have best achieved good and consistent scores because all the scores are above the mid point score of three in a five category ranking.

Ten Major Usability Categories	Bulls	Cheetahs	Lions	Sharks	Stormers
First impressions	2	3	1	4	5
Navigation	4	3	2	1	5
Content	3	4	1	2	5
Attractors	3	4	2	1	5
Findability	3	4	1	2	5
Making contact	4	2	1	3	5
Browser compatibility	1	5	2	3	4
Knowledge of users	4	3	2	1	5
User satisfaction	3	2	1	4	5
Other useful information	5	4	1	2	3

*Table 5: Summary of the web sites' scores relative to one another*

Therefore, in isolation, none of the web sites achieved good and consistent usability criteria scores within each web site for all ten of the major usability categories. Also, in isolation, only one good and consistent usability score was achieved across all the web sites, being the first impressions major usability category. Further, from a relative point of view, only the Lions may be considered to have best achieved good and consistent scores because all the Lion's scores are above the mid point score of three in a five category ranking, for all ten of the major usability categories.

However, the ANOVA and chi-square tests negate using the sample means, indicating that the differences in the means of the web sites in the sample are attributed to chance, and are not statistically significant. The ANOVA and chi-square negation does not directly address the in isolation measures, because the median was also used. The ANOVA and chi-square

negation does directly address the relative measures, which only use the mean. The method triangulation with the Delphi method will corroborate or reject this negation.

### 4.7 Presentation and discussion of research question 3

The third research question is: What are the most important factors to focus on in order to achieve good and consistent usability?

The e-mail questionnaire contains ten major usability categories, and usability sub-criteria within each of these ten major categories. The usability sub-criteria within each of the ten major categories are used to answer this research question.

The researcher uses factor analysis on the sub-criteria within each of the ten major categories in order to determine what the most important factors are to focus on. Factor analysis is a statistical technique that examines the patterns of correlations between the sub-criteria and extracts a smaller number of factors without losing excessive information (Taylor, 2004; DeCoster, 1998; Statsoft, Inc, n.d.). The need to seek common underlying factors stems from a practical efficiency requirement, so that a manageable and effective set of factors can be used in the Delphi method to measure good and consistent web site usability. Table 6 shows that the total number of sub-criteria is eighty-one, and it also shows the number of sub-criteria per major usability category on the questionnaire.

Ten Major Usability Categories	Number of Sub-Criteria Questions
First impressions	13
Navigation	8
Content	14
Attractors	8
Findability	8
Making contact	6
Browser compatibility	4
Knowledge of users	3
User satisfaction	5
Other useful information	12
<b>Total</b>	<b>81</b>

**Table 6: The number of sub-criteria questions per major usability category**

For each of the ten major usability categories two figures are shown and these are used to focus on the most important factors. All the factor analysis data and figures are extracted from XLSTAT. The first figure is a scree plot and the second figure is a chart showing correlations between the sub-criteria and selected factors.

The scree plot visually shows the factors and how much of the data each explains. Subsequent factors provide diminishing returns in terms explaining the total data variability. Factors are retained which have eigenvalues greater than one (Taylor, 2004).

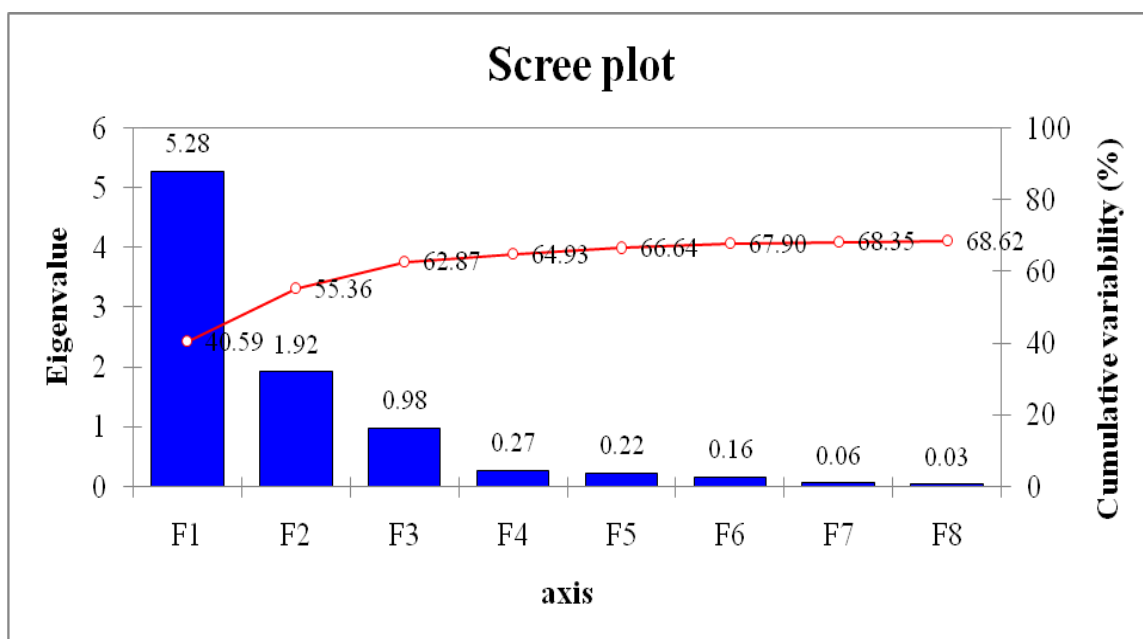
The second figure visually shows how the sub-criteria are correlated with the selected factors. Correlation presents the strength of the linear relationship between two variables (Lind *et al.*, 2005: 431). A positive correlation coefficient indicates that when one variable



increases so does the other variable, and a negative correlation coefficient indicates that when one variable increases then the other variable decreases. A correlation coefficient of greater than positive or negative 0.5 to positive or negative 1, respectively, indicates a strong relationship, and a correlation coefficient of less than positive or negative 0.5 to 0 indicates a weak relationship. The correlation coefficient's range is 0 to positive or negative 1, a value of 0 indicates no relationship, and a value of one indicates a perfect relationship (Lind *et al.*, 2005: 433; Oates, 2006: 258).

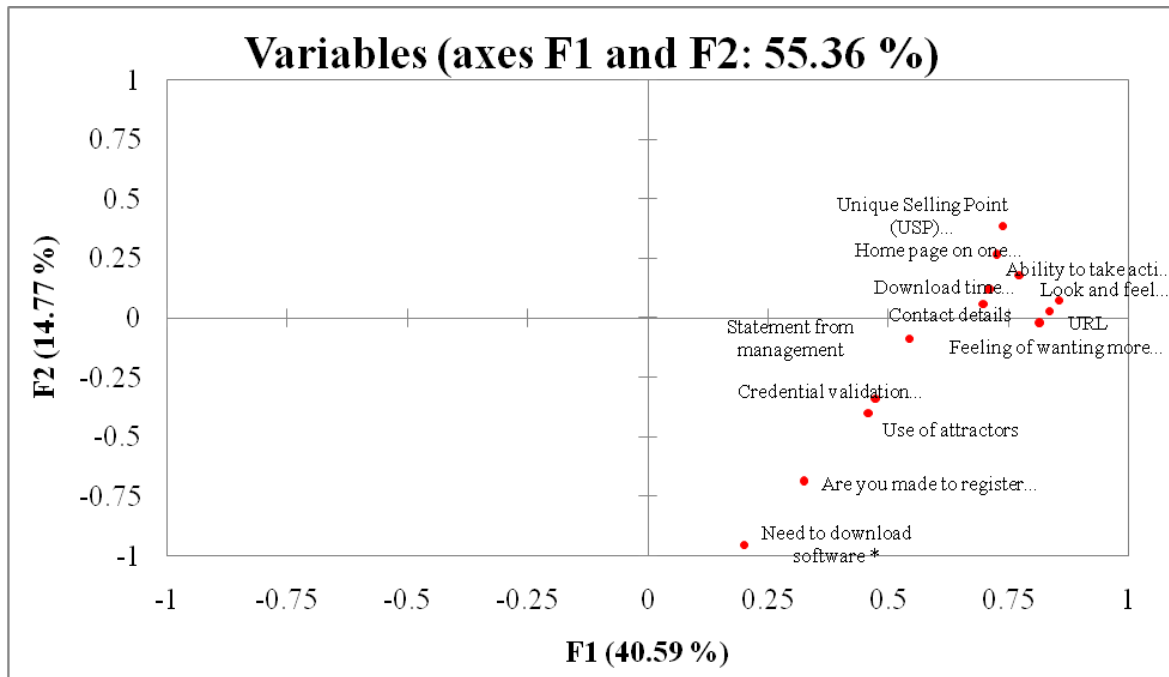
This second figure is used to formulate descriptions for each of the selected factors, by reference to which of the sub-criteria are grouped together for that factor. The descriptions are subjective but these descriptions will be accompanied by the grouped sub-criteria names for the Delphi method. This will provide the Delphi method participants with the actual sub-criteria that are contained within the factor descriptions chosen by the researcher. This will prevent any bias from being introduced by the researcher's chosen factor descriptions. Only sub-criteria that correlate strongly and positively with a factor are used.

The first major usability category is first impressions. Figure 14 shows that the first factor (F1) explains 41% of the total data variability, and the first two factors (F1 and F2) explain 55% of the total data variability.



**Figure 14: Scree plot: Eigenvalues and cumulative variability for first impressions**

Figure 15 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description initial comprehension: Look and feel – readability; URL; feeling of wanting more - depth of site; ability to take action (key action point – KAP); unique selling point (USP) or value proposition; home page on one screen (above the fold); download time - size of home page; contact details; and statement from management. None of the sub-criteria correlate strongly and positively with factor two (F2), so factor two (F2) is not retained.



**Figure 15: Correlations between sub-criteria and factors for first impressions**

The look and feel – readability sub-criterion, per the e-mail survey questionnaire, relates to the user’s first impressions of the web site’s readability. The web site pages must be clear, scannable and easy to comprehend; the pages must not be too cluttered with text and images; the text font size must be comfortable to read and conflicting colours must be avoided.

The URL sub-criterion, per the e-mail survey questionnaire, relates to the user’s first impressions of the web site’s Internet address. The address must be short, simple, and intuitive.

The feeling of wanting more - depth of site sub-criterion, per the e-mail survey questionnaire, relates to the user’s first impressions of how attractive the web site is. The web site must invoke a feeling in the user of wanting to stay as long as possible on the web site and to visit again.

The ability to take action (key action point – KAP) sub-criterion, per the e-mail survey questionnaire, relates to the user’s first impressions of how interactive and engaging the web site is. The web site must be interactive and encourage user interaction from the beginning. The home page must make the web site’s key action points obvious.

The unique selling point (USP) or value proposition sub-criterion, per the e-mail survey questionnaire, relates to the user’s first impressions of what use the web site is to the user. The home page must clearly state the unique selling point of the web site.

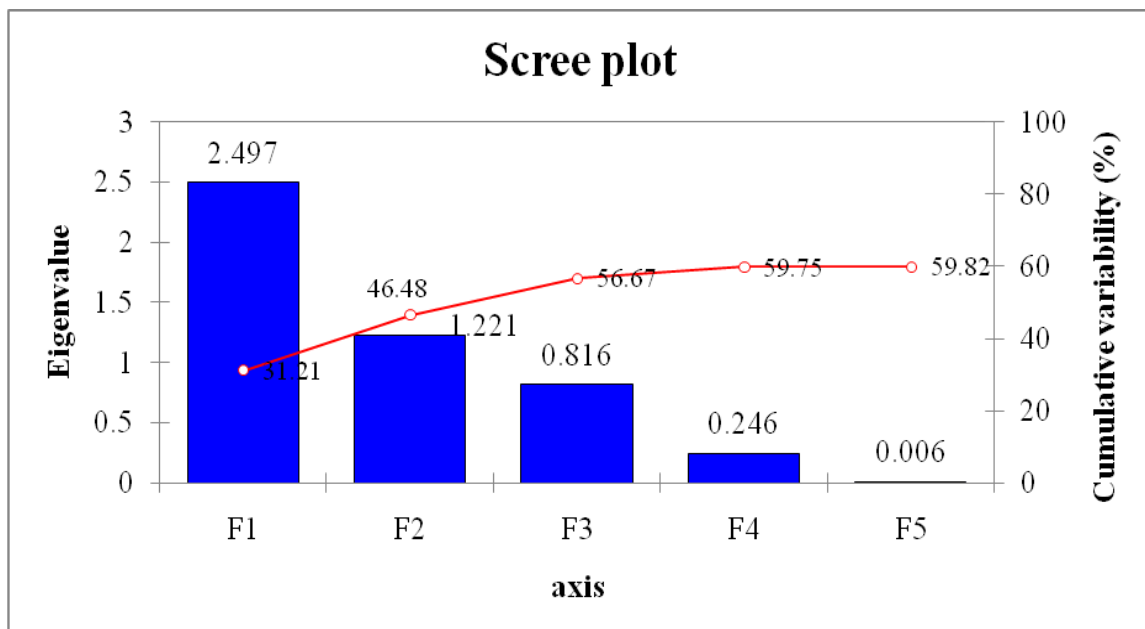
The home page on one screen (above the fold) sub-criterion, per the e-mail survey questionnaire, relates to the user’s first impressions of how the home page is displayed. The home page must not require a user to scroll up or down to see the contents of the home page.

The download time - size of home page sub-criterion, per the e-mail survey questionnaire, relates to the user's first impressions of the time it takes for the home page to download. A user will not wait long for a home page to download. The home page download time is an indication of a web site's efficiency. The home page must be small and quick to download, and all pages must be under 50k in size.

The contact details sub-criterion, per the e-mail survey questionnaire, relates to the user's first impressions of the web site's trustworthiness and personal feel. The home page must show contact details such as e-mail addresses and telephone numbers, this will increase a user's confidence in a web site.

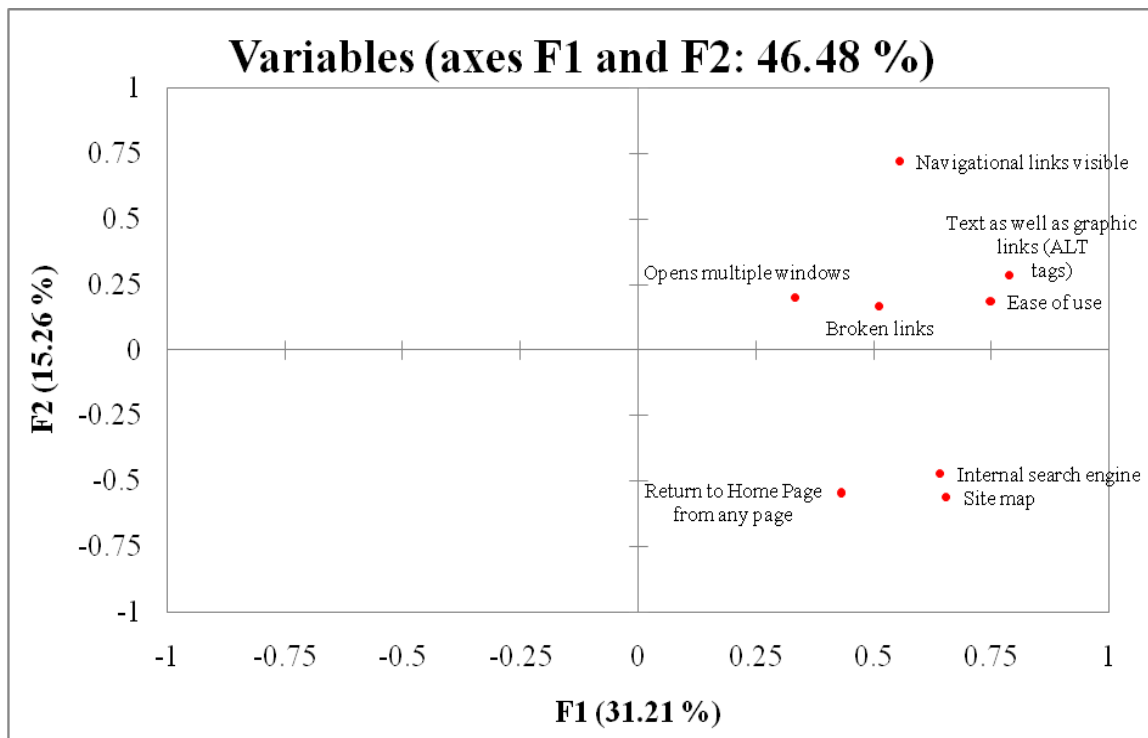
The statement from management sub-criterion, per the e-mail survey questionnaire, relates to the user's first impressions of the web site owner's business vision and values.

The second major usability category is navigation. Figure 16 shows that the first factor (F1) explains 31% of the total data variability, and the first two factors (F1 and F2) explain 46% of the total data variability.



**Figure 16: Scree plot: Eigenvalues and cumulative variability for navigation**

Figure 17 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description site layout: Text as well as graphic links (ALT tags); ease of use; site map; internal search engine; navigational links visible; and broken links. Only the sub-criterion navigational links visible correlates strongly and positively with factor two (F2), but this sub-criterion is already included in factor one (F1), so factor two (F2) is not retained.



*Figure 17: Correlations between sub-criteria and factors for navigation*

The text as well as graphic links (ALT tags) sub-criterion, per the e-mail survey questionnaire, relates to navigation of images on a web site. Images alone may not assist in a user’s navigation of a web site, so additional text links are important. ALT tags or image descriptors assist the visually impaired users and will improve a web site’s search engine rankings.

The ease of use sub-criterion, per the e-mail survey questionnaire, relates to how easy and intuitive it is to navigate on a web site. Users must have direct access to various content and facilities on a web site.

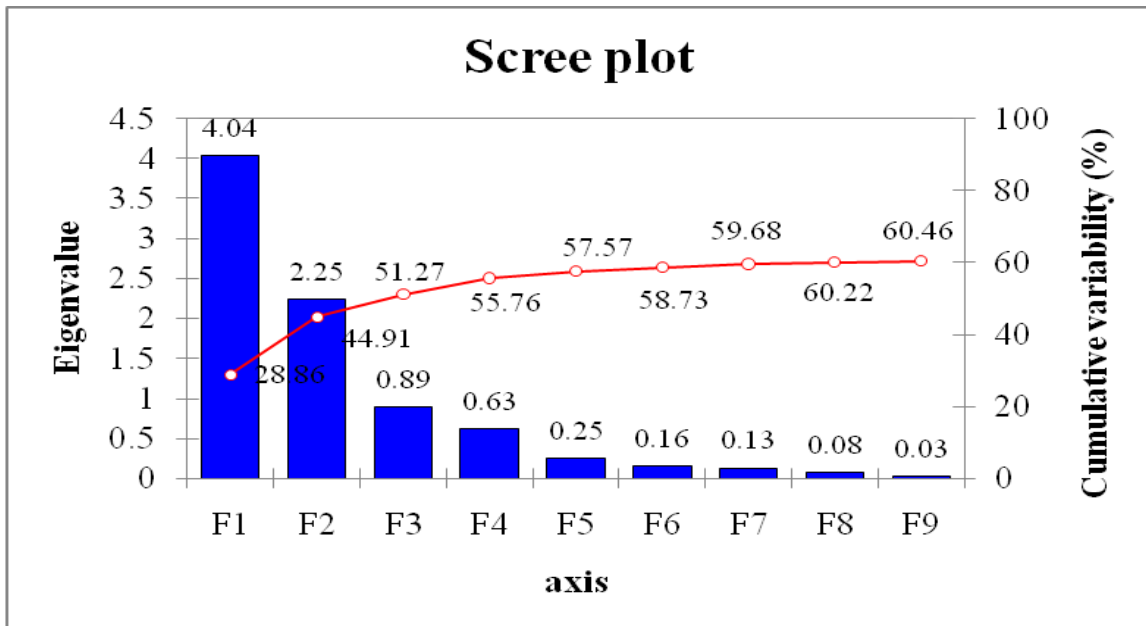
The site map sub-criterion, per the e-mail survey questionnaire, relates to providing users with an easy to understand and use method of navigating on a web site. Site maps are an alternative navigation method for web sites.

The internal search engine sub-criterion, per the e-mail survey questionnaire, relates to providing users with an efficient and quick means of finding selected web site content on a web site. This is very important for web sites with large amounts of content.

The navigational links visible sub-criterion, per the e-mail survey questionnaire, relates to how visible and consistent are the navigational links on a web site.

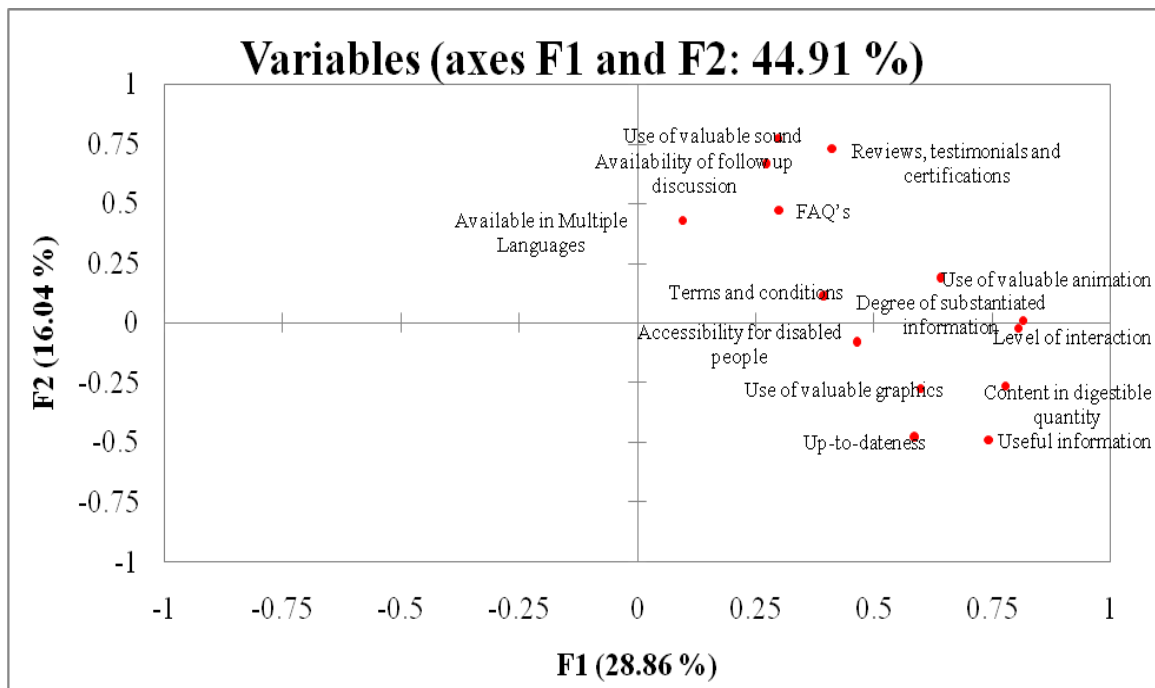
The broken links sub-criterion, per the e-mail survey questionnaire, relates to whether there are broken links on a web site. Broken links will frustrate users and give a web site an unprofessional appearance. Links must be continuously tested.

The third major usability category is content. Figure 18 shows that the first factor (F1) explains 29% of the total data variability, and the first two factors (F1 and F2) explain 45% of the total data variability.



**Figure 18: Scree plot: Eigenvalues and cumulative variability for content**

Figure 19 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description content quality: Degree of substantiated information; level of interaction; content in digestible quantity; useful information; use of valuable animation; use of valuable graphics; and up-to-dateness. The following sub-criteria correlate strongly and positively with factor two (F2) and are grouped to together under the factor description content interaction: Use of valuable sound; reviews, testimonials and certifications; and availability of follow up discussion.



**Figure 19: Correlations between sub-criteria and factors for content**

The degree of substantiated information sub-criterion, per the e-mail survey questionnaire, relates to the evaluation of the credibility of the content on a web site. Web site content can be evaluated under the factors: Authority, currency, coverage, objectivity, and accuracy. Authority determines who is responsible for the content, what are their qualifications and associations, and can these facts be verified. Currency determines when the content was created and last updated. Coverage determines the focus of the content, and whether clear headings illustrate a comprehensive outline of the content. Objectivity determines if any biases or affiliations are clearly stated. Accuracy determines if the information and factual data sources are clearly listed and available for verification.

The level of interaction sub-criterion, per the e-mail survey questionnaire, relates to the evaluation of how interactive is the content on a web site. Web sites can present content as text, images, and animation, and this offers users extensive content variety and interaction possibilities. Web sites must use all these factors to be as interactive as possible.

The content in digestible quantity sub-criterion, per the e-mail survey questionnaire, relates to the way content is presented on a web site. The content must be chunked or broken up into easily scannable parts. Web site content that is only composed of scrolling text must be avoided because this leads to bored users.

The useful information sub-criterion, per the e-mail survey questionnaire, relates to the quality of the content on a web site. Users are interested in textual content and not just fancy animations and images, so it is important that all textual content is proof read thoroughly to maintain a high level of content quality.

The use of valuable animation sub-criterion, per the e-mail survey questionnaire, relates to the whether animation adds value to the content on a web site. Animation must not reduce the performance of a web site and must provide a real benefit to a user.

The use of valuable graphics sub-criterion, per the e-mail survey questionnaire, relates to the value that web site graphics add to the content on a web site. Graphics must add value and not reduce a web site's performance.

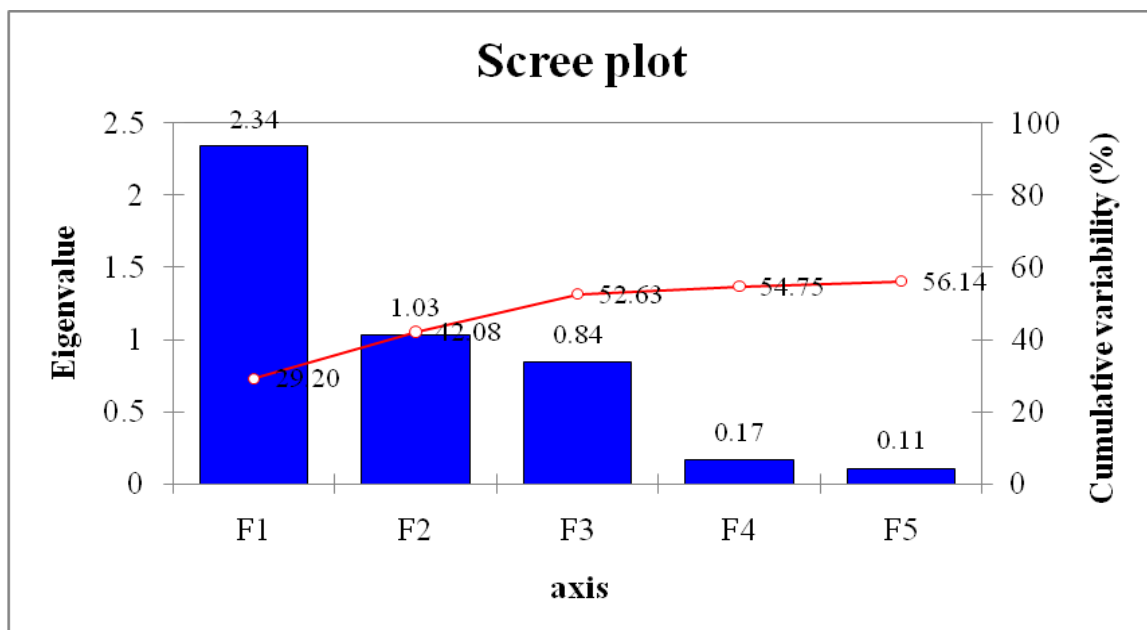
The up-to-dateness sub-criterion, per the e-mail survey questionnaire, relates to how recent the content on a web site is.

The use of valuable sound sub-criterion, per the e-mail survey questionnaire, relates to the benefit that web site sound gives to the content on a web site. Web site sound must give a bigger benefit than any performance cost.

The reviews, testimonials and certifications sub-criterion, per the e-mail survey questionnaire, relates to the how trustworthy the content is on a web site. Independent comments on a web site, about the web site, will build trust in a user.

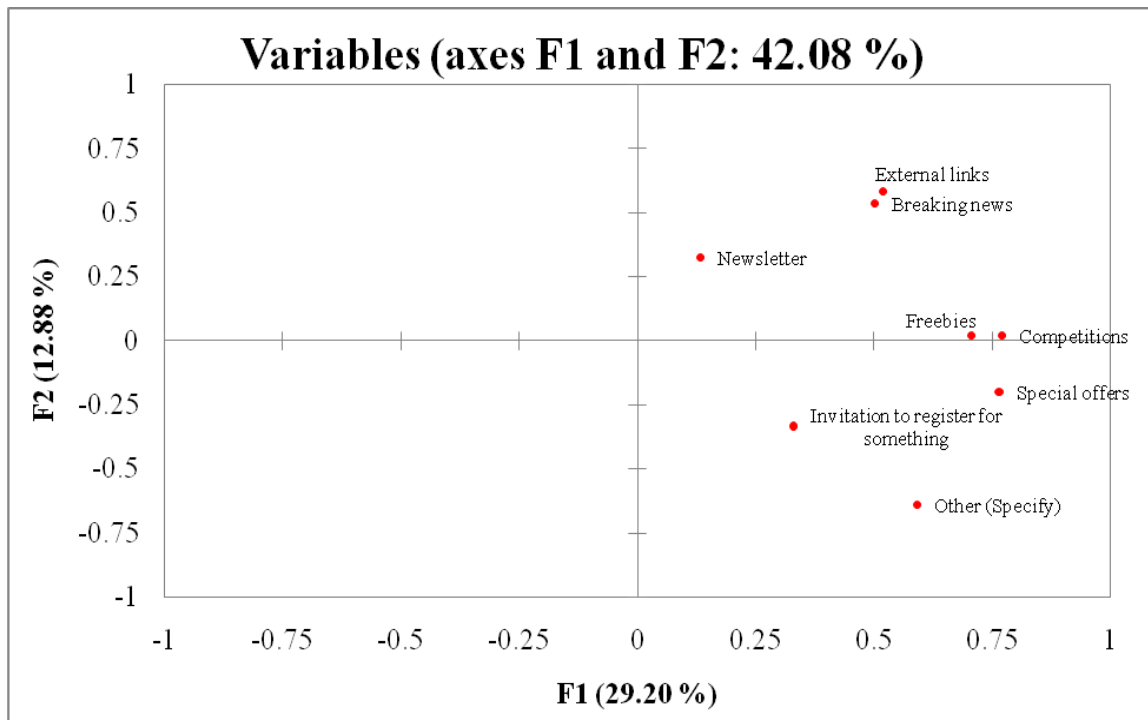
The availability of follow up discussion sub-criterion, per the e-mail survey questionnaire, relates to a facility for users to engage with the web site owners about the content on a web site.

The fourth major usability category is attractors. Figure 20 shows that the first factor (F1) explains 29% of the total data variability, and the first two factors (F1 and F2) explain 42% of the total data variability.



*Figure 20: Scree plot: Eigenvalues and cumulative variability for attractors*

Figure 21 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description enticements: Competitions; special offers; freebies; other (Specify); external links; and breaking news. The sub-criteria external links and breaking news correlate strongly and positively with factor two (F2), but these sub-criteria are already included in factor one (F1), so factor two (F2) is not retained.



**Figure 21: Correlations between sub-criteria and factors for attractors**

The competitions sub-criterion relates to the use of competitions on a web site to attract users to a web site.

The special offers sub-criterion relates to the use of specific offers for the benefit of web site users, in order to attract users to a web site.

The freebies sub-criterion relates to any free items offered to web site users, to attract users to a web site.

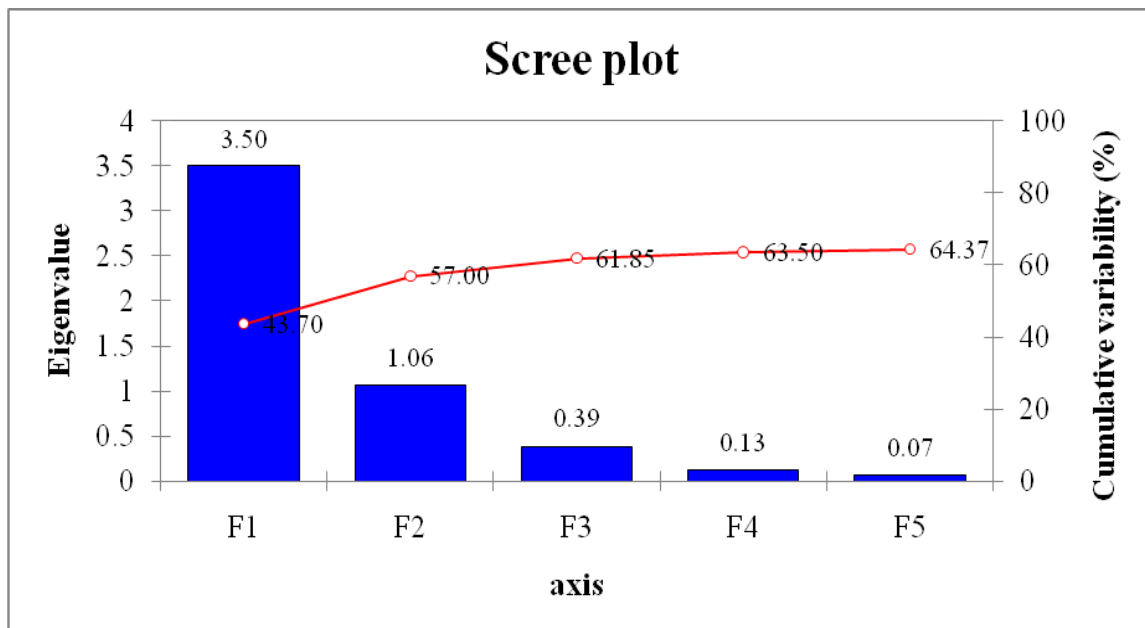
The other (Specify) sub-criterion relates to any new, creative attractions on a web site, for the purpose of attracting users to a web site.

The external links sub-criterion relates to any external links to other web sites that cause users to be attracted to the initial web site.

The breaking news sub-criterion relates to content on a web site that is very up-to-date and very recent and usually not available on other web sites. It is put on a web site to attract users to a web site.

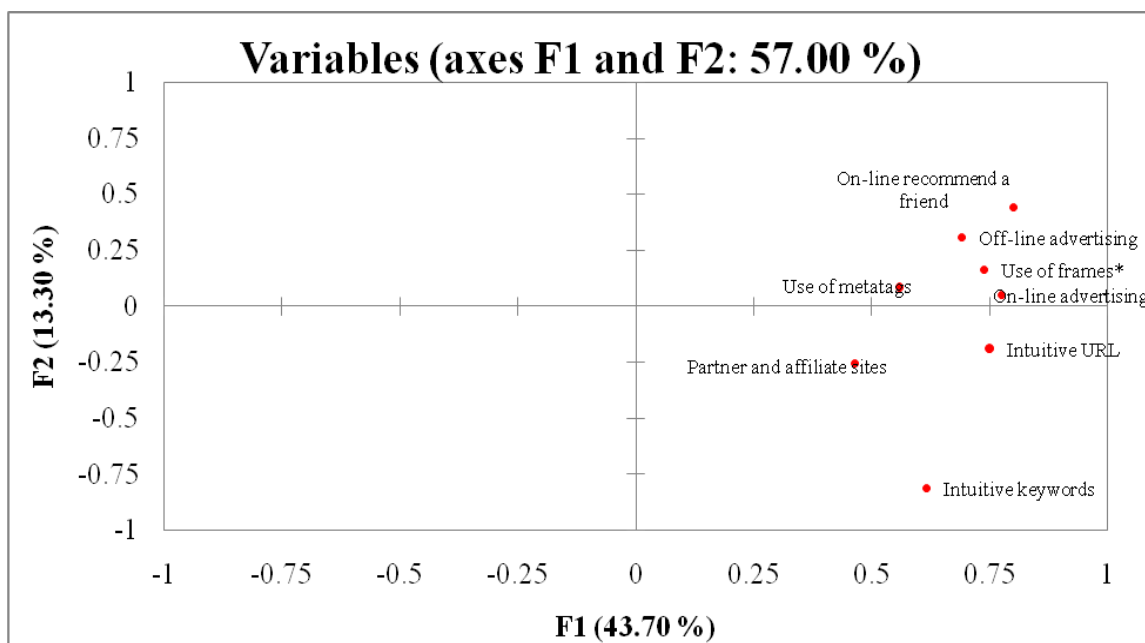
The fifth major usability category is findability. Figure 22 shows that the first factor (F1) explains 44% of the total data variability, and the first two factors (F1 and F2) explain 57% of the total data variability.





**Figure 22: Scree plot: Eigenvalues and cumulative variability for findability**

Figure 23 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description site discovery: On-line recommend a friend; on-line advertising; intuitive URL; use of frames\*; off-line advertising; intuitive keywords; and use of metatags. None of the sub-criteria correlate strongly and positively with factor two (F2), so factor two (F2) is not retained.



**Figure 23: Correlations between sub-criteria and factors for findability**

The on-line recommend a friend sub-criterion, per the e-mail survey questionnaire, relates to users finding a web site from a recommendation by a friend. The recommend a friend facility is important for promoting a web site. A user that thinks a web site is interesting and useful may have friends and associates that have similar interests.

The on-line advertising sub-criterion, per the e-mail survey questionnaire, relates to users finding a web site from an advert elsewhere on the Internet. On-line banner advertising is a useful promotional tool and there are many services that charge per number of users directed to a web site.

The intuitive URL sub-criterion, per the e-mail survey questionnaire, relates to users finding a web site by entering a URL that is intuitive. It is estimated that almost half of all web site referrals come from direct navigation, being when the URL is typed directly into the navigation bar. So, a URL must be as close to the company's name or brand as possible.

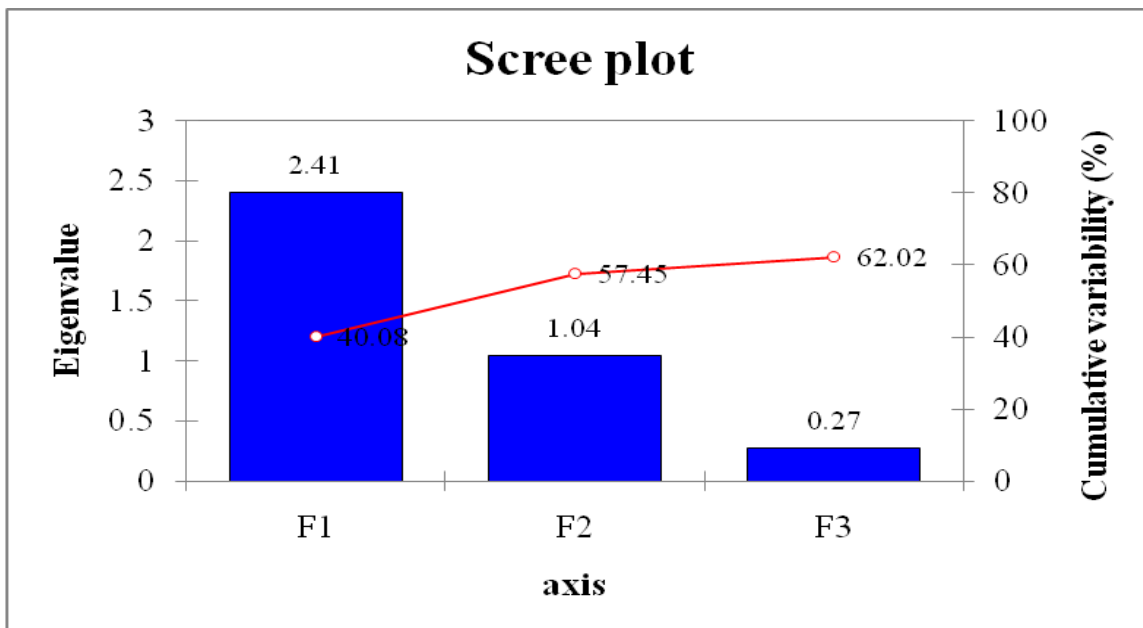
The use of frames\* sub-criterion, per the e-mail survey questionnaire, relates to users having difficulty finding a web site due to a frame reference. Search engines can have difficulties indexing framed web site pages, because when frames are used, URL's can cease to work as the URL in the address box is no longer a complete specification of the information shown in the window.

The off-line advertising sub-criterion, per the e-mail survey questionnaire, relates to users learning of a web site through non-Internet means. A web site's address must be printed on all business literature, such as business cards, letterheads, brochures, catalogues, and invoices. A web site must be mentioned in all existing advertising methods, such as television, billboards, radio, newspaper, magazine advertising, and off-line directories.

The intuitive keywords sub-criterion, per the e-mail survey questionnaire, relates to users finding a web site from searching the Internet. Internet users search for web sites by typing keywords into the search boxes of search engines. A web site's strategic keywords must be those that you imagine users will enter to find the web site.

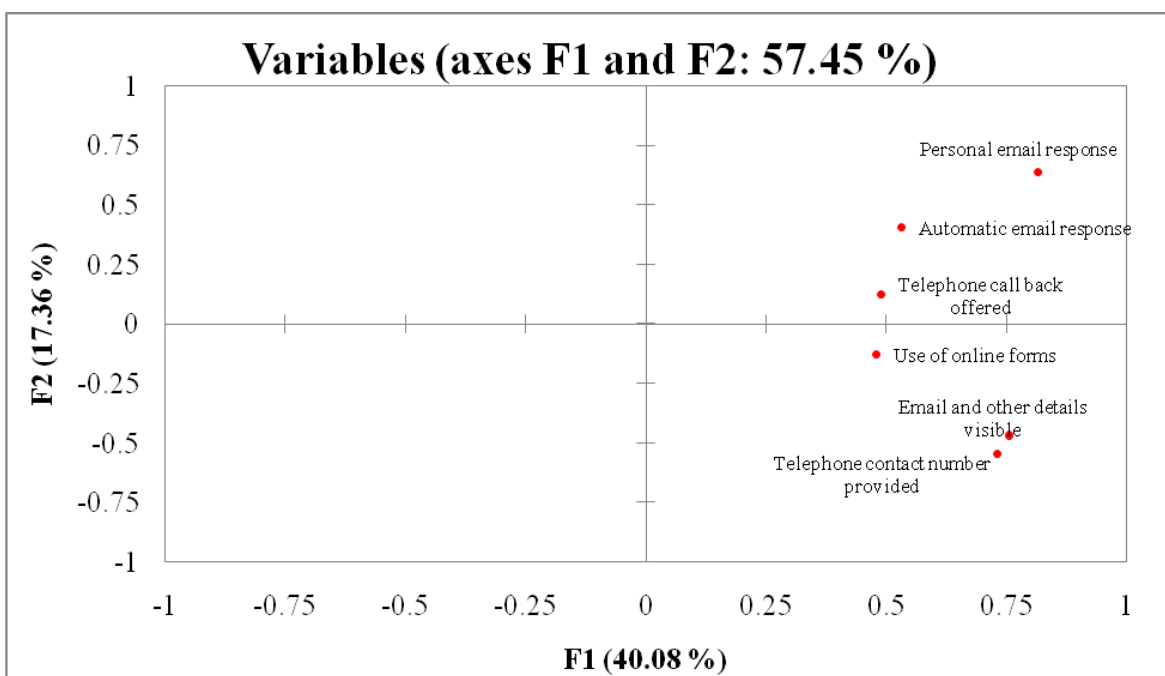
The use of meta tags sub-criterion, per the e-mail survey questionnaire, relates to users finding a web site from searching the Internet and the web site having a high search ranking on the search engine due to meta tags. Meta tags can improve a web site's ranking with a number of search engines, which makes the use of meta tags essential. Meta tags are machine readable information for the Internet. Meta tags are used to define and document the content of a web site. Meta tags do not appear when a web page is viewed with a browser, but stay hidden in the HEAD element of a web page.

The sixth major usability category is making contact. Figure 24 shows that the first factor (F1) explains 40% of the total data variability, and the first two factors (F1 and F2) explain 57% of the total data variability.



**Figure 24: Scree plot: Eigenvalues and cumulative variability for making contact**

Figure 25 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped together under the factor description communication: Personal e-mail response; e-mail and other details visible; telephone contact number provided; and automatic e-mail response. Only the sub-criterion personal e-mail response correlates strongly and positively with factor two (F2), but this sub-criterion is already included in factor one (F1), so factor two (F2) is not retained.



**Figure 25: Correlations between sub-criteria and factors for making contact**

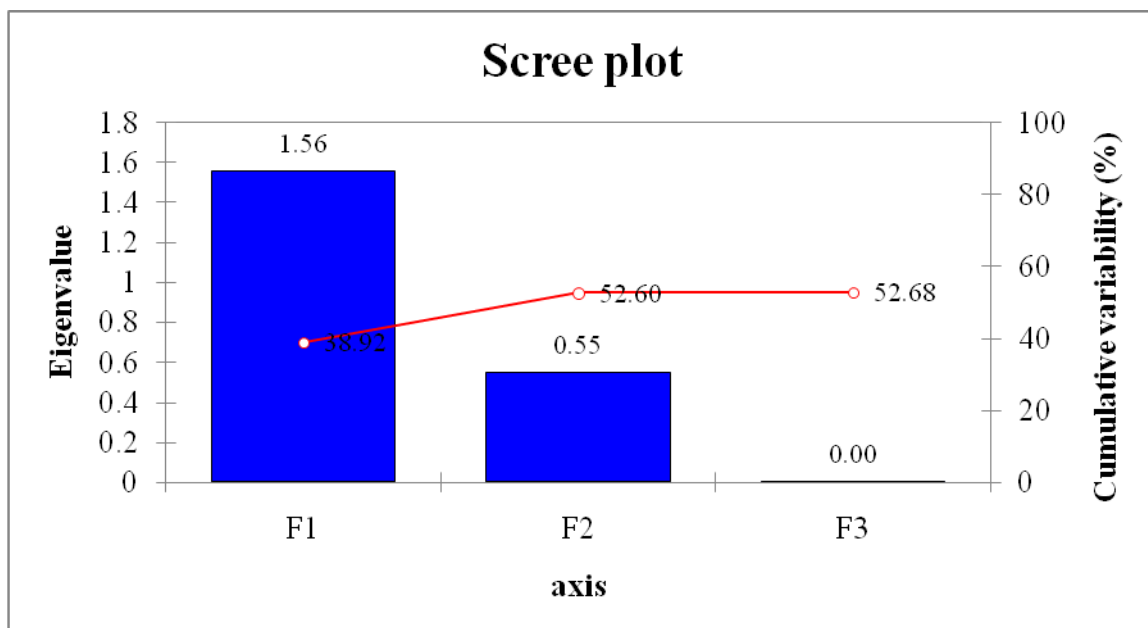
The personal e-mail response sub-criterion relates to users receiving a non-automated e-mail response to any e-mail queries made.

The e-mail and other details visible sub-criterion relates to a web site providing clear and visible contact details of the web site owners.

The telephone contact number provided sub-criterion relates to a web site making available the telephone contact numbers of the web site owners.

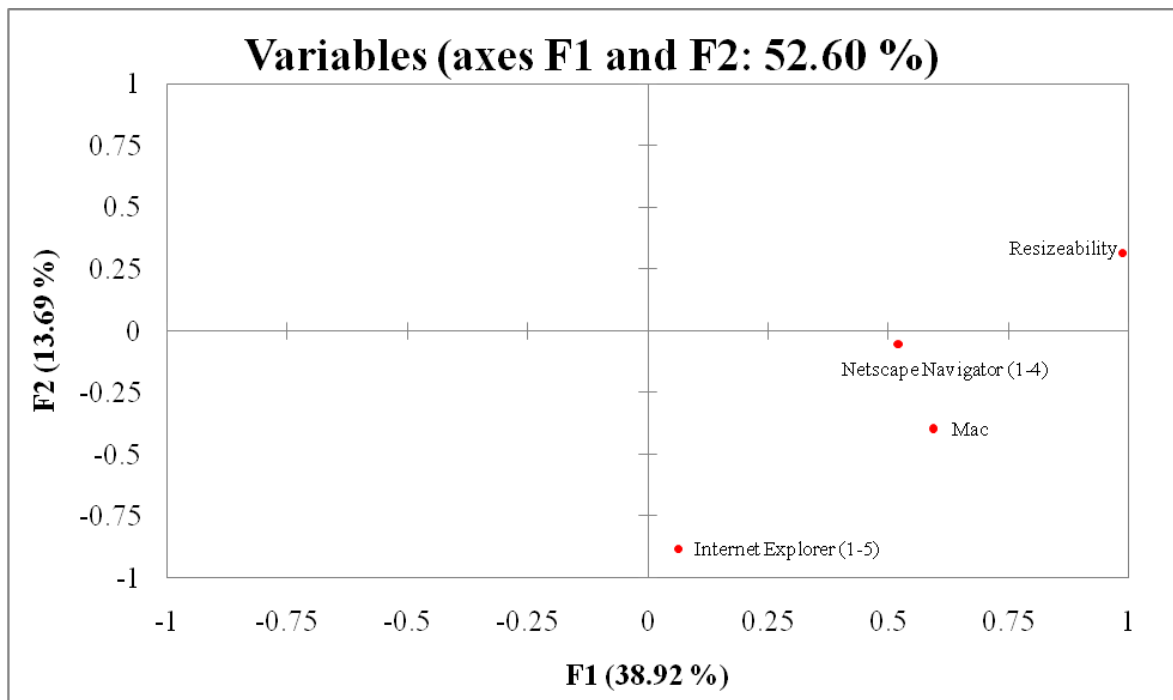
The automatic e-mail response sub-criterion relates to users receiving an automated e-mail response to any e-mail queries made. The automated e-mail response will provide receipt acknowledgment of the e-mail query and provide a query reference number.

The seventh major usability category is browser compatibility. Figure 26 shows that the first factor (F1) explains 39% of the total data variability, and the first two factors (F1 and F2) explain 53% of the total data variability.



**Figure 26: Scree plot: Eigenvalues and cumulative variability for browser compatibility**

Figure 27 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description display consistency: Resizeability; mac; and netscape navigator (1-4). None of the sub-criteria correlate strongly and positively with factor two (F2), so factor two (F2) is not retained.



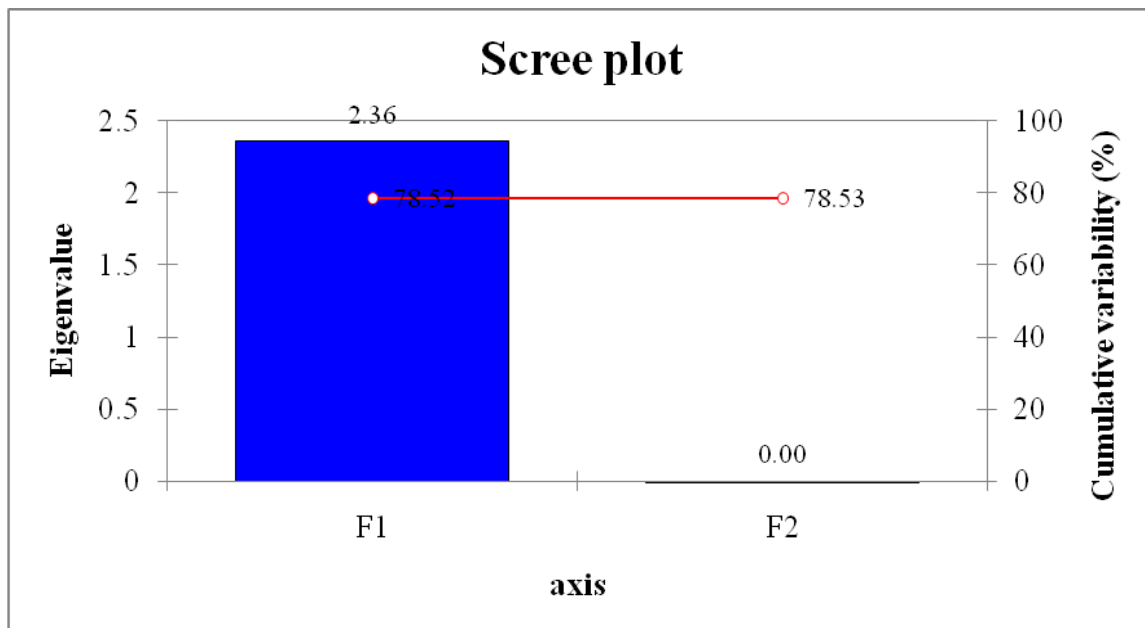
**Figure 27: Correlations between sub-criteria and factors for browser compatibility**

The resizeability sub-criterion relates to the display of a web site on a browser. A user must be able to resize a web site's display to suit the user's particular monitor and browser.

The mac sub-criterion relates to a web site displaying correctly on a mac machine.

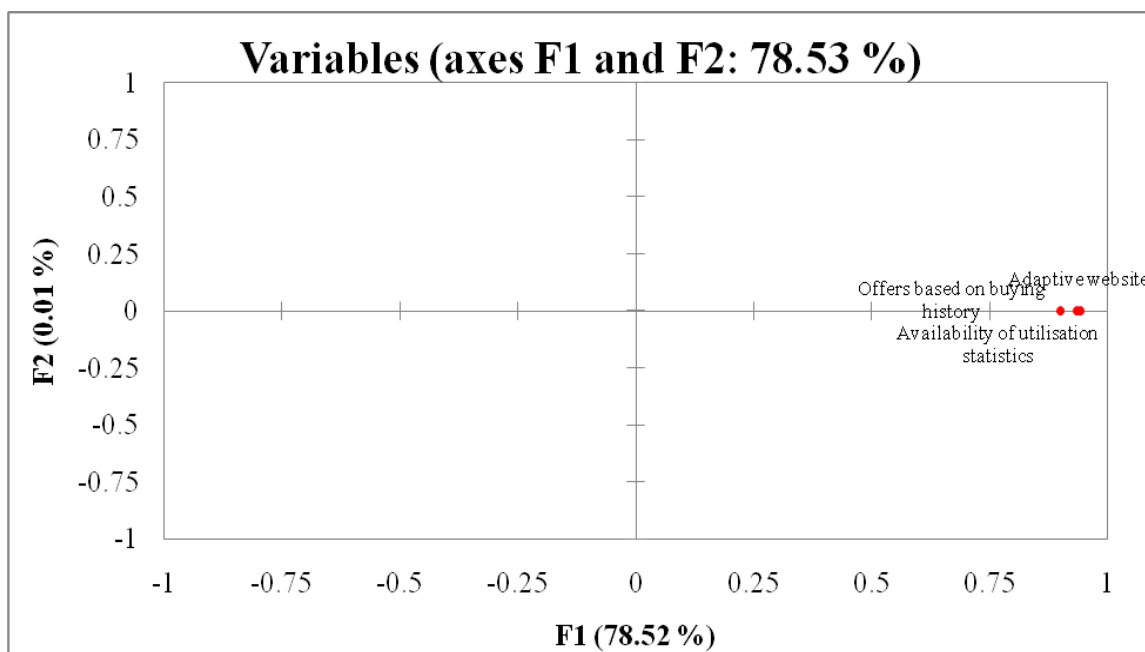
The netscape navigator (1-4) sub-criterion relates to a web site displaying correctly on the netscape navigator browser.

The eighth major usability category is knowledge of users. Figure 28 shows that the first factor (F1) explains 79% of the total data variability, and the first two factors (F1 and F2) explain 79% of the total data variability.



**Figure 28: Scree plot: Eigenvalues and cumulative variability for knowledge of users**

Figure 29 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description personalised web site: Availability of utilisation statistics; adaptive website; and offers based on buying history. None of the sub-criteria correlate strongly and positively with factor two (F2), so factor two (F2) is not retained.



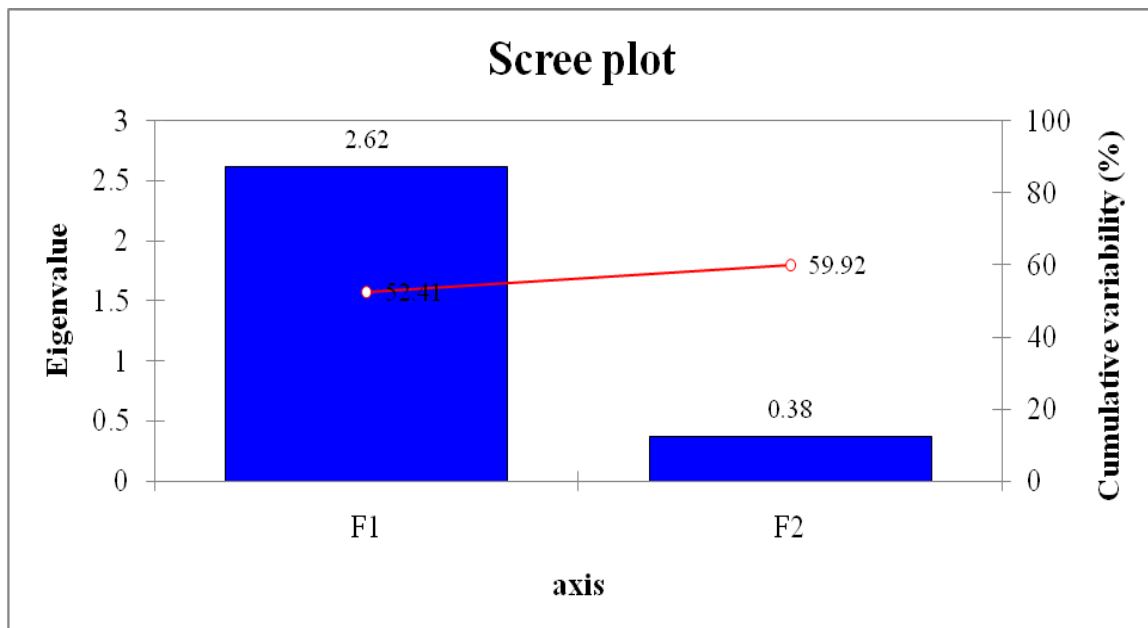
**Figure 29: Correlations between sub-criteria and factors for knowledge of users**

The availability of utilisation statistics sub-criterion relates to a web site analysing a particular user's usage statistics, in order to present to that user those aspects of a web site which the user prefers.

The adaptive website sub-criterion, per the e-mail survey questionnaire, relates to a web remembering a web site user's buying preferences, and presenting these to the user.

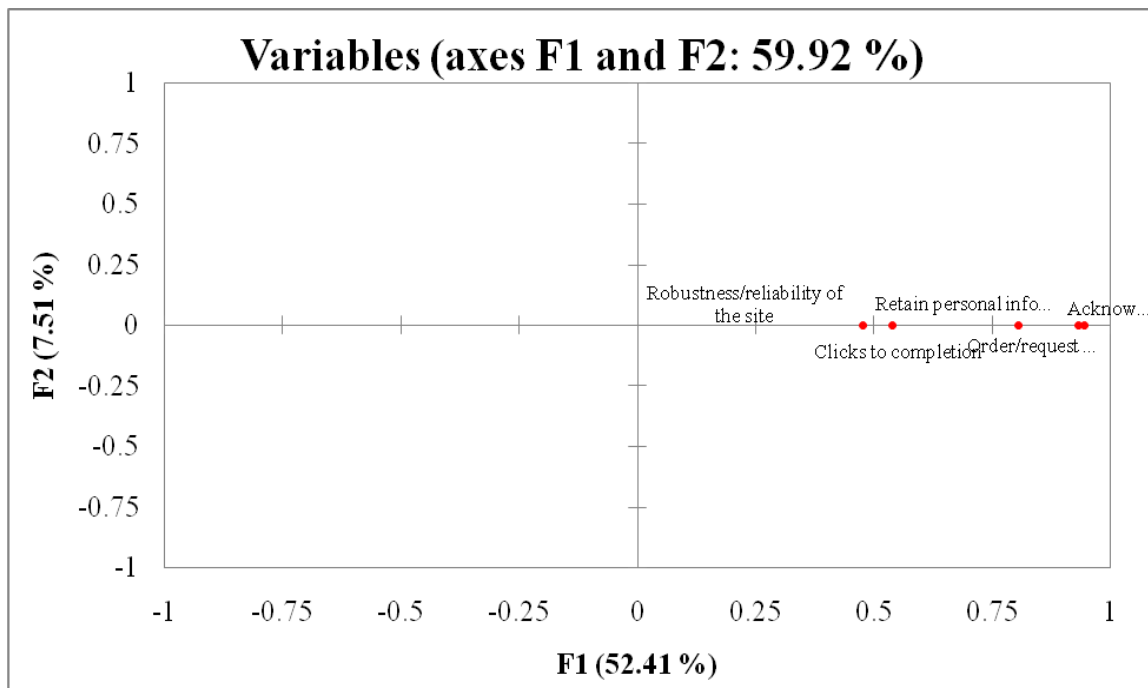
The offers based on buying history sub-criterion relates to a web making specific offers to a web site user based on that user's buying history.

The ninth major usability category is user satisfaction. Figure 30 shows that the first factor (F1) explains 52% of the total data variability, and the first two factors (F1 and F2) explain 60% of the total data variability.



**Figure 30: Scree plot: Eigenvalues and cumulative variability for user satisfaction**

Figure 31 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped to together under the factor description purchases support: Acknowledge order/request; order/request tracking online; retain personal information to minimise detail entering; and clicks to completion. None of the sub-criteria correlate strongly and positively with factor two (F2), so factor two (F2) is not retained.



**Figure 31: Correlations between sub-criteria and factors for user satisfaction**

The acknowledge order/request sub-criterion relates to a web site acknowledging a user's order and the details of that order, so that a user is left satisfied that the order is being processed correctly.

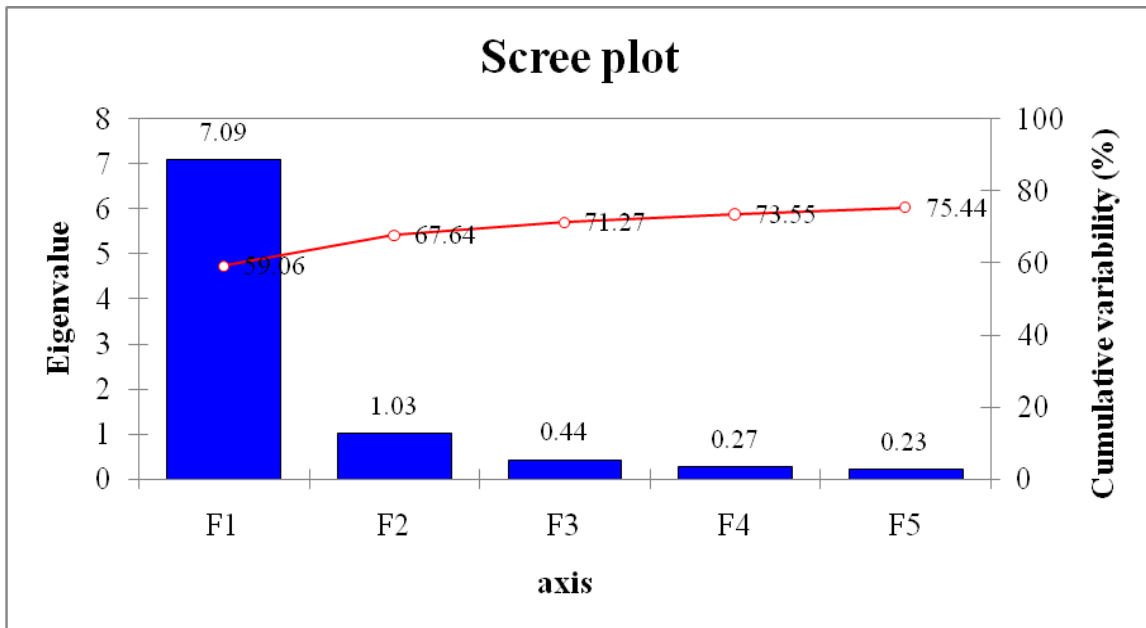
The order/request tracking online sub-criterion relates to a web site providing a user with full order tracking information. At any time a user will know at what stage an order is, resulting in a satisfied user.

The retain personal information to minimise detail entering sub-criterion relates to a web site automatically filling in previously provided user details for all new orders. Artifacts such as a cookie may fill in an order form. A user will be satisfied when a web site automatically completes repetitive user details.

The clicks to completion sub-criterion relates to a how much effort is required from a user to complete an order. The fewer steps required from a user to complete an order, the more satisfied a user will be.

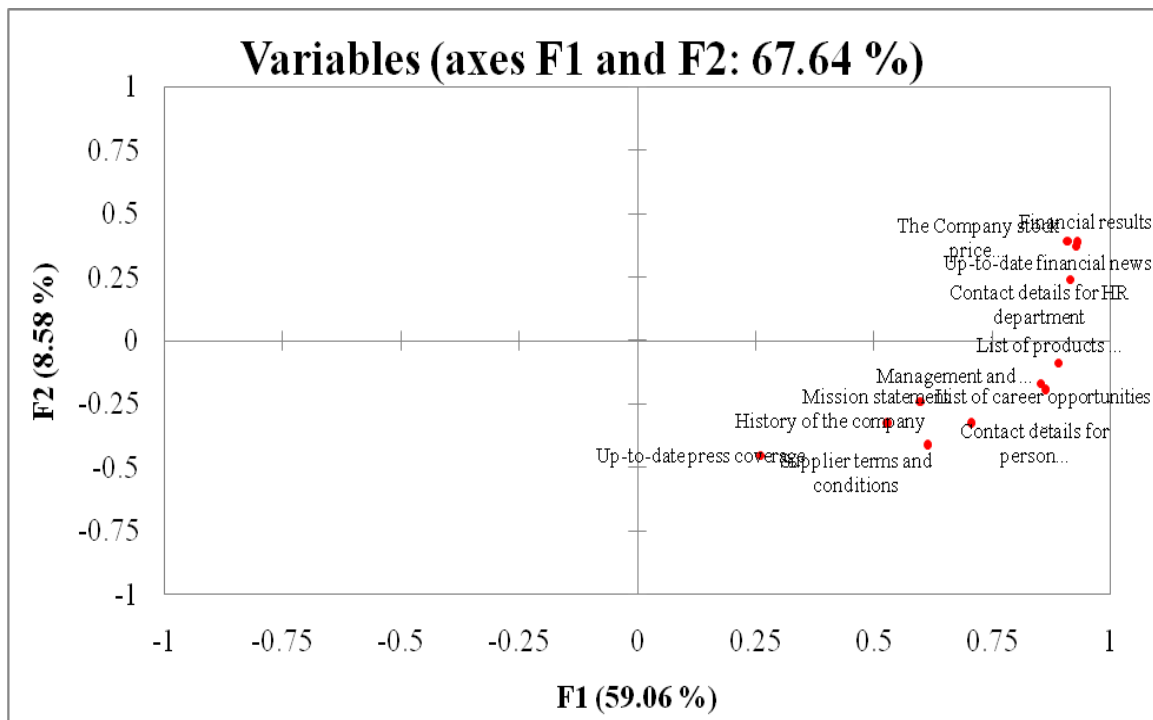
The tenth major usability category is other useful information. Figure 32 shows that the first factor (F1) explains 59% of the total data variability, and the first two factors (F1 and F2) explain 68% of the total data variability.





**Figure 32: Scree plot: Eigenvalues and cumulative variability for other useful information**

Figure 33 shows how each of the sub-criteria are correlated with the first and second factors (F1 and F2). The following sub-criteria correlate strongly and positively with factor one (F1) and are grouped together under the factor description company details: Financial results; up-to-date financial news; contact details for HR department; the company stock price performance; list of products bought by your company; list of career opportunities with the company; management and geographical structure of company; contact details for person in charge of suppliers; supplier terms and conditions; mission statement; and history of the company. None of the sub-criteria correlate strongly and positively with factor two (F2), so factor two (F2) is not retained.



**Figure 33: Correlations between sub-criteria and factors for other useful information**

The financial results sub-criterion relates to a web site providing the financial results of the web site owner. This is useful information for users deciding on doing business with the owner via the web site.

The up-to-date financial news sub-criterion relates a web site providing up-to-date financial news about the web site owner. This is useful information for a user deciding whether to continue transacting on the web site.

The contact details for HR department sub-criterion relates to a web site giving out the contact details for vacancy queries. This is useful information for users seeking employment with the web site owner.

The company stock price performance sub-criterion relates to a web site providing performance information about the web site owner's shares. This is useful information because it is an indication of how successful the web site owner's business is.

The list of products bought by your company sub-criterion relates to a web site providing a user's buying history. This is useful information when analysing previous buying history or doing reconciliations.

The list of career opportunities with the company sub-criterion relates to a web site providing a list of available vacancies for the web site owner. This is useful information for users seeking employment with the web site owner.

The management and geographical structure of company sub-criterion relates to a web site providing the internal and external structure of the web site owner. This is useful information for users deciding to do business with the web site owner.

The contact details for person in charge of suppliers sub-criterion relates to a web site providing contact details of a web site owner's supply manager. This is useful information for users wanting to supply goods and services to a web site owner.

The supplier terms and conditions sub-criterion relates to a web site providing the supplier terms and conditions of the web site owner. This is useful information for users planning on supplying good and services to the web site owner.

The mission statement sub-criterion relates to a web site providing the business purpose of the web site owner. This is useful information for users wanting to understand the business purpose of the web site owner.

The history of the company sub-criterion relates to a web site providing the history of the web site owner. This is useful information for users wanting to understand how a web site owner started and progressed to present day.

Table 7 presents the final set of factors retained, together with the respective sub-criteria. In conclusion, Table 7 shows that a total of eleven factors are the most important factors to focus on in order to achieve good and consistent usability. The reduction from eighty-one sub-criteria to eleven factors provides practical efficiency, so that a manageable and effective set of factors will be used in the Delphi method to corroborate or refute the sample statistics and inferences from research question one and research question two.

<b>Ten Major Usability Categories</b>	<b>Retained Factor/s and Descriptions</b>	<b>Respective Sub-Criteria</b>
First impressions	1. Initial comprehension	<ul style="list-style-type: none"> <li>• Look and feel – readability;</li> <li>• URL;</li> <li>• Feeling of wanting more - depth of site;</li> <li>• Ability to take action (key action point – KAP);</li> <li>• Unique selling point (USP) or value proposition;</li> <li>• Home page on one screen (above the fold);</li> <li>• Download time - size of home page;</li> <li>• Contact details; and</li> <li>• Statement from management.</li> </ul>
Navigation	2. Site layout	<ul style="list-style-type: none"> <li>• Text as well as graphic links (ALT tags);</li> <li>• Ease of use;</li> <li>• Site map;</li> <li>• Internal search engine;</li> <li>• Navigational links visible; and</li> <li>• Broken links.</li> </ul>
Content	3. Content quality	<ul style="list-style-type: none"> <li>• Degree of substantiated information;</li> <li>• Level of interaction;</li> <li>• Content in digestible quantity;</li> <li>• Useful information;</li> <li>• Use of valuable animation;</li> <li>• Use of valuable graphics; and</li> <li>• Up-to-dateness.</li> </ul>
Content	4. Content interaction	<ul style="list-style-type: none"> <li>• Use of valuable sound;</li> <li>• Reviews, testimonials and certifications; and</li> <li>• Availability of follow up discussion.</li> </ul>
Attractors	5. Enticements	<ul style="list-style-type: none"> <li>• Competitions;</li> <li>• Special offers;</li> <li>• Freebies;</li> <li>• Other (Specify);</li> <li>• External links; and</li> <li>• Breaking news.</li> </ul>
Findability	6. Site discovery	<ul style="list-style-type: none"> <li>• On-line recommend a friend;</li> <li>• On-line advertising;</li> <li>• Intuitive URL;</li> <li>• Use of frames*;</li> <li>• Off-line advertising;</li> <li>• Intuitive keywords; and</li> <li>• Use of metatags.</li> </ul>
Making contact	7. Communication	<ul style="list-style-type: none"> <li>• Personal e-mail response;</li> <li>• E-mail and other details visible;</li> <li>• Telephone contact number provided; and</li> <li>• Automatic e-mail response.</li> </ul>
Browser compatibility	8. Display consistency	<ul style="list-style-type: none"> <li>• Resizeability;</li> <li>• Mac; and</li> <li>• Netscape navigator (1-4).</li> </ul>
Knowledge of users	9. Personalised web site	<ul style="list-style-type: none"> <li>• Availability of utilisation statistics;</li> <li>• Adaptive website; and</li> <li>• Offers based on buying history.</li> </ul>

User satisfaction	10. Purchases support	<ul style="list-style-type: none"> <li>• Acknowledge order/request;</li> <li>• Order/request tracking online;</li> <li>• Retain personal information to minimise detail entering; and</li> <li>• Clicks to completion.</li> </ul>
Other useful information	11. Company details	<ul style="list-style-type: none"> <li>• Financial results;</li> <li>• Up-to-date financial news;</li> <li>• Contact details for HR department;</li> <li>• The company stock price performance;</li> <li>• List of products bought by your company;</li> <li>• List of career opportunities with the company;</li> <li>• Management and geographical structure of company;</li> <li>• Contact details for person in charge of suppliers;</li> <li>• Supplier terms and conditions;</li> <li>• Mission statement; and</li> <li>• History of the company.</li> </ul>

*Table 7: The final set of factors retained*

#### **4.8 Delphi method presentation and discussion of the data**

During February 2009 and March 2009 a total of twenty three suitable experts were approached before seven agreed to participate.

The Delphi Method started with the round one face-to-face interview. Round two and round three was done via e-mail between the dates 19 April 2009 to 30 April 2009, and between the dates 03 May 2009 to 15 May 2009, respectively. All seven experts participated in all three rounds. Table 8 presents a summary of the seven participants, the Delphi Method process, and costs.

#	Work & Qualifications	Org.	Date of Interview	No. of Changes Round 2	No. of Changes Round 3	Amount Paid to Participant
	Printing cost for participant copies.					R 932.00
A	Lecturer - BSc(Ed), BTech(IT)	UNISA-school of computing	Friday 20/03/2009 at 8:00am	3	0	R 300.00
B	Senior Lecturer - BCom Hons (Rhodes), MSc (UNISA)	UNISA-school of computing	Wednesday 01/04/2009 at 11:00am	3	0	R 300.00
C	Lecturer - Bcom (BIS), Btech (IT), MSc (IS)	UNISA-school of computing	Wednesday 01/04/2009 at 9:00am	0	0	R 300.00
D	Lecturer - BSc(HonsOR)UCT, BSc(HonsIS)UNISA, MSc (IS). Involved in research since 1986 at CSIR. Involved in the teaching and research at UNISA, mostly in visual programming, where HCI and usability criteria of any user interface is important	UNISA-school of computing	Monday 23/03/2009 at 11:00am	7	0	R 300.00
E	Lecturer - MSc: CS (Pret)	UNISA-school of computing	Monday 23/03/2009 at 8:45am	0	2	R 300.00
F	Lecturer - BSc (Honours) (UNISA), MSc (Computer Science) (UP)	UNISA-school of computing	Wednesday 01/04/2009 at 8:30am	0	0	R 300.00
G	Lecturer - BSC(UDW), BSC(hons)(UDW), MSC(UNP). Work experience: 12 years lecturing in IT-related courses. Qualifications: MSc (IT).	UNISA-school of computing	Wednesday 01/04/2009 at 8:00am	2	0	R -
	TOTAL			15	2	R 2,732.00

**Table 8: Summary of the Delphi Method participants, process start dates and costs**

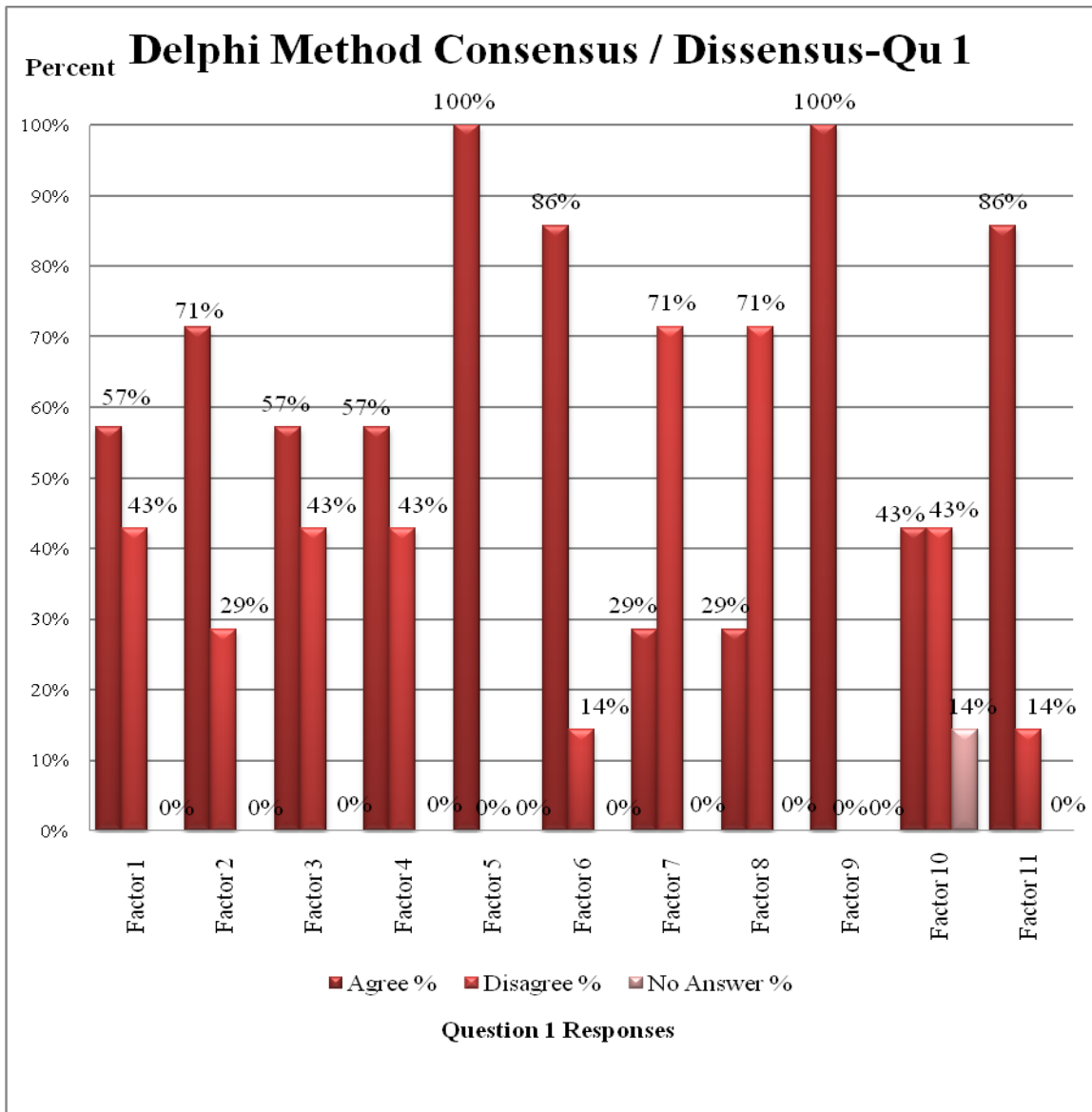
During the round one face-to-face interviews, each participant was also asked which South African Super 14 Rugby Team they support and if they do any work for any of the South African Super 14 Rugby franchises. These questions were to assess any biases that may affect the outcome of the Delphi Method. Table 9 summarises the responses to these questions. Four out of the seven participants do not support rugby at all, and each of the other three who support South African Super 14 Rugby Teams, support different teams. In addition, none of the participants have done any work for any of the South African Super

14 Rugby franchises as at the date of the interview. No bias effect is expected in the outcome of the Delphi Method.

#	South African Super 14 Rugby Team Supported	Work Done for any South African Super 14 Rugby Franchise
A	Is a Lions supporter.	None.
B	Is not a fan of Rugby.	None.
C	Is a casual Bulls and Sharks supporter.	None.
D	Is a Stormers supporter.	None.
E	Is not a fan of Rugby.	None.
F	Is not a fan of Rugby.	None.
G	Is not a fan of Rugby.	None.

**Table 9: Summary Delphi Method participant bias assessment**

Figure 34 and Figure 35 shows the level of expert consensus (agreement) or dissensus (disagreement) achieved after round three of the Delphi Method. Figure 34 shows the experts' answers to each factor's Question One, shown by the Qu 1 suffix in the figure header. Figure 35 shows the experts' answers to each factor's Question Two, shown by the Qu 2 suffix in the figure header. There is a separate figure for each of the Question One answers and the Question Two answers for ease of analysis. The objective of each factor's Question One is to determine if the experts agree or disagree with the mean scores obtained in the survey, for the web site ranking first and the web site ranking last in each major usability category. The objective of Question Two is to determine if the experts agree or disagree with an improvement recommendation for the web site with the first place relative ranking in each major usability category.

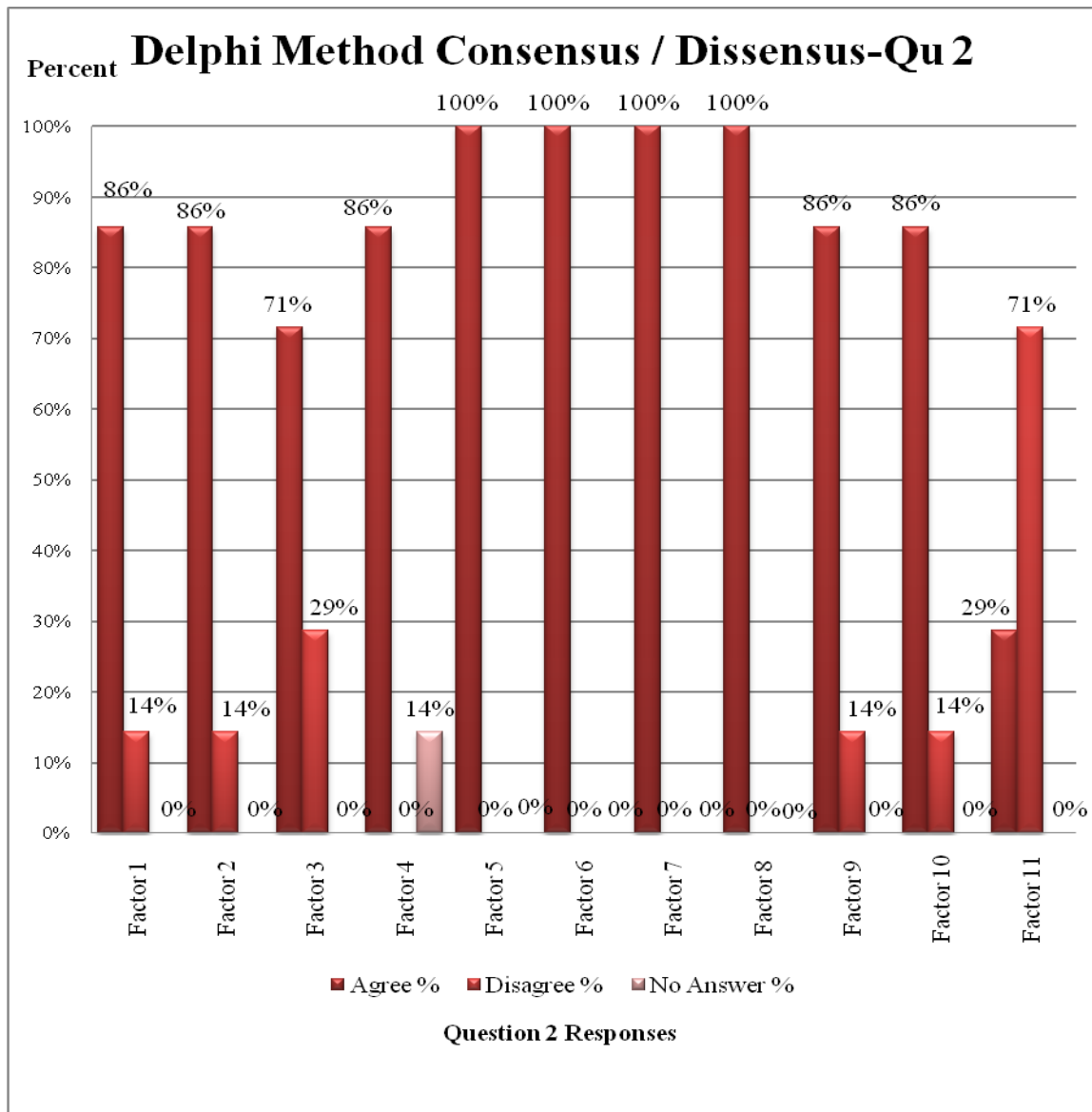


**Figure 34: Delphi Method Question One consensus / dissensus**

The answers to Question One, for all the factors, show a majority consensus or agreement with the mean scores and relative rankings of the first and last place web sites, obtained in the e-mail questionnaire survey; except for factors seven, eight, and ten. Factor seven and factor eight show a majority dissensus. Factor ten shows an even consensus/dissensus split.

The Delphi Method then corroborates the mean scores and the relative rankings obtained in the e-mail questionnaire survey; for the first and last place web sites for all of the major usability categories, except the making contact, browser compatibility, and user satisfaction major usability categories. This consensus does not directly confirm the means scores and relative rankings of the second, third and fourth place web sites; the corroboration of the first and last place web sites is reasonably extendable to the corroboration for the second, third and fourth place web sites, given the accuracy of the corroboration for the first and last place web sites.





**Figure 35: Delphi Method Question Two consensus / dissensus**

The answers to Question Two, for all the factors, show a majority consensus or agreement with the improvement recommendation for the web site with the first place relative ranking in each major usability category, except for factor eleven. Factor eleven shows a majority dissensus. Factor eleven relates to the usability category called other useful information.

The consensus from Question Two indicates that all the first place relative ranking web sites need improvement in all the major usability categories; except for the major usability categories where there is dissensus in Question One or in Question Two, being the making contact, browser compatibility, user satisfaction, and other useful information major usability categories. Consensus in Question One, to corroborate the first place relative ranking web sites, is a prerequisite for the application of consensus in Question Two, which is based on the first place relative ranking web sites. The need for improvement is also reasonably extendable to the web sites with second, third, fourth, and fifth place relative rankings, because these web sites have poorer usability scores than the first place relative ranking web sites, which need improvement.

## 4.9 Conclusions

In summary, Chapter Four began with the e-mail questionnaire survey process, and then presented and discussed the data gathered from the e-mail questionnaire survey. Thereafter, Chapter Four followed with the Delphi Method process, and then presented and discussed the data gathered from the Delphi method. Lastly, the data from both methods were presented and discussed, providing the method triangulation.

In conclusion, Chapter Four addressed all three of the research questions by using the data from the e-mail questionnaire survey. The Delphi Method interview was formed from addressing research question three. The method triangulation, of the Delphi Method data with the e-mail questionnaire survey data, provided a high level of corroboration for the results obtained by the e-mail questionnaire for research questions one and two, in light of the low survey response rate.

This chapter answers the research questions by using a method triangulation of the two research methodologies. The answers to the research questions measure the usability of the web sites. These answers are the insight into the usability of the web sites, and they are the underlying value of the research. From these answers improvement guidelines and recommendations are made, so that the web sites can be improved.

Chapter Four was a detailed discussion and statistical analysis of the data gathered from the e-mail questionnaire survey and the Delphi Method. The next chapter, Chapter Five presents the final, research conclusions based on the analyses in Chapter Four. Chapter Five also presents management guidelines and recommendations for improvements to the web sites.

## **Chapter 5: Research Conclusions**

### **5.1 Introduction to the research conclusions**

Chapter Five presents the research conclusions and Chapter Five completes the research. Chapter Five produces a concluding argument for the problem statement. The evidence for this concluding argument is provided by the presentation and discussion of the data in Chapter Four.

Chapter Five realises the objectives of this research, which are to measure and improve the usability of the five South African Super 14 Rugby franchise web sites. Chapter Five does this by providing conclusive results on the usability measures; and providing usability improvement, management guidelines and recommendations, based on the data evidence in Chapter Four.

Chapter Five starts by presenting a summary of the presentation and discussion of the data. Chapter Five then restates the research problem statement, shows how the results obtained in Chapter Four relate to the research questions, and shows how the research questions relate to the research problem statement. Following this, the chapter presents the limitations of the research, provides management guidelines and recommendations, and proposes future research. Lastly, the chapter ends with the final research conclusions.

### **5.2 Summary of the presentation and discussion of the data**

The presentation and discussion of the data started with a description of the e-mail questionnaire survey process, and then the data gathered from the e-mail questionnaire survey was presented and discussed. The presentation and discussion of the e-mail questionnaire survey data shows that, in isolation all of the web sites have poor overall usability scores. Also, from a relative point of view and based on the mean scores only, the ranking from best to poorest for overall usability scores is: Lions, Sharks, Cheetahs, Bulls, and then Stormers.

In addition, the presentation and discussion of the e-mail questionnaire survey data shows that in isolation, none of the web sites achieved good and consistent usability criteria scores within each web site for all ten of the major usability categories. Further, in isolation, only one good and consistent usability score was achieved across all the web sites, being the first impressions major usability category. In addition, from a relative point of view, only the Lions may be considered to have best achieved good and consistent scores because all the Lion's scores are above the mid point score of three in a five category ranking, for all ten of the major usability categories. Lastly, the presentation and discussion of the e-mail questionnaire survey data extracted a total of eleven factors, being the most important factors to focus on in order to achieve good and consistent usability.

Thereafter, the Delphi Method process was described. Subsequently, the data from the Delphi method was presented, discussed, and triangulated with the e-mail questionnaire survey data. The answers to Delphi Method Question One, for all the factors, show a majority consensus or agreement with the mean scores and relative rankings of the first and last place web sites, obtained in the e-mail questionnaire survey; except for the making contact, browser compatibility, and user satisfaction major usability categories. The Delphi

Method then corroborates the mean scores and the relative rankings obtained in the e-mail questionnaire survey; for the first and last place web sites for all of the major usability categories, except three major usability categories. This consensus does not directly confirm the means scores and relative rankings of the second, third and fourth place web sites; the corroboration of the first and last place web sites is reasonably extendable to the corroboration for the second, third and fourth place web sites, given the accuracy of the corroboration for the first and last place web sites.

The answers to Delphi Method Question Two, for all the factors, show a majority consensus or agreement with the improvement recommendation for the web sites with a first place relative ranking in each major usability category, except for the other useful information major usability category. The consensus from Question Two indicates that all the first place relative ranking web sites need improvement in all the major usability categories; except for the major usability categories where there is dissensus in Question One or in Question Two, being the making contact, browser compatibility, user satisfaction, and other useful information major usability categories. Consensus in Question One, to corroborate the first place relative ranking web sites, is a prerequisite for the application of consensus in Question Two, which is based on the first place relative ranking web sites. The need for improvement is also reasonably extendable to the web sites with second, third, fourth, and fifth place relative rankings, because these web sites have poorer usability scores than the first place relative ranking web sites, which need improvement.

### **5.3 The research questions answered**

The problem statement states that, the five South African Super 14 Rugby franchise web sites do not have good usability consistency, within each web site, and across all five web sites. The problem statement states that each website may only have some aspects that show good usability, not all aspects within each web site will show good usability. The problem statement also states that those aspects that show good usability in one website are not the same aspects that show good usability in the other web sites.

Good web site usability is a prerequisite for the success and the financial profitability of a web site, as stated in Section 2.13 (Djamasbi *et al.*, 2007; Nielsen, 1998; Chiravuri & Peracchio, 2003; Bentley *et al.*, 2005; Kuan *et al.* 2003; Darisipudi *et al.*, 2007; Aladwani, 2003; Fisher *et al.*, 2002; Fisher *et al.*, 2004; Levi & Conrad, 2003; Agarwal & Venkatesh, 2002; Bevan, 2001; Davis *cited in* Kralisch & Koeppen, 2005; Gillenson *et al.*, 1999; Wells *et al.*, 2007; Lam & Lee, 1999; Hong & Moriai, 1997).

Research question one asks, how good or poor are the web sites' overall usability scores, in isolation and relative to one another?

Research question one measures the overall usability of the web sites, and this is mentioned as a relevant measure in Section 2.7.2 (Agarwal & Venkatesh, 2002); Section 2.9 (Chiravuri & Peracchio, 2003); Section 2.9 (Hu & Chang, 2006); Section 2.10.2 (Ssemugabi, 2006); and Section 2.13 (Djamasbi *et al.*, 2007).

Based on the e-mail questionnaire survey only, in isolation, all of the web sites have poor overall usability scores because all the mean and median scores lie below the 375

benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for overall usability scores is: Lions, Sharks, Cheetahs, Bulls, and then Stormers.

The answers to Delphi Method Question One, for all the factors, show a majority consensus or agreement with the mean scores and relative rankings of the first and last place web sites, obtained in the e-mail questionnaire survey; except for the making contact, browser compatibility, and user satisfaction major usability categories. The Delphi Method then corroborates the mean scores and the relative rankings obtained in the e-mail questionnaire survey; for the first and last place web sites for all of the major usability categories, except three major usability categories. This consensus does not directly confirm the means scores and relative rankings of the second, third and fourth place web sites; the corroboration of the first and last place web sites is reasonably extendable to the corroboration for the second, third and fourth place web sites, given the accuracy of the corroboration of the first and last place web sites. The overall usability scores consist of all ten major usability categories. Therefore, the Delphi Method provides a seven out of ten or seventy percent corroboration of the poor, in isolation, overall usability scores and relative ranking from best to poorest; as obtained in the e-mail questionnaire survey.

The answers to Delphi Method Question Two, for all the factors, show a majority consensus or agreement with the improvement recommendation for the web sites with a first place relative ranking in each major usability category, except for the other useful information major usability category. The consensus from Question Two indicates that all the first place relative ranking web sites need improvement in all the major usability categories; except for the major usability categories where there is dissensus in Question One or in Question Two, being the making contact, browser compatibility, user satisfaction, and other useful information major usability categories. Consensus in Question One, to corroborate the first place relative ranking web sites, is a prerequisite for the application of consensus in Question Two, which is based on the first place relative ranking web sites. The need for improvement is also reasonably extendable to the web sites with second, third, fourth, and fifth place relative rankings, because these web sites have poorer usability scores than the first place relative ranking web sites, which need improvement.

Therefore, the data from the Delphi Method supports the conclusions from the e-mail questionnaire survey. The conclusions from the e-mail questionnaire survey answer research question one by stating that, in isolation, all of the web sites have poor overall usability scores because all the mean and median scores lie below the 375 benchmark value. Further, from a relative point of view and based on the mean scores only, the ranking from best to poorest for overall usability scores is: Lions, Sharks, Cheetahs, Bulls, and then Stormers.

Research question two asks, are the web sites' usability criteria scores good and consistent, in isolation and relative to one another?

Research question two measures the underlying usability criteria of the web sites. Section 2.11 provides many cases where usability is measured by underlying web site usability evaluation criteria, factors or attributes.

Based on the e-mail questionnaire survey only, in isolation, none of the web sites achieved good and consistent usability criteria scores within each web site for all ten of the major usability categories. Also, in isolation, only one good and consistent usability score was achieved across all the web sites, being the first impressions major usability category. Further, from a relative point of view, only the Lions may be considered to have best achieved good and consistent scores because all the Lion's scores are above the mid point relative ranking of three in a five category ranking, for all ten of the major usability categories.

The answers to Delphi Method Question One, for all the factors, show a majority consensus or agreement with the mean scores and relative rankings of the first and last place web sites, obtained in the e-mail questionnaire survey; except for the making contact, browser compatibility, and user satisfaction major usability categories. The Delphi Method then corroborates the mean scores and the relative rankings obtained in the e-mail questionnaire survey; for the first and last place web sites for all of the major usability categories, except three major usability categories. This consensus does not directly confirm the means scores and relative rankings of the second, third and fourth place web sites; the corroboration of the first and last place web sites is reasonably extendable to the corroboration for the second, third and fourth place web sites, given the accuracy of the corroboration of the first and last place web sites.

The dissensus obtained in the Delphi Method for the making contact, browser compatibility, and user satisfaction major usability categories does not directly substantiate the ANOVA and chi-square tests either, which negate using the sample means, indicating that the differences in the means are attributed to chance, and are not statistically significant. The dissensus only indicates that the experts do not agree with the means scores obtained in the e-mail questionnaire survey, and not that the mean scores should be identical. The result is that the mean scores and relative rankings for these three categories remain unknown, being the making contact, browser compatibility, and user satisfaction major usability categories.

Therefore, by omitting the making contact, browser compatibility, and user satisfaction major usability categories, the data from the Delphi Method still supports the conclusions from the e-mail questionnaire survey. The conclusions from the e-mail questionnaire survey answer research question two by stating that, in isolation, none of the web sites achieved good and consistent usability criteria scores within each web site, for the remaining seven out of ten major usability categories. Also, in isolation, only one good and consistent usability score was achieved across all the web sites, being the first impressions major usability category. Further, from a relative point of view, only the Lions may be considered to have best achieved good and consistent scores because all the Lion's scores are above the mid point score of three in a five category ranking, for the remaining seven out of ten major usability categories.

Research question three asks, what are the most important factors to focus on in order to achieve good and consistent usability?

Research question three follows from research question two; with a purpose to extract the most important underlying usability criteria that are appropriate for the web sites in this research. Section 2.11 again provides the background of underlying web site usability evaluation criteria, factors or attributes.

Based on the factor analysis in Chapter Four, a total of eleven factors are the most important factors to focus on in order to achieve good and consistent usability. The factors are: Initial comprehension, site layout, content quality, content interaction, enticements, site discovery, communication, display consistency, personalised web site, purchases support, and company details.

To conclude, this research provides supporting evidence that the five South African Super 14 Rugby franchise web sites do not have good usability consistency, within each web site, and across all five web sites. Each website only has some aspects that show good usability, not all aspects within each web site show good usability. Those aspects that show good usability in one website are not the same aspects that show good usability in the other web sites.

#### **5.4 Research limitations**

This research was limited by time and monetary resources. Also, the survey response rate is acknowledged as a limitation. There was also an apparent time based problem, being that the e-mail questionnaire survey took place between 20 July 2008 and 25 September 2008 and the Delphi Method took place between 20 March 2009 and 15 May 2009; during this time all of the web sites changed, mostly in content, but there were also seemingly minor structural changes. The exact effect of these minor changes on the research conclusions was not measured or part of this research.

#### **5.5 Management guidelines and recommendations**

This research provides evidence that all of the web sites have poor overall usability. The eleven factors extracted in research question three are the most important factors to focus on in order to achieve good and consistent usability, based on the factor analysis in Chapter Four. Following are those factors, with the percentage score of the web site with the best relative ranking, in that factor. The percentage score is the score obtained by the web site with the best relative ranking, indicating the highest level attained by any of the web sites. The researcher recommends that management give extra attention to those factors with very low percentage scores.

- 1) In the initial comprehension factor, the Lions web site has the best relative usability with an 84% score;
- 2) In the site layout factor, the Sharks web site has the best relative usability with a 56% score;
- 3) In the content quality factor, the Lions web site has the best relative usability with a 48% score;
- 4) In the content interaction factor, the Lions web site has the best relative usability with a 48% score;
- 5) In the enticements factor, the Sharks web site has the best relative usability with a 49% score;
- 6) In the site discovery factor, the Lions web site has the best relative usability with a 58% score;

- 7) In the communication factor, the Lions web site has the best relative usability with a 40% score;
- 8) In the display consistency factor, the Bulls web site has the best relative usability with a 35% score;
- 9) In the personalised web site factor, the Sharks web site has the best relative usability with a 23% score;
- 10) In the purchases support factor, the Lions web site has the best relative usability with a 40% score; and
- 11) In the company details factor, the Lions web site has the best relative usability with a 20% score.

The research also shows the relative usability of the web sites, each web site has different strong and weak usability characteristics. Where a web site has the best relative usability in a specific major usability category, it is recommended that management use this web site as a guideline for improvement in that major usability category. Following is each major usability category and the web site that has the best relative usability in that category, which is to be used as a guideline for that major usability category:

- 1) In the first impressions major usability category, the Lions web site has the best relative usability;
- 2) In the navigation major usability category, the Sharks web site has the best relative usability;
- 3) In the content major usability category, the Lions web site has the best relative usability;
- 4) In the attractors major usability category, the Sharks web site has the best relative usability;
- 5) In the findability major usability category, the Lions web site has the best relative usability;
- 6) In the making contact major usability category, the Lions web site has the best relative usability;
- 7) In the browser compatibility major usability category, the Bulls web site has the best relative usability;
- 8) In the knowledge of users major usability category, the Sharks web site has the best relative usability;
- 9) In the user satisfaction major usability category, the Lions web site has the best relative usability;
- 10) In the other useful information major usability category, the Lions web site has the best relative usability.

Following are ten more management guidelines and recommendations. These management guidelines and recommendations are specific and are only those improvements agreed to by the Delphi Method experts, in the Delphi Method Question Two responses:

- 1) For initial comprehension, ensure that the web site URL takes the user straight to content, and not to a cover page first with options to different content pages.
- 2) For site layout, ensure that the web site provides a visible site map.
- 3) For content quality, ensure that the web site does not have floating objects that hide parts of the content text.
- 4) For content interaction, ensure that the web site has a blog on the main content page.
- 5) For enticements, ensure that the web site makes the enticements obvious.



- 6) For site discovery, ensure that the web site has an on-line recommend a friend.
- 7) For communication, ensure that only the contact information is displayed when the contact us link is clicked, and not obscured by other content.
- 8) For display consistency, ensure that the web site displays correctly on all web browsers, and ensure that all of the display area is used.
- 9) For a personalised web site, provide relevant statistics on the web site, such as the number of visitors this season, so that web site users can feel part of the fan base.
- 10) For purchases support, ensure that the users' login details are placed before the rest of the order details; so that the order flow is logical, the user purchase preferences can be employed, and the users do not have to re-enter personal information on each order.

A final management guideline and recommendation relates to the use of the e-mail survey questionnaire to evaluate the usability of web site designs. The e-mail survey questionnaire is a validated usability instrument that provides insight into the usability of a web site. The e-mail survey questionnaire is broad enough in scope to be successful in evaluating the usability of any web site.

## **5.6 Contributions to the field**

This research aims to contribute to the field of web site usability evaluation in order to assist with future evaluation approach decisions. This research contributes by providing a discussion on the available evaluation literature and explaining why the particular evaluation choices, including analysis techniques and research strategies, were made for this web site domain. This research provides the resultant benefits and detriments of these evaluation choices, which are useful as guidance for future research in this field.

## **5.7 Proposals for future research**

Rugby and many other sports must be commercially viable in order to exist. It follows that their web sites, too, must be commercially viable. Future research which measures the effect of usability on the commercial viability of sports web sites may prove to be very important for sports organisations.

The design, validation, and implementation of sport web site survey instruments, especially web-based instruments, which result in high response rates, may also prove to be very important for sports organisations.

Longitudinal studies across several sports seasons, which monitor recommended changes to the web sites, may be another research avenue that will provide valuable information to sports organisations.

## 5.8 Conclusions

To conclude, this research indicates the importance of web site usability. This research shows that prior usability research has not been undertaken on the five South African Super 14 Rugby franchise web sites or on web sites in this domain. This research provides insight into the usability of the five South African Super 14 Rugby franchise web sites. This research provides sufficient evidence that the five South African Super 14 Rugby franchise web sites do not have good usability consistency, within each web site, and across all five web sites. This research also provides management guidelines and recommendations to improve the usability of these web sites.

The insight into the usability of these web sites, and the management guidelines and recommendations, is valuable for the South African Super 14 Rugby franchises. This research will allow the usability of these web sites and similar web sites to be improved on, so that the web site goals can be better achieved. The first web site goal is having as many visitors as possible, both unique visitors and repeat visitors. The second web site goal is to keep each visitor on the web site for as long as possible, so that each visitor can experience all that the web site has to offer. This research is also valuable for all the users of these web sites; better web site usability will result in web sites that are easier to use, users that are not frustrated, and users that have good experiences on these web sites.

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## Appendix A: Literature Matrix

Themes 1 – 6:

	Original Theme Letter	a	b	h	l	c	i
	Theme Number	1	2	3	4	5	6
Paper #	Themes / Papers File Name	Universal web site usability	General web site usability design issues	Web site usability design guidelines, principles, and heuristics	User analysis for web site usability	General web site usability evaluation or testing issues	Web site usability evaluation or testing methods
1	1. ACM Ubiquity - Shaping Web Usability Interaction Design in Context.htm		1	1			
2	2. Concise scannable and objective how to write for the web.pdf			1			
3	3. Designing beneath the surface of the web.pdf	1	1	1			
4	4. Designing for web site usability.pdf		1		1	1	
5	5. Developing a theory of website usability-an exploratory study to identify constructs and nomological networks.pdf						
6	6. Dissertation_Usability evaluation of a web based e learning application.pdf			1			1
7	7. Enhancing the explanatory power of usability heuristics.pdf						
8	8. Gender preferences in web design-usability testing through eye tracking.pdf						
9	9. Introduction to web design.pdf		1	1	1		
10	10. Investigating online consumer behaviour using thin slices of usability of web sites.pdf						
11	11. Klares useful information is useful for web designers.pdf		1	1	1		
12	12. Methods for evaluating the usability of web-based systems.pdf						1
13	13. On-line point-of-click web usability mining with popeval_mb-webeval_ab and the c-assure methodology.pdf						1
14	14. Report from a 1994 web usability study.pdf						
15	15. SME myths-if we put up a website customers will come to us-why usability is important.pdf		1	1			

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16	16. State of the art of web usability guidelines.pdf			1			
17	17. Ten Most Violated Homepage Design Guidelines (Jakob Nielsen's Alertbox).htm			1			
18	18. The Impact of usability on the Intention of planned purchases in e-commerce service websites.pdf						
19	19. The state of the art in automating usability evaluation of user interfaces.pdf						1
20	20. Usability over time.pdf						
21	21. Usability testing a quick cheap and effective method.pdf					1	1
22	22. Use of eye-tracking methodology in conjunction with usability software for websites usability testing-an hci study.pdf						
23	23. Web home pages as advertisements.pdf				1		
24	24. Web site usability a cultural perspective.pdf						
25	25. Web site usability design and performance metrics.pdf						
26	26. Web sites that work designing with your eyes open.pdf						
27	27. Web sites usability, usability requirements specification & usability evaluation.pdf						
28	28. Web usability a review of the research.pdf		1				
29	29. Web usability study a review.pdf						
30	30. A comparison of the most important website features in different domains an empirical study of user perceptions.pdf		1				
31	31. A longitudinal study of the use of the web by regional tourism organisations in the asia pacific region.pdf						
32	32. A study on tolerable waiting time-how long are web users willing to wait.pdf		1				
33	33. An empirical study to assess the use of a new web-based customer services system.pdf						
34	34. Antecedents of website acceptance and use an interdisciplinary view.pdf						

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35	35. Assessing the effects of website control button differentiation on user attitudes and performance.pdf		1				
36	36. Discovering hidden knowledge on the behaviour of web users and content providers through web mining.pdf						
37	37. End-user control in web-based electronic services a case study.pdf		1				
38	38. End-user experience with information in web-based electronic service a case study.pdf						
39	39. Evaluating small business web sites - understanding users.pdf		1				
40	40. From novices to experts user performance confidence and satisfaction on the world wide web.pdf						
41	41. Intentions and perceptions-the emerging gaps between web systems designers and users.pdf		1				1
42	42. Measurement of user satisfaction with web-based information systems an empirical study.pdf					1	
43	43. Measurement of user-perceived web quality.pdf					1	
44	44. Measuring online trust of websites-credibility perceived ease of use and risk.pdf						
45	45. Observing a users mental model of an informational website.pdf		1				
46	46. Perceived affect user experience and the use of the web.pdf						
47	47. Predicting the use of web-based information systems intrinsic motivation and self-efficacy.pdf						
48	48. Some determinants of user perceptions of information quality on the world wide web.pdf						
49	49. The impact of animation on individual performance a web-based experiment.doc		1				
50	50. The impact of language on website use and user satisfaction project description.pdf	1					



Appendix A: Literature Matrix

51	51. The use of an expert system to dynamically alter web pages for one-to-one marketing.pdf						
52	52. User interface multimedia richness and learning style on the world wide web a literature review.pdf	1	1	1			
53	53. User satisfaction and web portal use.pdf		1				
54	54. User-centered navigation re-design for web -based information systems.pdf					1	
55	55. Web site evaluation - do web applications meet user expectations music consumer goods and e-banking on the test bed.pdf					1	1
56	56. When do users detect information quality problems on the world wide web.pdf						
57	57. Customer web interaction fundamentals and decision tree.pdf						
58	58. Designing for appropriation.pdf		1	1			
59	59. Evaluating website effectiveness towards formal representation and analysis of knowledge about design of business processes and communications.pdf		1				
60	60. Improving web site usability through a clustering approach.pdf		1	1			
61	61. Models for cross-cultural communications for cross-cultural website design.pdf	1					
62	62. Usability issues in web site design.pdf		1	1	1	1	1
63	63. Using HCI techniques to evaluate electronic commerce sites.pdf					1	1
64	64. Beyond the five-user assumption benefits of increased sample sizes in usability testing.pdf		1			1	
65	65. Page design guidelines developed through usability.pdf		1	1			
66	66. Usability testing a case study.pdf					1	
67	67. Usability testing of world wide web sites.pdf			1		1	1

Appendix A: Literature Matrix

68	68. A comparison of questionnaires for assessing website usability.pdf						
69	69. A methodological framework for the analysis and design of adaptive web-based information systems.pdf		1		1		
70	70. An empirical analysis of web site stickiness.pdf						
71	71. Assessing a firms web presence a heuristic evaluation procedure for the measurement of usability.pdf		1	1		1	1
72	72. Content versus structure in information environments a longitudinal analysis of website preferences.pdf		1				
73	73. Designing useful and usable questionnaires you cant just throw a questionnaire together.pdf						
74	74. Effect of website characteristics on consumer loyalty a multilevel analysis.pdf				1		
75	75. Information quality of commercial web site home pages an explorative analysis.pdf		1			1	
76	76. Using protocol analysis to understand the effects of web site design on consumer purchase behaviours.pdf		1			1	1
77	77. Web design in e-commerce a theory and empirical analysis.pdf		1				
78	78. Web surveys a review of issues and approaches.pdf						
79	79. Web content and design a review of e-commerce e-business program sites.pdf	1	1				
80	80. An objective assessment of commercial usage of the world wide web.pdf		1				
81	81. The influence of website quality and expectancy-disconfirmation on assessments of service quality a signalling theory perspective.pdf						
82	82. A proposed research model for appraisal and evaluation of the design quality of web sites in the context of electronic commerce.pdf		1				
83	83. Evaluation Criteria for the Design of Commercial Web Sites.doc						

Appendix A: Literature Matrix

84	84. Towards analytical approach to effective website designs a framework for modelling evaluation and enhancement.pdf	1	1				
85	85. A model of internet consumer satisfaction focusing on the web-site design.pdf		1				
86	86. Web site information design what small business needs to know.pdf	1	1	1	1	1	

Themes 7 – 12:

		Original Theme Letter	d	e	j	m	g	k
		Theme Number	7	8	9	10	11	12
Paper #	Themes / Papers File Name	Qualitative web site evaluation methods	Quantitative web site evaluation methods	Questionnaires to evaluate web site usability	Web site usability evaluation criteria, factors or attributes	Usability problems or usability errors on web sites	The importance of good usability on web sites	
1	1. ACM Ubiquity - Shaping Web Usability Interaction Design in Context.htm					1	1	
2	2. Concise scannable and objective how to write for the web.pdf	1	1	1			1	
3	3. Designing beneath the surface of the web.pdf							
4	4. Designing for web site usability.pdf		1					
5	5. Developing a theory of website usability-an exploratory study to identify constructs and nomological networks.pdf			1	1	1	1	1
6	6. Dissertation_Usability evaluation of a web based e learning application.pdf	1		1			1	
7	7. Enhancing the explanatory power of usability heuristics.pdf							
8	8. Gender preferences in web design-usability testing through eye tracking.pdf		1					1
9	9. Introduction to web design.pdf						1	1
10	10. Investigating online consumer behaviour using thin slices of usability of web sites.pdf		1			1		1
11	11. Klares useful information is useful for web designers.pdf						1	

Appendix A: Literature Matrix

12	12. Methods for evaluating the usability of web-based systems.pdf	1					
13	13. On-line point-of-click web usability mining with popeval_mb-webeval_ab and the c-assure methodology.pdf						
14	14. Report from a 1994 web usability study.pdf	1				1	
15	15. SME myths-if we put up a website customers will come to us-why usability is important.pdf	1	1	1	1		1
16	16. State of the art of web usability guidelines.pdf					1	
17	17. Ten Most Violated Homepage Design Guidelines (Jakob Nielsen's Alertbox).htm						
18	18. The Impact of usability on the Intention of planned purchases in e-commerce service websites.pdf		1	1		1	1
19	19. The state of the art in automating usability evaluation of user interfaces.pdf						
20	20. Usability over time.pdf					1	
21	21. Usability testing a quick cheap and effective method.pdf	1					
22	22. Use of eye-tracking methodology in conjunction with usability software for websites usability testing-an hci study.pdf						1
23	23. Web home pages as advertisements.pdf		1		1		
24	24. Web site usability a cultural perspective.pdf			1	1		1
25	25. Web site usability design and performance metrics.pdf			1	1		
26	26. Web sites that work designing with your eyes open.pdf				1		
27	27. Web sites usability, usability requirements specification & usability evaluation.pdf		1				1
28	28. Web usability a review of the research.pdf				1		
29	29. Web usability study a review.pdf						
30	30. A comparison of the most important website features in different domains an empirical study of user perceptions.pdf				1		

Appendix A: Literature Matrix

31	31. A longitudinal study of the use of the web by regional tourism organisations in the asia pacific region.pdf						
32	32. A study on tolerable waiting time-how long are web users willing to wait.pdf				1		
33	33. An empirical study to assess the use of a new web-based customer services system.pdf	1					1
34	34. Antecedents of website acceptance and use an interdisciplinary view.pdf				1		1
35	35. Assessing the effects of website control button differentiation on user attitudes and performance.pdf						
36	36. Discovering hidden knowledge on the behaviour of web users and content providers through web mining.pdf						
37	37. End-user control in web-based electronic services a case study.pdf	1				1	
38	38. End-user experience with information in web-based electronic service a case study.pdf	1					
39	39. Evaluating small business web sites - understanding users.pdf	1	1	1	1		1
40	40. From novices to experts user performance confidence and satisfaction on the world wide web.pdf				1	1	
41	41. Intentions and perceptions-the emerging gaps between web systems designers and users.pdf	1			1	1	
42	42. Measurement of user satisfaction with web-based information systems an empirical study.pdf			1	1		
43	43. Measurement of user-perceived web quality.pdf			1	1		
44	44. Measuring online trust of websites-credibility perceived ease of use and risk.pdf				1		
45	45. Observing a users mental model of an informational website.pdf		1			1	
46	46. Perceived affect user experience and the use of the web.pdf				1		

Appendix A: Literature Matrix

47	47. Predicting the use of web-based information systems intrinsic motivation and self-efficacy.pdf						
48	48. Some determinants of user perceptions of information quality on the world wide web.pdf			1	1		
49	49. The impact of animation on individual performance a web-based experiment.doc					1	
50	50. The impact of language on website use and user satisfaction project description.pdf			1	1		1
51	51. The use of an expert system to dynamically alter web pages for one-to-one marketing.pdf				1	1	1
52	52. User interface multimedia richness and learning style on the world wide web a literature review.pdf				1	1	1
53	53. User satisfaction and web portal use.pdf			1	1		
54	54. User-centered navigation re-design for web -based information systems.pdf			1	1	1	
55	55. Web site evaluation - do web applications meet user expectations music consumer goods and e-banking on the test bed.pdf		1	1	1	1	
56	56. When do users detect information quality problems on the world wide web.pdf			1	1	1	
57	57. Customer web interaction fundamentals and decision tree.pdf					1	1
58	58. Designing for appropriation.pdf						
59	59. Evaluating website effectiveness towards formal representation and analysis of knowledge about design of business processes and communications.pdf	1	1		1		
60	60. Improving web site usability through a clustering approach.pdf				1	1	
61	61. Models for cross-cultural communications for cross-cultural website design.pdf				1		
62	62. Usability issues in web site design.pdf				1	1	1

Appendix A: Literature Matrix

63	63. Using HCI techniques to evaluate electronic commerce sites.pdf				1		
64	64. Beyond the five-user assumption benefits of increased sample sizes in usability testing.pdf						
65	65. Page design guidelines developed through usability.pdf					1	
66	66. Usability testing a case study.pdf			1		1	
67	67. Usability testing of world wide web sites.pdf	1		1		1	1
68	68. A comparison of questionnaires for assessing website usability.pdf			1			
69	69. A methodological framework for the analysis and design of adaptive web-based information systems.pdf						
70	70. An empirical analysis of web site stickiness.pdf		1				
71	71. Assessing a firms web presence a heuristic evaluation procedure for the measurement of usability.pdf			1	1		1
72	72. Content versus structure in information environments a longitudinal analysis of website preferences.pdf			1			
73	73. Designing useful and usable questionnaires you cant just throw a questionnaire together.pdf			1			
74	74. Effect of website characteristics on consumer loyalty a multilevel analysis.pdf						1
75	75. Information quality of commercial web site home pages an explorative analysis.pdf			1	1		
76	76. Using protocol analysis to understand the effects of web site design on consumer purchase behaviours.pdf			1	1	1	
77	77. Web design in e-commerce a theory and empirical analysis.pdf			1	1		
78	78. Web surveys a review of issues and approaches.pdf						
79	79. Web content and design a review of e-commerce e-business program sites.pdf				1		
80	80. An objective assessment of commercial usage of the world wide web.pdf						

Appendix A: Literature Matrix

81	81. The influence of website quality and expectancy-disconfirmation on assessments of service quality a signalling theory perspective.pdf		1		1		1
82	82. A proposed research model for appraisal and evaluation of the design quality of web sites in the context of electronic commerce.pdf			1	1		
83	83. Evaluation Criteria for the Design of Commercial Web Sites.doc				1		1
84	84. Towards analytical approach to effective website designs a framework for modelling evaluation and enhancement.pdf		1		1		
85	85. A model of internet consumer satisfaction focusing on the web-site design.pdf			1		1	1
86	86. Web site information design what small business needs to know.pdf		1	1	1	1	1



## Appendix B: Delphi Method Literature Matrix

	Original Theme Letter	a	b	c	d	e	f
	Theme Number	1	2	3	4	5	6
Paper #	Themes / Papers File Name	History of the Delphi technique / method.	Specific Delphi technique / method procedures.	Benefits of the Delphi technique / method.	Disadvantages / problems of the Delphi technique / method.	Specific purpose and uses of the Delphi technique / method.	Definition of the Delphi technique / method.
1	1. Human factors analysis of a Delphi forecast of computer display technology.	1	1	1	1	1	1
2	2. A Delphi approach to acquiring knowledge from single and multiple experts.		1	1	1	1	1
3	3. A Delphi examination of public sector ERP implementation issues.	1	1		1	1	1
4	4. Identifying important and difficult concepts in introductory computing courses using a Delphi process.		1	1			1
5	5. A multi-agent based implementation of a Delphi process.		1	1			1
6	6. Classifying computing education papers: Process and results.		1		1		1
7	7. From privacy methods to a privacy toolbox: Evaluation shows that heuristics are complementary.						
8	8. Premium usability: Getting the discount without paying the price.						
9	9. Tools and approaches for developing data-intensive Web applications: A survey.						
10	10. User-centered design methods in practice: A survey of the state of the art.						
11	11. Education goes digital: The evolution of online learning and the revolution in higher education.						
12	12. Impact analysis.	1	1	1	1		
13	13. Use of the Delphi method in developing a data base for academic performance.		1	1	1	1	
14	14. Toward an ideal competency-based computer science teacher certification program: the Delphi approach.		1			1	

Appendix B: Delphi Method Literature Matrix

15	15. A prolog simulation for a Delphi-based problem solver.	1	1	1		1	
16	16. A framework for assessing the global diffusion of the Internet.						
17	17. Knowledge-based support in a group decision making context: An expert-novice comparison.		1				
18	18. The intellectual development of human-computer interaction research: A critical assessment of the MIS literature.						
19	19. An empirical assessment of user perceptions of feature versus application level usage.		1	1	1	1	
20	20. Perceptions of information technology risk: A Delphi study.		1			1	
21	21. The essential components of disaster recovery methods: A Delphi study among small businesses.		1	1	1	1	
22	22. A dynamic voting wiki model.						
23	23. Content and design metrics for web sites: Combining qualitative and quantitative results.		1	1		1	
24	24. Web site analysis: A review and assessment of previous research.						
25	25. Sophistication of online tourism websites in Hong Kong: An exploratory study.						
26	26. Disintermediation and reintermediation in the U.S. air travel distribution industry: A Delphi reprise.	1	1	1	1		
27	27. Open standards and government policy: results of a Delphi survey.		1	1	1	1	
28	28. Design science in information systems research.						
29	29. Duplicate of item 23.						
30	30. Just a chapter in the book, item 37.						
31	31. The Delphi-an evaluation tool.		1	1	1	1	1
32	32. A Delphi study to develop a national survey of accessibility of medical instrumentation.		1	1		1	
33	33. Culture, internationalisation and usability.		1			1	

Appendix B: Delphi Method Literature Matrix

34	34. Detail procedure of Delphi survey.		1				
35	35. The Delphi method: General background.	1	1	1			1
36	36. The Delphi method for graduate research.	1	1	1	1	1	1
37	37. The Delphi method techniques and applications.	1	1	1	1	1	1
38	38. Delphi method.	1	1	1	1	1	1
39	39. Delphi method.	1	1			1	1
40	40. Computer based Delphi processes.	1	1	1	1	1	1
41	41. Delphi method.		1	1		1	
42	42. The Delphi method.	1	1	1	1	1	
43	43. Prioritization process using Delphi technique.	1	1	1		1	
44	44. Using the Delphi Technique to Achieve Consensus.		1		1	1	
45	45. Delphi technique.		1	1	1	1	
46	46. The Delphi technique.				1	1	
47	47. The Delphi technique – what is it?				1	1	

## Appendix C: E-mail Survey Questionnaire

FOR RESEARCHER USE ONLY: Respondent Code: \_\_\_\_\_

### VOLUNTARY QUESTIONNAIRE FOR UNISA STUDENTS

#### “Comparative Usability of the South African Super 14 Rugby Franchise Web Sites”

Department of Computer Science (Information Systems)

University of South Africa (UNISA)

Researcher: Grant Howard

Research Supervisor: Professor Sam Lubbe

#### Note to the respondent

- ☞ I need your help to understand how users rate the five South African Super 14 Rugby franchise web sites.
- ☞ Although I would like you to help me, you do not have to take part in this survey.
- ☞ If you do not want to take part, just return the blank questionnaire. If I do not hear from you, I may send you a reminder.
- ☞ What you say in this questionnaire will remain private and confidential. No one will be able to trace your responses back to you as a person.
- ☞ If you decide to take part, and return a completed questionnaire by dd/mm/ccyy, I will compensate you Rx for your completed questionnaire. To receive the payment of Rx, kindly provide your bank details when you submit your completed questionnaire, so that I can do an electronic funds transfer (EFT) of Rx into your specified bank account. If an EFT is not suitable for you, kindly contact me before filling out the questionnaire so that an alternative payment method can be arranged. If you do not wish to receive payment for a completed questionnaire just return the completed questionnaire without any banking details. No compensation will be paid for questionnaires returned after dd/mm/ccyy.

#### The questionnaire as three parts:

Part 1 asks permission to use your responses for academic research.

Part 2 asks general personal particulars like your age and gender.

Part 3 asks you to rate the web sites.

#### How to complete the questionnaire

1. Please answer the questions as truthfully as you can. Also, please be sure to read and follow the directions for each part. If you do not follow the directions, it will make it harder for me to process your responses.
2. I am only asking you about things that you and your fellow students should feel comfortable telling me about. If you do not feel comfortable answering a question, you

can indicate that you do not want to answer it. For those questions that you do answer, your responses will be kept confidential.

*Thank you very much for filling in this questionnaire.*

Directions for Part 1: Please fill in the required words, in the block below.

<b><u>PART 1:</u> PERMISSION TO USE MY RESPONSES FOR ACADEMIC RESEARCH</b>	
I hereby give permission that my responses may be used for research purposes provided that my identity is not revealed in the published records of the research.	
Initials and surname: _____	
Postal _____	address: _____
_____	_____
_____	_____
Postal code: _____	
E-mail address: _____	
Contact numbers: Home: _____ Cell: _____	

Directions for Part 2: You can mark each response by making a tick or a cross, or by typing an “X” to the left of the appropriate block, or by filling in the required words or numbers.

**PART 2: GENERAL PERSONAL PARTICULARS**

*Please tell me a little about yourself*

Please mark only ONE option per question below.

1.  I am \_\_\_\_\_ years old.       I do not want to answer this question
2. I am a:  female    male       I do not want to answer this question
3. I grew up:  in South Africa       abroad: \_\_\_\_\_  
 I do not want to answer this question
4. I am:  
 African    Coloured    Indian    White    Other  
 I do not want to answer this question

5. I like the following South African Super 14 Rugby team the most:  
 Bulls    Cheetahs    Lions    Sharks    Stormers    None of these teams  
 I do not want to answer this question
6. I am:  a fan of Rugby    not a fan of Rugby    I do not want to answer this question

Directions for Part 3: Please open the spreadsheet called “Questionnaire.xls”, and then rate the web sites by completing the questionnaire based on the detailed instructions that follow:

### **PART 3: RATE THE WEB SITES**

*Following are the detailed instructions to rate the web sites*

- The questionnaire requires that you provide a rating for each item on the questionnaire, for all five of the South African Super 14 Rugby franchise web sites, namely, in alphabetical order, the Bulls, the Cheetahs, the Lions, the Sharks, and the Stormers.
- The questionnaire requires that you access the web site of each of these five South African Super 14 Rugby franchises, via the Internet.
- Score each web site using a number from -10 to +10, including 0. 0 means that the criteria is not available at all to score.
- Scores from +1 to +10 relate to the how well the criteria is being represented, where +1 indicates that the criteria is extremely poorly represented, and +10 indicates that the criteria is extremely well represented.
- Scores from -10 to -1 relate to how distracting or irritating the criteria is, where -10 indicates a major distraction/irritant and -1 a minor distraction/irritant. These negative scores are only apply to the criteria with an asterisk (\*).

*Thanks again for helping me with this survey*

Appendix C: E-mail Survey Questionnaire

<b>Web Site Review Questionnaire</b>		<b>Bulls</b>	<b>Cheetahs</b>	<b>Lions</b>	<b>Sharks</b>	<b>Stormers</b>
<p>Score each web site using a number from -10 to +10, including 0. 0 means that the criteria is not available at all to score. Scores from +1 to +10 relate to the how well the criteria is being represented, where +1 indicates that the criteria is extremely poorly represented, and +10 indicates that the criteria is extremely well represented. Scores from -10 to -1 relate to how distracting or irritating the criteria is, where -10 indicates a major distraction/irritant and -1 a minor distraction/irritant. These negative scores are only apply to the criteria with an asterisk (*).</p>						
<b>Criteria Explanation</b>	<b>Criteria</b>					
First Impressions are always important. If the website does not look professional and if it does not function in an efficient and effective way as well as being attractive, potential clients/users may be lost.	<b>1. FIRST IMPRESSIONS</b>					
The URL (Universal Resource Locator. An Internet World Wide Web Address) needs to be short and simple. The best URLs are intuitive.	URL					
Size of home page. The most important factor in conveying an efficient impression is download time. A user will only wait so long for a page to download. All pages should be kept under 50k in size. The homepage should be especially small and quick to download.	Download time - size of home page					
Readability. Pages should be easily readable, clear and easy to understand. It is important that the site is not too cluttered with text and images. The font size needs to be large enough to be readable and clashing colours need to be avoided.	Look and feel - readability					
Asking users to download an application or a plug-in before entering a site can cause annoyance and confusion, hence driving them away.	Need to download software *					
Users entering the site will appreciate seeing everything in front of them without having to make the effort of scrolling up and down.	Home page on one screen (above the fold)					
It is extremely important that the user immediately realises that the site is of potential use to them. The unique selling point of the site should be stated on the homepage.	Unique Selling Point (USP) or Value Proposition					
The site should be interactive and encourage user participation from the outset. There should be direct links to key action points immediately visible on the homepage.	Ability to take action (Key action point – KAP)					
The site should strive to create a feeling of wanting more in the user. The goal should be to get the user to stay as long as possible and to come back to the site again.	Feeling of wanting more - depth of site					
Providing immediate contact details such as e-mail addresses and telephone numbers on the homepage will give the site an open feel and add a personal touch, thus increasing user confidence and trust in using the site.	Contact details					
Providing credential information is a useful way to build trust in the user.	Credential validation - certifications, associations etc.					

Appendix C: E-mail Survey Questionnaire

This provides an opportunity for the user to see the business vision and values of the company.	Statement from management					
	Use of attractors					
Forcing users to subscribe or register on the home page before continuing will not be appreciated and may turn users away. Users will only identify themselves when they are ready.	Are you made to register to get into site? *					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Being offered an easy way to find your way around the website is critical to the success of the venture.	<b>2. NAVIGATION</b>					
The navigation system should be intuitive and easy to use, providing direct access to various content and facilities on the site.	Ease of use					
Site maps are easy to understand and present a completely alternative method of navigating the site to the user.	Site map					
Constantly providing a link back to the homepage is essential to ensuring users do not get lost and feel more secure navigating the site.	Return to Home Page from any page					
An internal search facility provides users with a means of finding what they want on the website quickly and efficiently. This is especially important for large sites with a substantial amount of content.	Internal search engine					
Allow users to move through the site not only through text or graphical navigation system but also through the content. This allows the user to navigate through the site following the natural progression of the content.	Internal links					
All links should be continuously tested to insure they are working. Broken links will frustrate users and give an unprofessional impression.	Broken links					
Graphics may not convey immediate meaning to some users so providing additional text links is important. ALT tags (image descriptors) on images accommodate the visually impaired and can boost ranking with some search engines.	Text as well as graphic links (ALT tags)					
Navigational links should be constantly visible and consistent throughout the complete website.	Navigational links visible					
The fundamental view of data on the Web is the page, which is viewed as an atomic unit. Frames split up web pages and can add confusion to the user attempting to navigate the site.	Opens multiple windows					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Without valuable and useful information the website may well fail to achieve its objectives. The key to good content is that it is extensive and original.	<b>3. CONTENT</b>					
All content presented on the site should be of the highest quality. Generally users are interested in content and not fancy animations and graphics. It is important to proof read content thoroughly before adding it to a site.	Useful information					



Appendix C: E-mail Survey Questionnaire

<p>Information published on the Web is generally evaluated under the following five headings.          Authority: Who is responsible for the pages, what are their qualifications and associations, can these be verified?          Currency: Are the dates when the site was created and last updated clear?          Coverage: What is the focus of the site? Are there clear headings to illustrate an outline of the content?          Objectivity: Are biases, if any, clearly stated? Are affiliations clear?          Accuracy: Are sources of information and factual data clearly listed, and available for cross checking?</p>	Degree of substantiated information					
<p>As a medium the Web is especially tailored to presenting content through the use of text, graphics and animation, offering a huge potential to convey content to users. Therefore a website should be as interactive as possible, taking advantage of the great opportunity to interact with users.</p>	Level of interaction					
<p>Graphics should add value to the website rather than reduce performance without providing any real benefit to the user.</p>	Use of valuable graphics					
<p>Animation used should add value to the website rather than reduce performance without providing any real benefit to the user.</p>	Use of valuable animation					
<p>Sound used should add value to the website rather than reduce performance without providing any real benefit to the user.</p>	Use of valuable sound					
<p>Providing independent comments about how trustworthy the website actually is will build trust in the users.</p>	Reviews, testimonials and certifications					
<p>Content should be chunked, that is broken up into easily digestible amounts. Pages that are only composed of scrolling text should be avoided as they will bore the user.</p>	Content in digestible quantity					
<p>All content published should be recent and up-to-date.</p>	Up-to-dateness					
<p>Making the site's content available in multiple languages will make the information accessible to a wider range of people.</p>	Available in Multiple Languages					
<p>It is highly important that the sight accomadates those with visual and audial disabilities.</p>	Accessibility for disabled people					
<p>It is important to supply details of how goods and services are to be delivered and returned if necessary. Information on how payment is to be made is also absolutely essential.</p>	Terms and conditions					
<p>Frequently asked questions provide a site with the ability to quickly introduce the site's content to an unfamiliar user.</p>	FAQ's					
<p>The website should provide a means to engage in a discussion with the business.</p>	Availability of follow up discussion					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Appendix C: E-mail Survey Questionnaire

Attractors draw individuals and business to your site.	<b>4. ATTRACTORS</b>					
	Invitation to register for something					
	Competitions					
	Special offers					
	Freebies					
	Breaking news					
	External links					
	Newsletter					
	Other (Specify)					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
These criteria make it easy to find your website in the first place.	<b>5. FINDABILITY</b>					
It is estimated that 47% of all website referrals come from direct navigation (the URL typed directly into the navigation bar). Therefore the site's URL should be intuitive i.e. as close to the company's name or brand as possible.	Intuitive URL					
	Designed for search engine performance					
Internet users usually search for Websites by typing keywords into the search box in search engines. The words that you imagine users entering to search for your site are your strategic keywords.	Intuitive keywords					
Meta tags can improve a site's ranking with a number of search engines and therefore are invaluable to making a site more findable. By definition Meta tags are machine understandable information for the Web. Generally it is information used to define and document the content of a site. They do not appear when the page is viewed through a browser but sit hidden in the HEAD element of a page.	Use of metatags					
Search engines can have difficulties indexing framed pages. This is because when frames are used URL's can cease to work, as the URL in the address box is no longer a complete specification of the information shown in the window.	Use of frames*					
	Advertising					
On-line banner advertising is a useful promotional tool and there are many services that charge per number of users directed to the site such as valueclick.com.	On-line advertising					

Appendix C: E-mail Survey Questionnaire

<p>The website address should be printed on all business literature such as business cards, letterheads, brochures, catalogs and invoices. Mention the website in all existing advertising methods such as television, billboards, radio, newspaper and magazine advertising. List the website in all available off-line directories such as the Yellow Pages.</p>	<p>Off-line advertising</p>					
<p>A "recommend a friend" facility is essential to promoting a website. A user that finds a site interesting and useful is likely to have friends or associates that will also have an interest in the site.</p>	<p>On-line recommend a friend</p>					
<p>Getting other websites to link to your site can substantially increase the flow of traffic through your site. Another benefit of other sites linking to your site is that it can boost your ranking with some of the search engines. Therefore negotiating reciprocal links with other sites can increase the findability of your site in two different ways.</p>	<p>Partner and affiliate sites</p>					
	<p><b>Total score for section</b></p>	<p><b>0</b></p>	<p><b>0</b></p>	<p><b>0</b></p>	<p><b>0</b></p>	<p><b>0</b></p>
<p>Many business transactions require some level of contact between the parties concerned. The checklist offers an approach to evaluating the effectiveness of a website using the following key issues with regard to Making Contact.</p>	<p><b>6. MAKING CONTACT</b></p>					
	<p>Email and other details visible</p>					
	<p>Response time to enquiries</p>					
	<p>Automatic email response</p>					
	<p>Personal email response</p>					
	<p>Use of online forms</p>					
	<p>Telephone contact number provided</p>					
	<p>Telephone call back offered</p>					
	<p><b>Total score for section</b></p>	<p><b>0</b></p>	<p><b>0</b></p>	<p><b>0</b></p>	<p><b>0</b></p>	<p><b>0</b></p>
<p>Make the website visit a much more useful and pleasant experience. There are many variations of browsers and monitors in use today and it is important that the website is accessible to as many internet users as possible.</p>	<p><b>7. BROWSER COMPATIBILITY</b></p>					
	<p>Internet Explorer (1-5)</p>					
	<p>Netscape Navigator (1-4)</p>					

Appendix C: E-mail Survey Questionnaire

	Mac					
	Resizeability					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
The more a website knows about the surfing and buying habits of the users, the more ability it has to fulfill the users needs.	<b>8. KNOWLEDGE OF USERS</b>					
	Availability of utilisation statistics					
An adaptive website will remember the buying preferences of the users.	Adaptive website					
	Offers based on buying history					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Satisfying users is essential to bringing e-shoppers and e-buyers back to the website.	<b>9. USER SATISFACTION</b>					
i.e. is the site frequently crashing or off-line.	Robustness/reliability of the site					
	Clicks to completion					
	Acknowledge order/request					
	Order/request tracking online					
Does the cookie fill the form?	Retain personal information to minimise detail entering					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Supplying additional useful information will help build confidence in the e-shopper.	<b>10. OTHER USEFUL INFORMATION</b>					
	Supplier terms and conditions					
	List of products bought by your company					
	Contact details for person in charge of suppliers					
	List of career opportunities with the company					
	Contact details for HR department					
	Financial results					
	Up-to-date financial news					

Appendix C: E-mail Survey Questionnaire

	The Company stock price performance					
	History of the company					
	Management and geographical structure of company					
	Mission statement					
	Up-to-date press coverage					
	<b>Total score for section</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
	<b>OVERALL TOTAL SCORE</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

## Appendix D: Delphi Method Interview Questions

FOR RESEARCHER USE ONLY: Participant Code: \_\_\_\_\_

### VOLUNTARY DELPHI METHOD PARTICIPATION

#### “Comparative Usability of the South African Super 14 Rugby Franchise Web Sites”

Department of Computer Science (Information Systems)  
University of South Africa (UNISA)  
Researcher: Grant Howard  
Research Supervisor: Professor Sam Lubbe

#### General information

- ☞ I need your help to understand how experts rate the five South African Super 14 Rugby franchise web sites. The five Super 14 Rugby franchises are: The Bulls, the Cheetahs, the Lions, the Sharks, and the Stormers.
- ☞ You have been referred as a person with expert knowledge relevant to this Delphi method.
- ☞ A total of seven experts will participate in this Delphi method.
- ☞ Although I would like you to help me, you do not have to take part in this Delphi method.
- ☞ If you do not want to take part, just return this document to me indicating as such. If I do not hear from you, I may send you a reminder in the case that the e-mail did not reach you initially.
- ☞ Your personal details and what you say in this Delphi method will remain private and confidential. No one will be able to trace your responses back to you as a person. In addition, all participants will remain anonymous to one another.
- ☞ If you decide to take part, I will compensate you R300.00. Taking part requires the following:
  - ☞ Responses from you to all twenty-two “agree/disagree” questions during round one, round two, and round three of the Delphi method;
  - ☞ Round one requires a maximum of one hour of your time in a face to face interview at a place and time of your choice, but before the 15 April 2009 (dates can be moved forward if all participants consent);
  - ☞ Round two requires about 30 minutes of your time and will be done via e-mail at your convenience, but between the 19 April 2009 and the 30 April 2009 (dates can be moved forward if all participants consent);
  - ☞ Round three requires about 30 minutes of your time and will also be done via e-mail at your convenience, but between the 3 May 2009 and the 15 May 2009 (dates can be moved forward if all participants consent);
  - ☞ Once your participation is complete, kindly provide your bank details, so that I can do an electronic funds transfer (EFT) of R300.00 into your specified bank account. If an EFT is not suitable for you, kindly let me know so that an alternative payment method can be arranged.

**This document as three parts:**

Part 1 asks permission to use your responses for this academic research.

Part 2 asks for details of your relevant expert knowledge.

Part 3 explains the Delphi method and contains all the Delphi method “agree or disagree” questions about the web sites.

**PART 1: PERMISSION DETAILS**

Directions for Part 1: Please fill in the spaces, in the block below.

**PART 1: PERMISSION TO USE MY RESPONSES FOR ACADEMIC RESEARCH**

I hereby give permission that my responses may be used for research purposes provided that my identity is not revealed in the published records of the research.

Initials and surname: \_\_\_\_\_

Postal address:

\_\_\_\_\_  
\_\_\_\_\_

Postal code: \_\_\_\_\_

E-mail address: \_\_\_\_\_

Contact number: Home/Work/Cell: \_\_\_\_\_





### **PART 3: THE DELPHI METHOD AND INTERVIEW QUESTIONS**

Directions for Part 3: Please read the following paragraphs explaining this Delphi method.

The Delphi method “agree or disagree” questions about the web sites are presented thereafter.

- The purpose of this Delphi method is gain expert opinion which will either support or negate the results of a prior survey done on the web sites. The use of more than one expert provides the benefit of applied, collective intelligence. The iterative nature of this Delphi method allows the experts to reconsider previous responses in light of the other experts’ responses and changes. The anonymity of the experts enables the experts to focus on the questions and responses, without any social pressures to confirm to any particular opinion.
- **All questions** require an agree/disagree answer. If your answer is disagree, then kindly provide a brief explanation stating why you disagree. If a question is not possible to answer you may enter a disagree answer with a brief explanation why it is not possible to answer that question.
- **Seven experts** are selected to participate in this Delphi method. Seven experts have been used in a previous Delphi method to successfully achieve consensus. The number seven is an odd number, selected in order to provide a majority of consensus (agreement) or dissensus (disagreement) if there is a 3/3 split of opinion. Also, a maximum of seven experts are selected due to the researcher’s money and time constraints.
- The participants will be **anonymous** to each other, their responses will be made under aliases, such as participant number one, participant number two, participant number three, and so on.
- This Delphi method consists of **three rounds**. The participants are welcome to view the web sites on the Internet during any of the rounds.
- **Round one** is a **semi-structured interview**, which has a set of predefined questions but also allows for free discussion of other relevant issues, question clarification, or further explanations.
- After round one, the researcher will analyse and collate the responses into a single document. Unless there is complete consensus, a **second round** begins where the researcher will submit the collated single document via e-mail to all seven of the participants so that each participant can reconsider their initial responses in the context of the other participants’ responses.
- A **final third round** will take place only if there is not complete consensus following round two. Round three follows the same format as round two.
- All the Delphi method rounds are based on the semi-structured interview questions. In the semi-structured interview there are **eleven factors**. These factors have been extracted from the prior survey. For each of these eleven factors, sub-criteria are listed which constitute the factor, and then two agree/disagree questions presented, thereafter

two screen copies of the first ranking web site (in the survey) and last ranking web site (in the survey), in that factor category are shown.

- The **first question** for each factor asks whether the participant agrees or disagrees with a percentage score for each of the two web sites shown in the screen prints. This question is to corroborate or refute the mean ratings obtained from the prior survey.
- The **second question** for each factor asks each participant to agree or disagree with an improvement recommendation for the web site that achieved a first place ranking (in the survey). The improvement recommendation is based on the researcher's opinion, and its purpose is to check whether the web sites in first place can still be improved upon.

### FACTOR 1

The first factor is called **initial comprehension**, and it has the following constituent sub-criteria:

Look and feel – readability;

URL;

Feeling of wanting more - depth of site;

Ability to take action (key action point – KAP);

Unique selling point (USP) or value proposition;

Home page on one screen (above the fold);

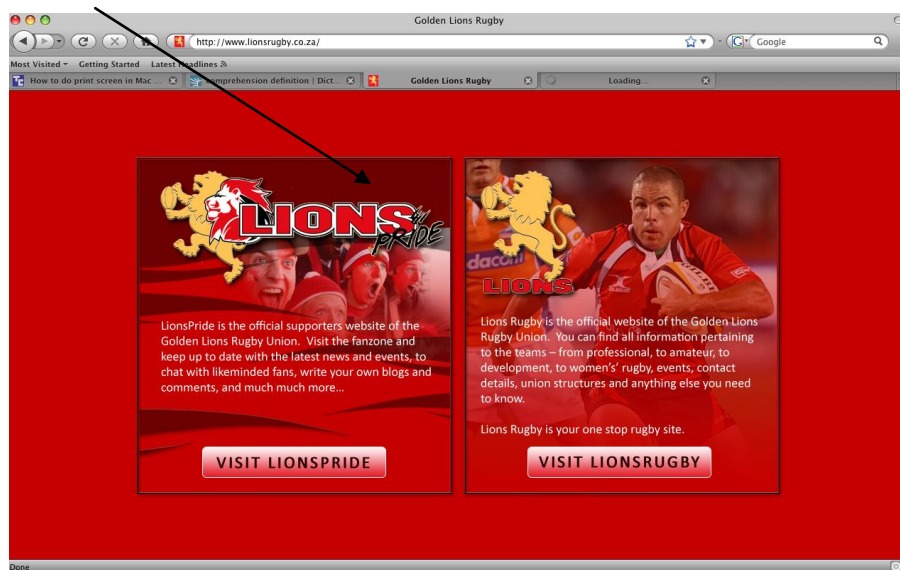
Download time - size of home page;

Contact details; and

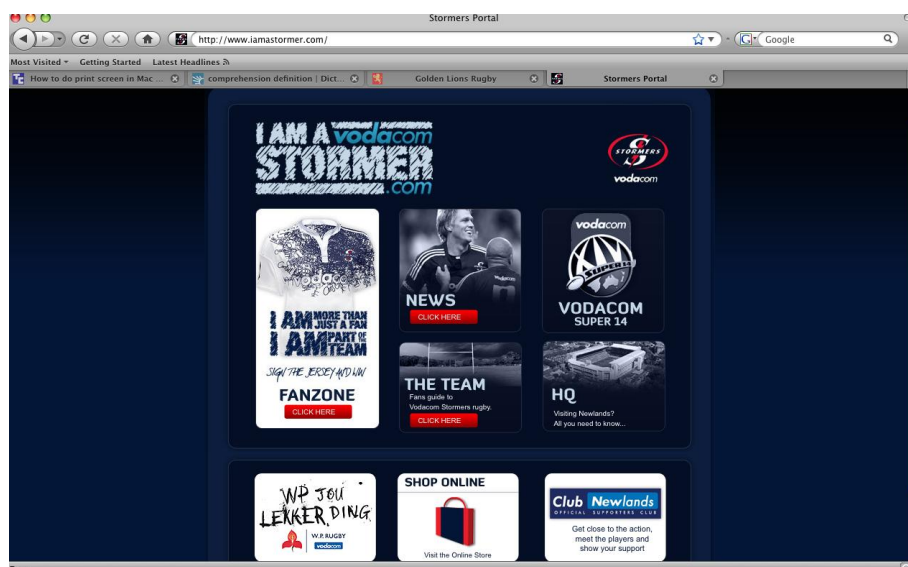
Statement from management.

The first question is: Do you think that an initial comprehension percentage score of 84% for the Lions and 66% for the Stormers is fair?

The second question is: The Lions web site can be improved by taking you straight to the content page?



Lions screen copy.



Stormers screen copy.

**FACTOR 2**

The second factor is called **site layout**, and it has the following constituent sub-criteria:

Text as well as graphic links (ALT tags);

Ease of use;

Site map;

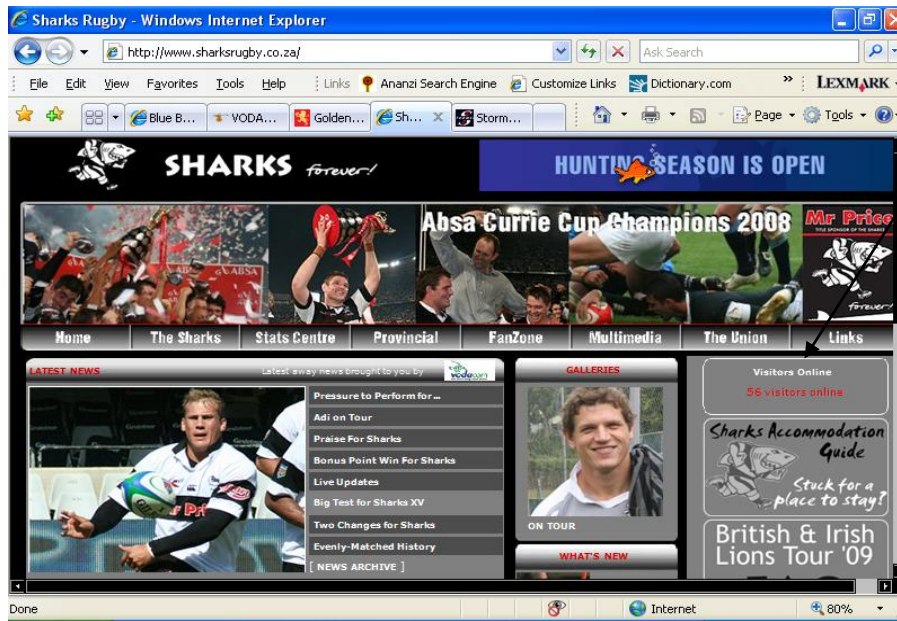
Internal search engine;

Navigational links visible; and

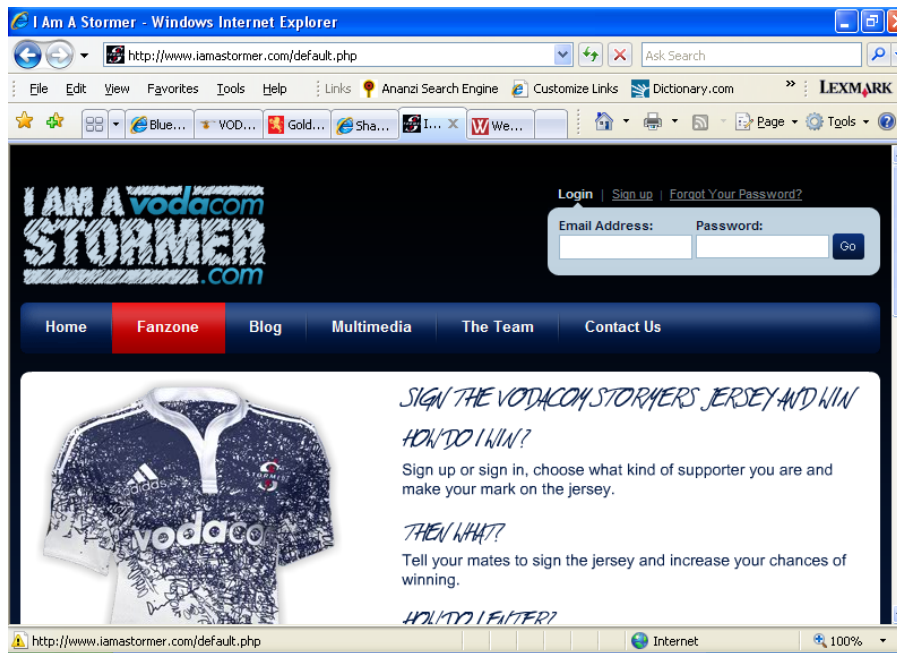
Broken links

The first question is: Do you think that a site layout percentage score of 56% for the Sharks and 45% for the Stormers is fair?

The second question is: The Sharks web site can be improved by providing a site map?



Sharks screen copy.



Stormers screen copy.

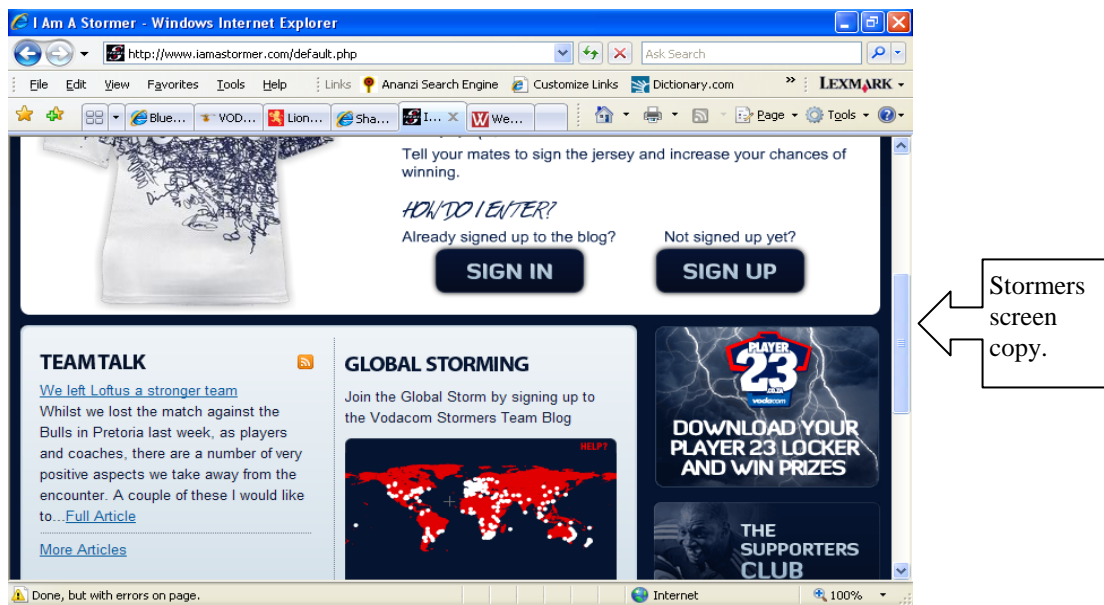
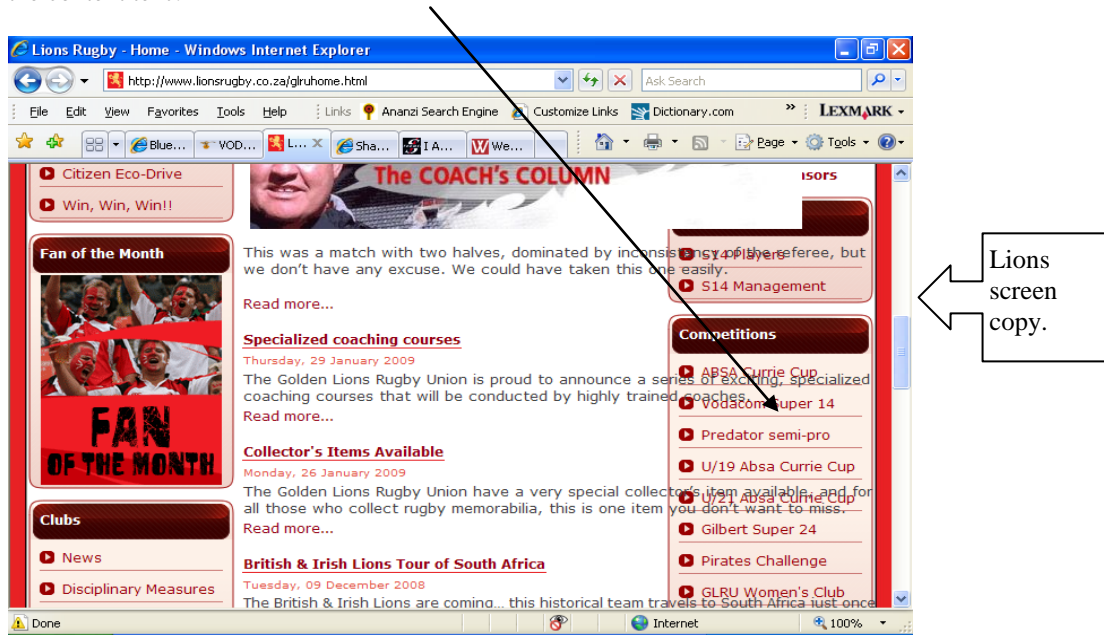
**FACTOR 3**

The third factor is called **content quality**, and it has the following constituent sub-criteria:

- Degree of substantiated information;
- Level of interaction;
- Content in digestible quantity;
- Useful information;
- Use of valuable animation;
- Use of valuable graphics; and
- Up-to-dateness.

The first question is: Do you think that a content quality percentage score of 48% for the Lions and 41% for the Stormers is fair?

The second question is: The Lions web site can be improved by removing the objects that are hiding parts of the content text?



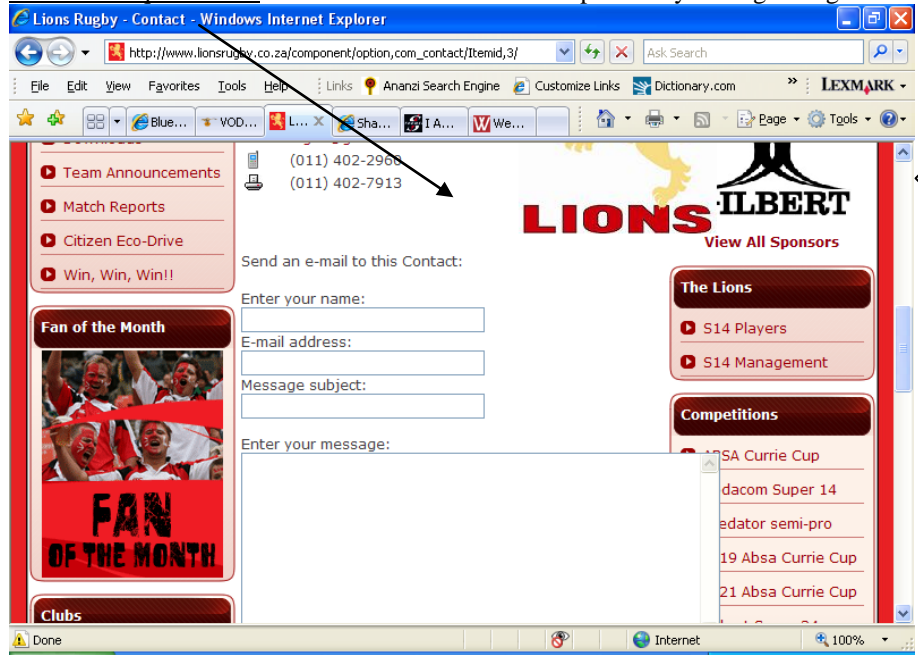
**FACTOR 4**

The fourth factor is called **content interaction**, and it has the following constituent sub-criteria:

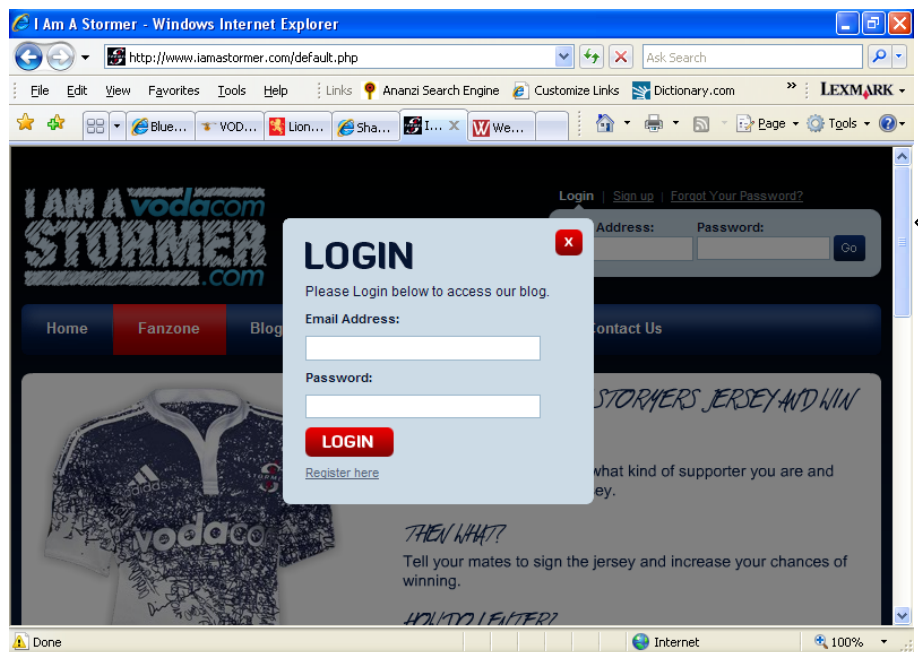
- Use of valuable sound;
- Reviews, testimonials and certifications; and
- Availability of follow up discussion.

The first question is: Do you think that a content interaction percentage score of 48% for the Lions and 41% for the Stormers is fair?

The second question is: The Lions web site can be improved by having a blog on the main rugby home page?



Lions screen copy.



Stormers screen copy.



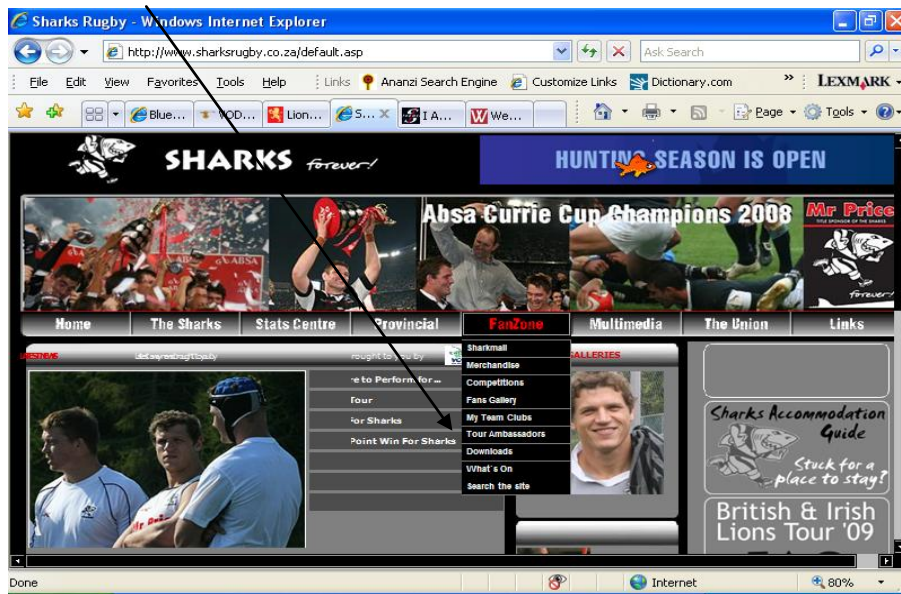
**FACTOR 5**

The fifth factor is called **enticements**, and it has the following constituent sub-criteria:

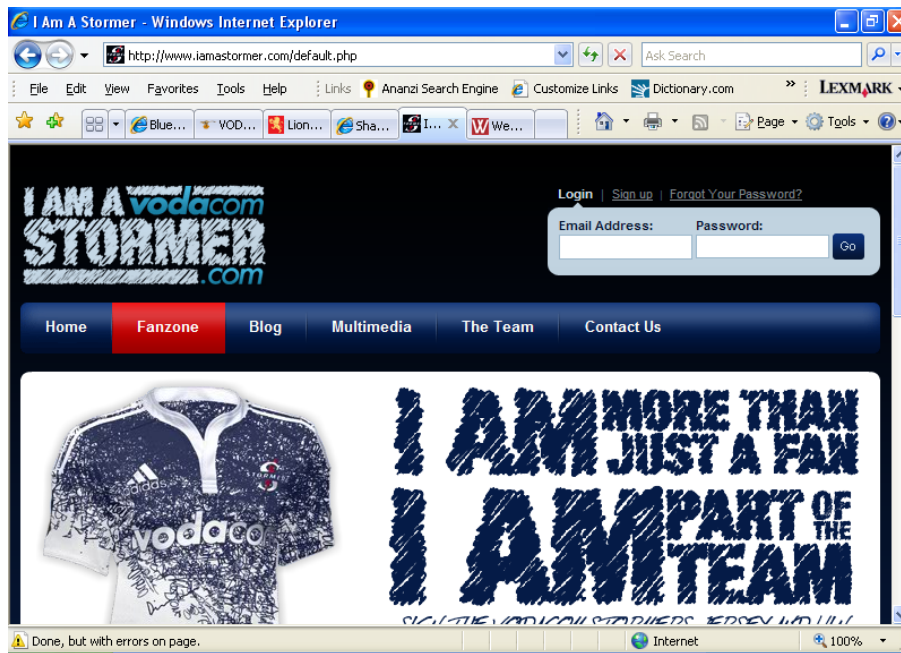
- Competitions;
- Special offers;
- Freebies;
- Other (Specify);
- External links; and
- Breaking news.

The first question is: Do you think that an enticements percentage score of 49% for the Sharks and 40% for the Stormers is fair?

The second question is: The Sharks web site can be improved by making the enticements more obvious?



Sharks screen copy.



Stormers screen copy.



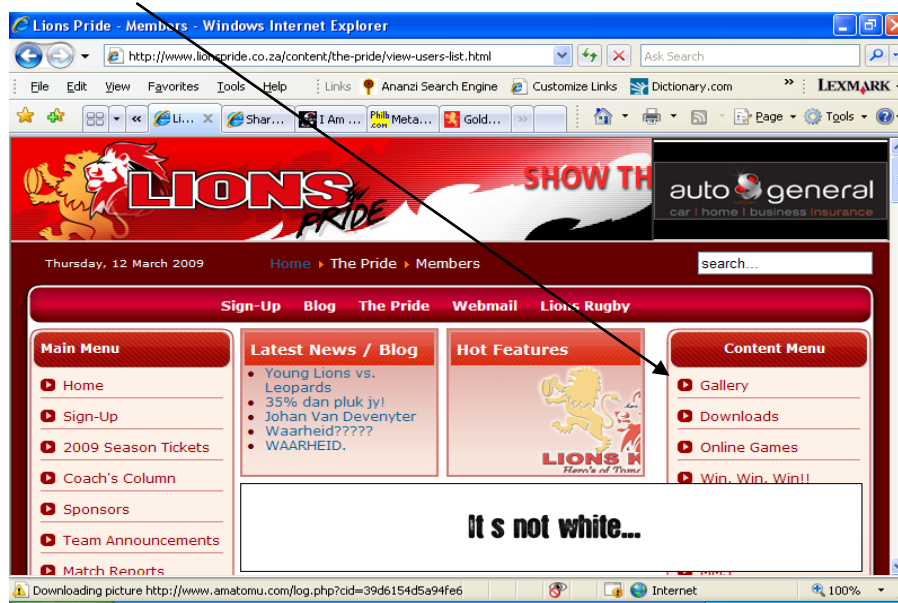
**FACTOR 6**

The sixth factor is called **site discovery**, and it has the following constituent sub-criteria:

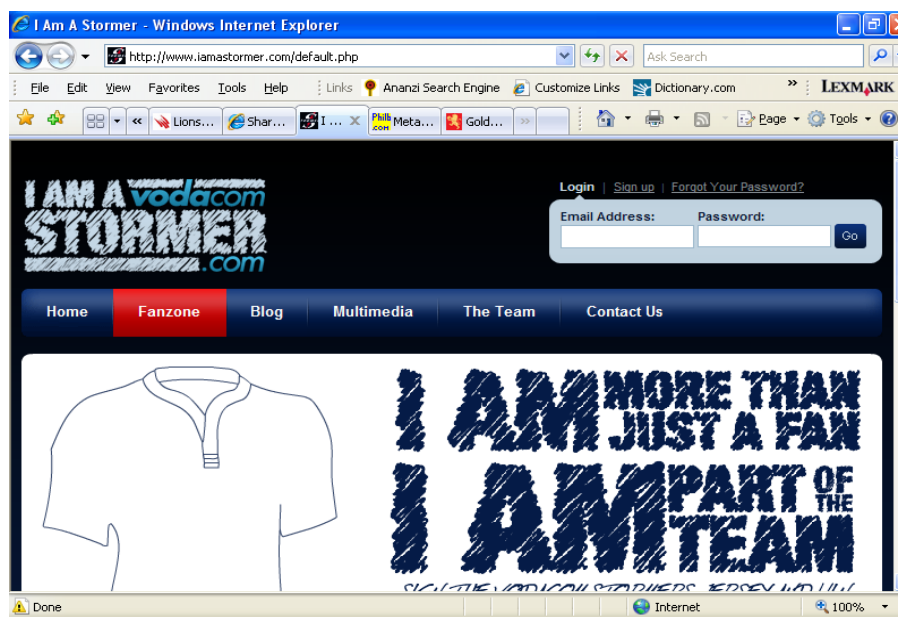
- On-line recommend a friend;
- On-line advertising;
- Intuitive URL;
- Use of frames\*;
- Off-line advertising;
- Intuitive keywords; and
- Use of metatags.

The first question is: Do you think that a site discovery percentage score of 58% for the Lions and 45% for the Stormers is fair?

The second question is: The Lions web site can be improved by having an on-line recommend a friend?



Lions screen copy.



Stormers screen copy.

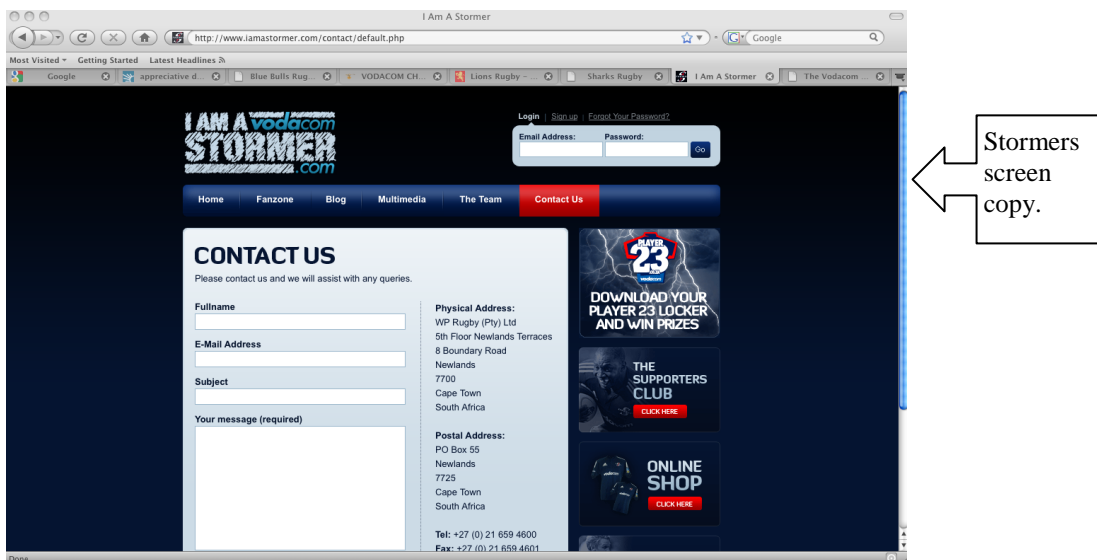
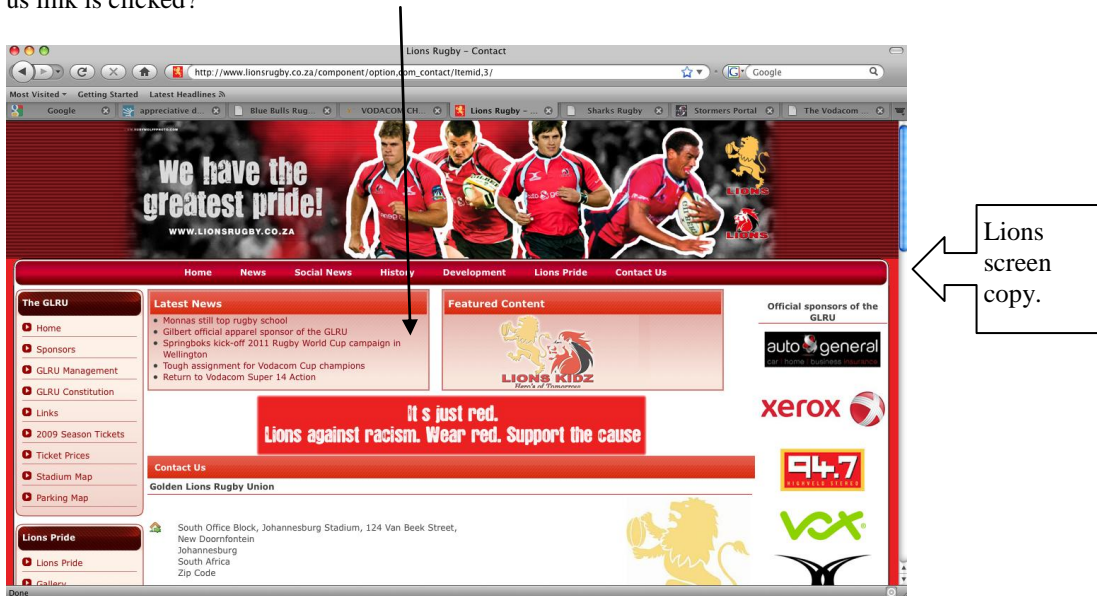
**FACTOR 7**

The seventh factor is called **communication**, and it has the following constituent sub-criteria:

- Personal email response;
- Email and other details visible;
- Telephone contact number provided; and
- Automatic email response.

The first question is: Do you think that a communication percentage score of 40% for the Lions and 28% for the Stormers is fair?

The second question is: The Lions web site can be improved by removing the other content when the contact us link is clicked?



## Appendix D: Delphi Method Interview Questions

### FACTOR 8

The eighth factor is called **display consistency**, and it has the following constituent sub-criteria:

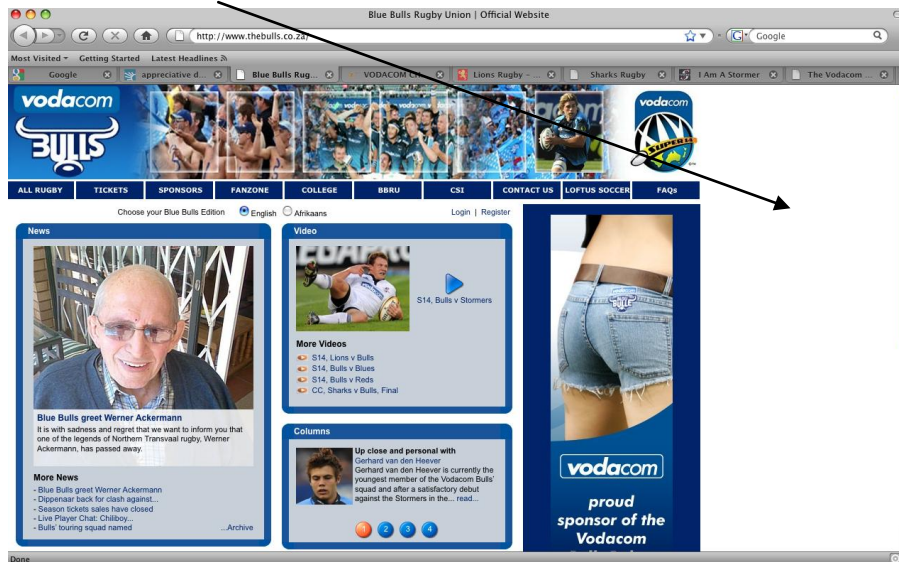
Resizeability;

Mac; and

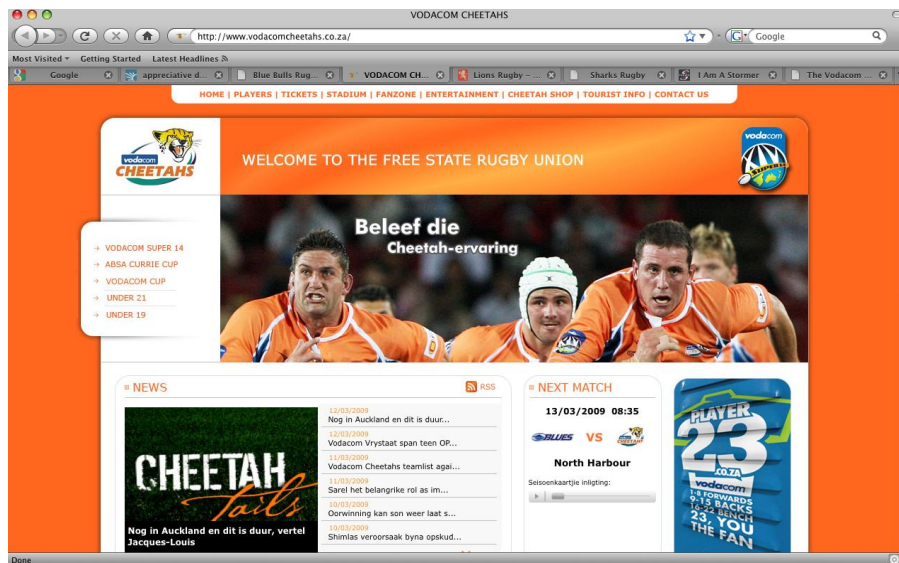
Netscape navigator (1-4).

The first question is: Do you think that a display consistency percentage score of 35% for the Bulls and 30% for the Cheetahs is fair?

The second question is: The Bulls web site can be improved by automatically filling the Mac Firefox screen?



Bulls  
screen  
copy.



Cheetahs  
screen  
copy.

**FACTOR 9**

The ninth factor is called **personalised web site**, and it has the following constituent sub-criteria:

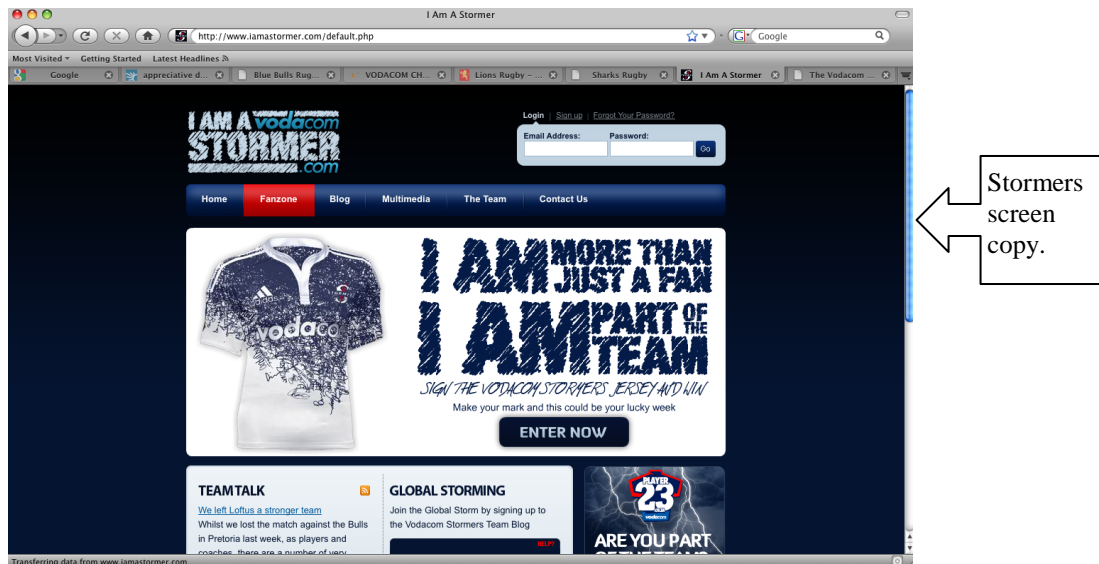
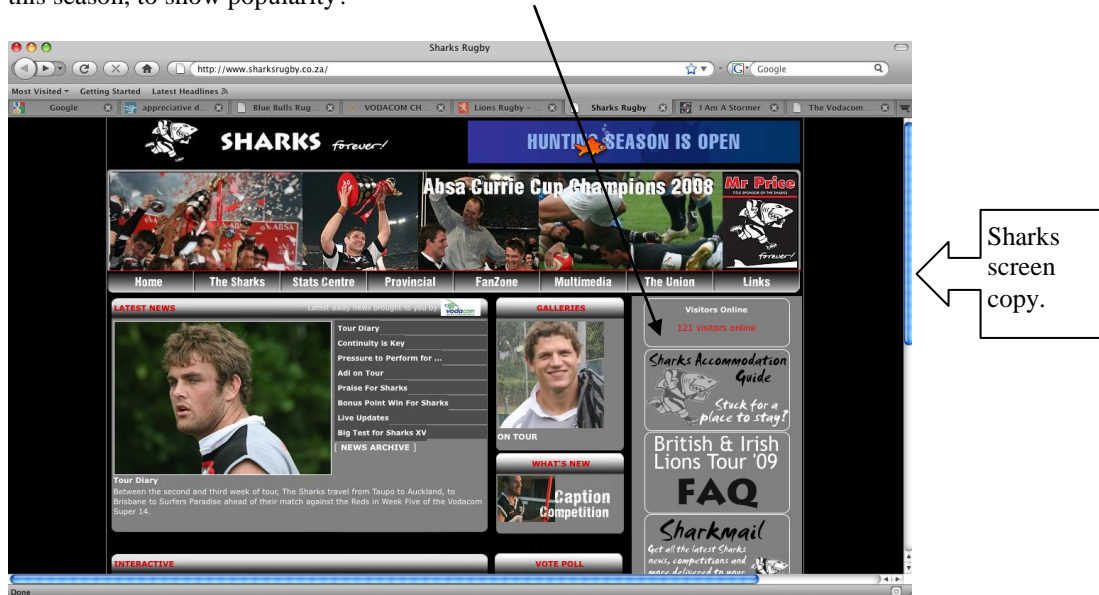
Availability of utilisation statistics;

Adaptive website; and

Offers based on buying history.

The first question is: Do you think that a personalised web site percentage score of 23% for the Sharks and 17% for the Stormers is fair?

The second question is: The Sharks web site can be improved by indicating what number visitor the user is this season, to show popularity?





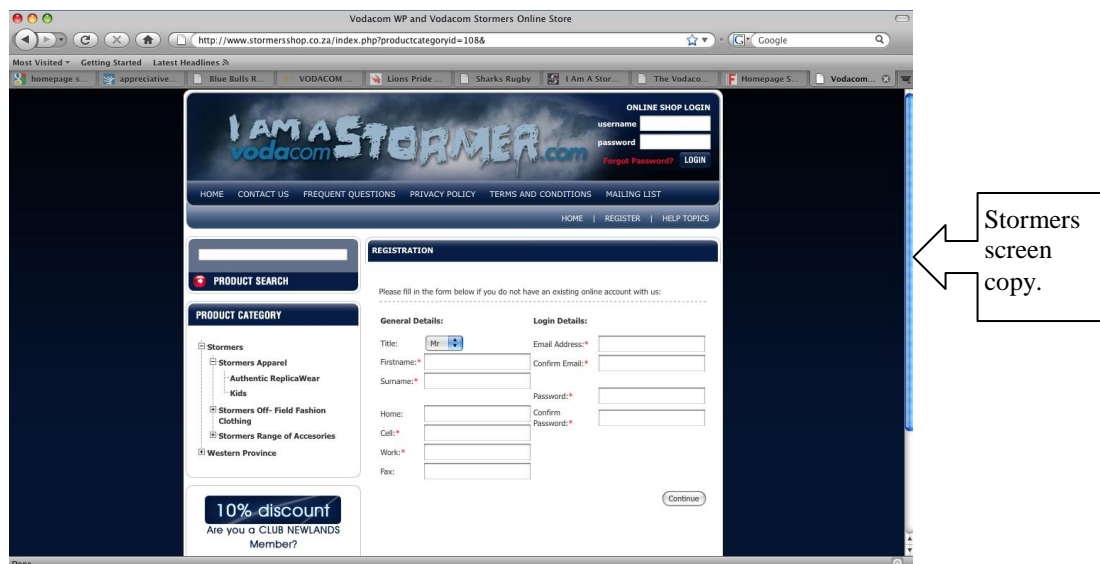
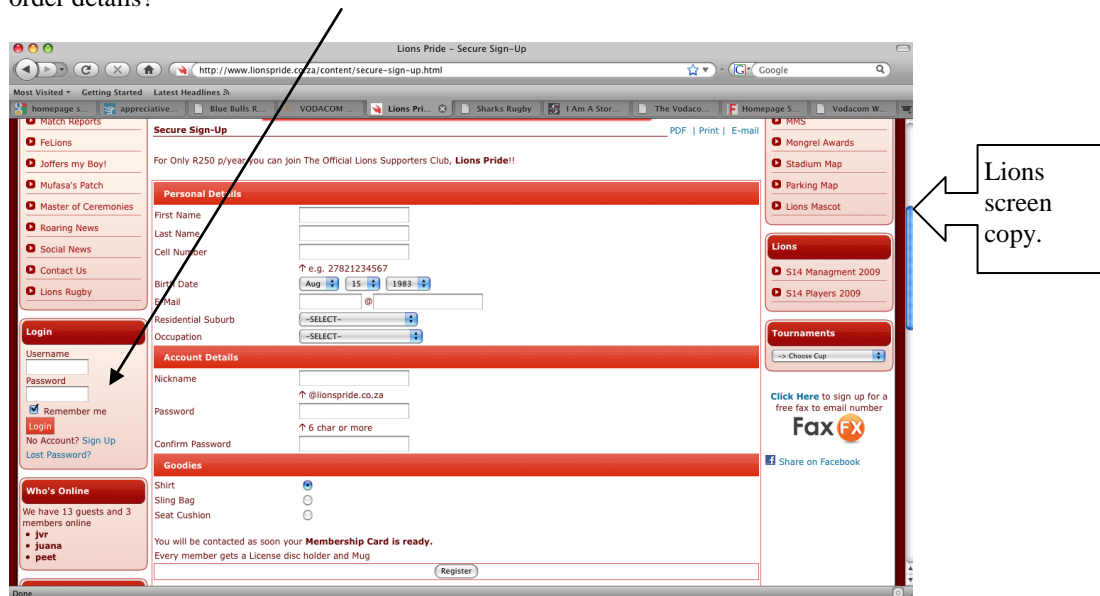
**FACTOR 10**

The tenth factor is called **purchases support**, and it has the following constituent sub-criteria:

- Acknowledge order/request;
- Order/request tracking online;
- Retain personal information to minimise detail entering; and
- Clicks to completion.

The first question is: Do you think that a purchases support percentage score of 40% for the Lions and 36% for the Stormers is fair?

The second question is: The Lions web site can be improved by putting the users' login details before the order details?



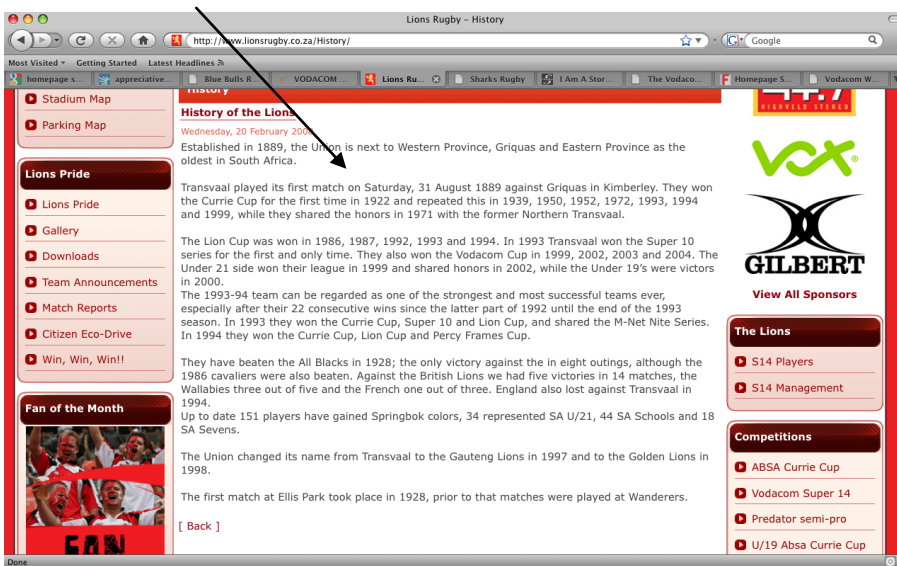
**FACTOR 11**

The eleventh factor is called **company details**, and it has the following constituent sub-criteria:

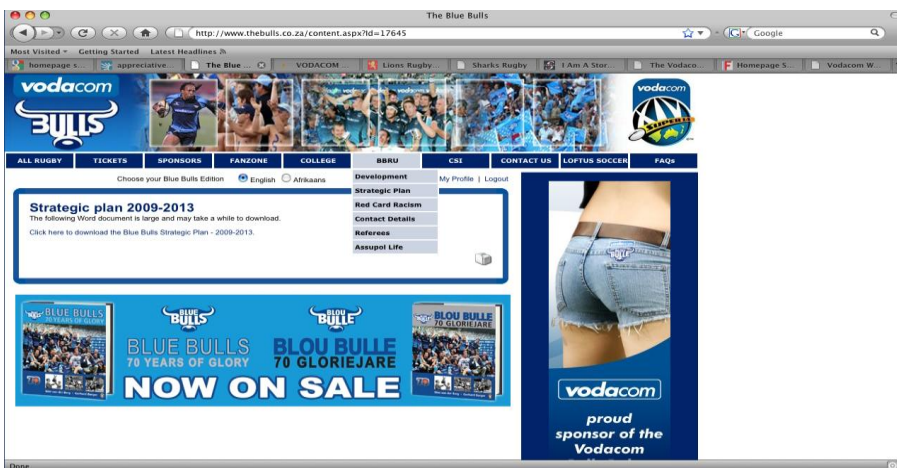
- Financial results;
- Up-to-date financial news;
- Contact details for HR department;
- The company stock price performance;
- List of products bought by your company;
- List of career opportunities with the company;
- Management and geographical structure of company;
- Contact details for person in charge of suppliers;
- Supplier terms and conditions;
- Mission statement; and
- History of the company.

The first question is: Do you think that a company details percentage score of 20% for the Lions and 17% for the Bulls is fair?

The second question is: The Lions web site can be improved by also providing financial information?



Lions screen copy.



Bulls screen copy.

*Thank you for your time.*

## Appendix E: Research Questions to Instrument Mapping

Research Question	Survey Questions	Variable(s) and/or Relationships measured	Question Type
1. Research question one: How good or poor are the web sites' overall usability scores, in isolation and relative to one another?	Overall score for each web site.	Research question one measures the overall usability of the web sites, and this is mentioned as a relevant measure in Section 2.7.2 (Agarwal & Venkatesh, 2002); Section 2.9 (Chiravuri & Peracchio, 2003); Section 2.9 (Hu & Chang, 2006); Section 2.10.2 (Ssemugabi, 2006); and Section 2.13 (Djamasbi et al., 2007).	Ratio Scale: Score each web site using a number from -10 to +10, including 0. 0 means that the criterion is not available at all to score. Scores from +1 to +10 relate to the how well the criterion is being represented, where +1 indicates that the criterion is extremely poorly represented, and +10 indicates that the criterion is extremely well represented. Scores from -10 to -1 relate to how distracting or irritating the criterion is, where -10 indicates a major distraction/irritant and -1 a minor distraction/irritant. These negative scores only apply to the criteria with an asterisk (*).
2. Research question two: Are the web sites' usability criteria scores good and consistent, in isolation and relative to one another?	<ol style="list-style-type: none"> <li>1. FIRST IMPRESSIONS total score.</li> <li>2. NAVIGATION total score.</li> <li>3. CONTENT total score.</li> <li>4. ATTRACTORS total score.</li> <li>5. FINDABILITY total score.</li> <li>6. MAKING CONTACT total score.</li> <li>7. BROWSER COMPATIBILITY total score.</li> <li>8. KNOWLEDGE OF USERS total score.</li> <li>9. USER SATISFACTION total score.</li> <li>10. OTHER USEFUL INFORMATION total score.</li> </ol>	Research question two measures the underlying usability criteria of the web sites. Section 2.11 provides many cases where usability is measured by underlying web site usability evaluation criteria, or attributes.	Ratio Scale: Score each web site using a number from -10 to +10, including 0. 0 means that the criterion is not available at all to score. Scores from +1 to +10 relate to the how well the criterion is being represented, where +1 indicates that the criterion is extremely poorly represented, and +10 indicates that the criterion is extremely well represented. Scores from -10 to -1 relate to how distracting or irritating the criterion is, where -10 indicates a major distraction/irritant and -1 a minor distraction/irritant. These negative scores only apply to the criteria with an asterisk (*).

Appendix E: Research Questions to Instrument Mapping

<p>3. Research question three: What are the most important factors to focus on in order to achieve good and consistent usability?</p>	<p>1. FIRST IMPRESSIONS</p> <p>1.1. URL</p> <p>1.2. Download time - size of home page</p> <p>1.3. Look and feel – readability</p> <p>1.4. Need to download software*</p> <p>1.5. Home page on one screen (above the fold)</p> <p>1.6. Unique Selling Point (USP) or Value Proposition</p> <p>1.7. Ability to take action (Key action point – KAP)</p> <p>1.8. Feeling of wanting more - depth of site</p> <p>1.9. Contact details</p> <p>1.10. Credential validation - certifications, associations etc.</p> <p>1.11. Statement from management</p> <p>1.12. Use of attractors</p> <p>1.13. Are you made to register to get into site? *</p> <p>2. NAVIGATION</p> <p>2.1. Ease of use</p> <p>2.2. Site map</p> <p>2.3. Return to Home Page from any page</p> <p>2.4. Internal search engine</p> <p>2.5. Internal links</p> <p>2.5.1. Broken links</p> <p>2.5.2. Text as well as graphic links (ALT tags)</p> <p>2.5.3. Navigational links visible</p> <p>2.6. Opens multiple windows</p> <p>3. CONTENT</p> <p>3.1. Useful information</p> <p>3.2. Degree of substantiated information</p> <p>3.3. Level of interaction</p> <p>3.4. Use of valuable graphics</p> <p>3.5. Use of valuable animation</p> <p>3.6. Use of valuable sound</p> <p>3.7. Reviews, testimonials and certifications</p> <p>3.8. Content in digestible quantity</p> <p>3.9. Up-to-dateness</p> <p>3.10. Available in multiple languages</p> <p>3.11. Accessibility for disabled people</p> <p>3.12. Terms and conditions</p> <p>3.13. FAQ's</p> <p>3.14. Availability of follow up discussion</p> <p>4. ATTRACTORS</p> <p>4.1. Invitation to register for</p>	<p>Research question three follows from research question two; with a purpose to extract the most important underlying usability criteria that are appropriate for the web sites in this research. Section 2.11 again provides the background of underlying web site usability evaluation criteria, factors or attributes.</p>	<p>Ratio Scale: Score each web site using a number from -10 to +10, including 0.</p> <p>0 means that the criterion is not available at all to score.</p> <p>Scores from +1 to +10 relate to the how well the criterion is being represented, where +1 indicates that the criterion is extremely poorly represented, and +10 indicates that the criterion is extremely well represented.</p> <p>Scores from -10 to -1 relate to how distracting or irritating the criterion is, where -10 indicates a major distraction/irritant and -1 a minor distraction/irritant. These negative scores only apply to the criteria with an asterisk (*).</p>
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	<p>something</p> <p>4.2. Competitions</p> <p>4.3. Special offers</p> <p>4.4. Freebies</p> <p>4.5. Breaking news</p> <p>4.6. External links</p> <p>4.7. Newsletter</p> <p>4.8. Other (Specify)</p> <p>5. FINDABILITY</p> <p>5.1. Intuitive URL</p> <p>5.2. Designed for search engine performance</p> <p>5.2.1. Intuitive keywords</p> <p>5.2.2. Use of metatags</p> <p>5.2.3. Use of frames*</p> <p>5.3. Advertising</p> <p>5.3.1. On-line advertising</p> <p>5.3.2. Off-line advertising</p> <p>5.3.3. On-line recommend a friend</p> <p>5.4. Partner and affiliate sites</p> <p>6. MAKING CONTACT</p> <p>6.1. Email and other details visible</p> <p>6.2. Response time to enquiries</p> <p>6.2.1. Automatic email response</p> <p>6.2.2. Personal email response</p> <p>6.3. Use of online forms</p> <p>6.4. Telephone contact number provided</p> <p>6.5. Telephone call back offered</p> <p>7. BROWSER COMPATIBILITY</p> <p>7.1. Internet Explorer (1-5)</p> <p>7.2. Netscape Navigator (1-4)</p> <p>7.3. Mac</p> <p>7.4. Resizability</p> <p>8. KNOWLEDGE OF USERS</p> <p>8.1. Availability of utilisation statistics</p> <p>8.2. Adaptive website</p> <p>8.3. Offers based on buying history</p> <p>9. USER SATISFACTION</p> <p>9.1. Robustness/reliability of the site</p> <p>9.2. Clicks to completion</p> <p>9.3. Acknowledge order/request</p> <p>9.4. Order/request tracking online</p> <p>9.5. Retain personal information to minimise detail entering</p> <p>10. OTHER USEFUL INFORMATION</p> <p>10.1. Supplier terms and conditions</p> <p>10.2. List of products bought by your company</p>		
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Appendix E: Research Questions to Instrument Mapping

	<p>10.3. Contact details for person in charge of suppliers</p> <p>10.4. List of career opportunities with the company</p> <p>10.5. Contact details for HR department</p> <p>10.6. Financial results</p> <p>10.7. Up-to-date financial news</p> <p>10.8. The company stock price performance</p> <p>10.9. History of the company</p> <p>10.10. Management and geographical structure of company</p> <p>10.11. Mission statement</p> <p>10.12. Up-to-date press coverage</p>		
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