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Methodologies and website development: a survey of practice

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Abstract

Website development work is a growing aspect of the IT activities within many organisations. However, the manner in which website development actually takes place within organisations is still largely uncertain. In this paper, we examine the results of a research exercise involving case studies in 25 UK organisations aimed at investigating the way in which website development activities are currently carried out within UK organisations. In particular, this paper discusses the activities that are typically involved in website development projects, and the techniques and standards actually used for website development found within 25 organisations studied. One of the main findings of the research project was that in 25 organisations studied there was only limited use of formalised website design techniques (mainly hierarchy charts and storyboards). However, roughly half of the organisations studied did use some form of website layout standards. Website documentation was only produced in roughly a third of the organisations and only roughly a quarter of the organisations had any formalised website testing procedures in place.

Keywords: Website development; Methodology; Standards

1. Introduction

The rapid growth in the use of the world wide web for commercial purposes has been noted by many researchers and practitioners [1–5]. This growth is due to a number of factors including the perceived strengthening of a company's competitive position [6] and the fact that the Internet can allow a small company to project a corporate presence equal to that of a much larger firm [7]. The increasing amount of website development work being carried out in organisations implies that such work should be carried out in an efficient and effective manner. It can therefore potentially be beneficial for organisations to have some form of methodology/standards/best practice guides for guiding IT staff through web development projects. In this paper, the results of a research exercise involving case studies in 25 organisations from the North West region of England are examined concerning the manner in which websites are currently developed within UK organisations. In particular, the research exercise reported in this paper examined the activities that were typically carried out in website development projects, and the techniques and standards that were actually used to support such activities in 25 organisations studied.

2. Literature review

Researchers and practitioners have commented that web-based systems are different in a number of respects to existing types of IT systems. Hence, existing IT development methodologies/standards/best practice guides for traditional IT systems may be inappropriate for web development projects. Gellersen and Gaedke [8], Aoyama [9], and Russo and Graham [10] argued that the delivery of applications in the web environment is radically different from the usual ways of delivering software, and imposes a completely different structure and approach on application development. Russo and Graham [10] stated that web-based applications differ from traditional information systems in terms of the purpose and audience for which they are developed, their use of communications technology and multi-platform accessibility and their non-sequential nature, due to their reliance on hypertext links to other web documents.

Researchers and practitioners have also commented that the development process for web-based systems is different from that for existing types of IT systems. Morris and Hinrichs [11] commented upon the new design activities involved in website design over traditional systems design

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activities. These included increased interaction and information handling, in particular navigation and pluralistic design. However, Morris and Hinrichs [11] did not investigate the actual techniques used for website design within organisations. Pressman [12] argued that as well as involving new design activities, web-based development projects also typically involve shorter development times and product life cycles.

There has been little if any research examining how website development work is actually carried out within organisations, and the actual methodologies/standards/techniques used for such work. Gellersen and Gaedke [8], Gunter et al. [13], Wiegers [14], and Russo and Graham [10] stated that the development of web-based applications is still mostly ad hoc. Gellersen and Gaedke [8] also commented that there is no rigorous systematic approach to website development, and that most current web application development and management practices rely on the knowledge and experience of individual developers. Quan et al. [15] had commented upon the range of technical activities involved in web-based application development, but had not really examined the full range of such activities.

It is important that the overall purpose of any new IT system be established before development begins. However, determining the overall purpose of an organisation's website may be complicated by the variety of potential users of the website. Gellersen and Gaedke [8] had stated that requirements analysis is an important aspect of website development projects in terms of content, structure, access and corporate identity. Palmer and Griffith [16] and Norris and West [1] had commented upon the need for website designers to understand both the marketing and technical issues of website design. Conallen [17] had stated that since web applications execute business logic, the most important models of a web-based system should focus on the business logic, not on presentation details.

Niederst [18] had commented on the need for web designers to have an understanding of the human computer interface issues of website design including navigation, function and graphics. Wan and Chung [19] had argued that website designers need to have navigational design skills, in order to avoid producing messy websites. Minotti et al. [20] and Reding [21] had commented that there is a wide range of web development tools commercially available. Cintron [22] had also commented upon the wide range of web development tools that are available for web development projects, and the need for web developers to know several of these. However, none of these researchers had examined the use of such website development tools in actual commercial/industrial practice.

Migrating software to the world wide web [23] requires a thorough understanding of systems architecture design principles in order to determine what will be executed on the client and server sides and what communication between client and server will occur. Froehlich et al. [24] argued that there are many design issues associated with moving information systems to web-based delivery, in particular moving the existing application framework towards web-based capabilities.

Overall it appears that a number of researchers have commented upon various individual aspects of website development work and the manner in which they should be carried out. However, few if any researchers have investigated the techniques used for website development in actual commercial/industrial practice.

The research project reported in this paper aimed to extend current academic knowledge regarding the process of website development by examining how website development work is actually carried out in current commercial/industrial practice. In particular, this research sought to examine the techniques, standards and methodologies actually used for such work. This is the academic originality of this paper, an investigation of actual current website development practice and its implications for academics and IT managers.

3. Research method

The research method used for this research exercise was case study. A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context in which multiple sources of evidence are used [25]. Walsham [26] argued that case studies allow explanations of particular phenomena derived from empirical research, which may be valuable in other settings and organisations as interpretations of phenomena. Cavaye [27] argued that statistical generalisations to a population is not the goal of case study research, as cases are not sampling units, rather theoretical or analytical generalisation is appropriate, where case study results can be used to develop theory.

Case studies based on personal contact are appropriate for investigating current IT practice because they can help overcome the problems of terminology and verification which other research methods such as questionnaires find difficulty in addressing. In addition, multiple case studies allow cross case analysis and comparison, and the investigation of a particular phenomenon in diverse settings [28]. A primary weakness of case studies, however, is the time-consuming nature of case study investigation for the researcher. Also it is disruptive for the organisation studied, and this makes it difficult to obtain the necessary co-operation. The main difficulty encountered in this research project was gaining access to the organisations studied. There is a trade-off when undertaking case study research between considering a wide number of organisations or a small number in more detail. Since this research project aimed to uncover the full range of website development approaches used in current industrial/commercial practice, studying a wide number of organisations was the most appropriate means of the examining the approaches used. The research approach adopted

was also useful for determining the differences in website development approaches between organisations.

The case study method was chosen over a survey approach because of the problems of misinterpretation of terminology and verification associated with surveys. For example, what does an organisation having website layout standards actually mean? In addition, unless examples of the techniques and samples of documentation are seen, how can the researcher verify that the organisation does use a particular technique?

The actual research techniques used for the research exercise reported in this paper included interviews, discussions, and observations of company staff, and document collection, and literature reviews. Darke et al. [28] stated that case studies typically combine data collection techniques such as interviews, observations, questionnaires and document and text analysis.

In each of 25 organisations studied, one or more IT staff involved in website development within the IT department were interviewed, and examples of website development documentation were examined, where these were available. The actual method of investigation within the organisations studied was to go through with the IT staff concerned what they would typically do in a website development project. That is, the whole life cycle of a typical website development project was examined through discussion, and examination of samples of coding, relevant documentation (where available), and the actual completed or partly completed web-based systems. In this way, the researchers gained an insight into the approaches used for website development by those interviewed, and what was actually created in terms of the artefacts such as designs, programs, test plans, and the final working systems during a typical website development project.

The job titles of those interviewed in 25 organisations studied included analyst programmer, web developer, computer technician, and IT officer, amongst others. Thirteen of 25 organisations studied had IT staff that specialised in website development work. In the other 12 organisations, the IT staff carried out other IT work as well as website development work.

All 25 organisations studied were based in the North West region of England, and already had well established links with the university for which the authors work either through industrial student placements or through consultancy contracts. There were no particular inclusion or exclusion criteria used for the companies selected. The initial contact made with the organisations studied was via the established contact staff within each organisation.

In particular, this research exercise sought to achieve an initial examination of the industrial/commercial use of techniques for website development using the following analytical framework:

The nature of website development, in particular:

- What is involved in website development projects?
- Who carries out website development activities?

The techniques used for website development, in particular:

- Which development techniques used for other types of IT projects are used for website development projects?
- Which development techniques are used solely for website development projects?

The standards/policies/best practice guides used for website development, in particular:

- Which existing standards/policies/best practice guides are used for website development?
- What new standards/policies/best practice guides have been created for website development?
- What are the potential benefits of adopting standards/policies/best practice guides for website development?

This analytical framework sought to achieve an empirical view of the use of methodologies for website development in actual commercial/industrial practice.

These research questions are pertinent to the IT industry and the academic IT community because as web-based systems become increasingly important within organisations there is an increasing need to understand what is new and different about such systems. In addition, it is important to develop appropriate strategies to ensure that such systems are developed in as competent and professional a manner as possible. The IT profession needs to adapt itself to the demands of Internet technologies, which looks set to have far reaching economic and social impacts. In particular, IT managers need to develop frameworks for their website development projects in order to ensure that such projects are conducted in an efficient and effective manner.

4. Research results

4.1. The nature of website development

When the IT practitioners within 25 organisations studied were interviewed with regard to the activities involved in website development projects, the following set of activities emerged.

4.1.1. Website design

The design of websites, in particular navigational design, that is, the structural design of a website that determines how users will navigate through the web pages contained within the website is an important activity. Any new IT system has to be designed to allow users to easily locate the functions they require. However, this can be more complex in web-based systems due to the large range of potential paths through the system in a large website, and the links to and from other websites, and between individual website pages even in a small website. The need for a clear navigational structure between website pages was stated by

Table 1
Details of the websites of the organisations researched

Type of organisation	Number of employees (approximately)	Number of IT staff (approximately)	IT infrastructure	Back end database	Linked to legacy system	Web development tools used	Type of website
Engineering	42	1	PC	N	N	Html	Advertising
Financial services	80	4	PC	Y	Y	Visual studio	Advertising/marketing
Education	2000	30	Mini, PC	Y	Y	Html, Java, Frontpage	Information
Pharmaceutical	90	4	Mini, PC	N	N	Hotmetal, Html	Information
Manufacturing	600	8	Mini, PC	N	N	Frontpage	Advertising/sales
Financial services	3000	300	M'frame, Mini, PC	Y	Y	Netobjects	Advertising/marketing/sales
Utility	2500	200	M'frame, Mini, PC	Y	Y	Visual studio	Advertising
Local government	2000	25	PC	N	N	Html, Javascript	Information
Engineering	200	4	PC	N	N	Frontpage	Advertising
IT services	25	17	PC	N	N	Html, Dreamweaver, Flash	Advertising/marketing/sales
Health	4000	10	PC	N	N	Dreamweaver	Information
Manufacturing	8000	1000	M'frame, Mini, PC	Y	Y	Frontpage, ASP	Advertising
Education	2000	150	Mini, PC	Y	Y	Frontpage, ASP	Information
Education	20	3	PC	N	N	Html, Javascript	Information
Financial services	34	1	PC	Y	N	Frontpage, ASP	Advertising
Manufacturing	180	5	PC	N	N	Html, JAVA	Advertising
Tourism	60	2	PC	Y	Y	Frontpage, ASP	Advertising/marketing
Retail	80	2	PC	Y	Y	Html, ASP	Advertising/marketing/sales
IT services	100	13	PC	Y	N	Html, ASP	Advertising
Retail	90	4	PC	Y	N	Html, ASP	Advertising/marketing/sales
Shipping	70	1	PC	Y	N	Html, ASP	Advertising/marketing/sales
Manufacturing	18,000	500	M'frame, Mini, PC	N	Y	Html, JAVA	Advertising/marketing
Local government	2000	45	Mini, PC	Y	N	Visual Interdev, ASP	Information
Charity	70	2	PC	Y	N	Frontpage, ASP, JAVA	Information
IT services	50	14	PC	Y	N	Frontpage, ASP, Flash	Advertising/marketing/sales

Table 2
Details of standards/techniques used for website development in the organisations researched

Type of organisation	Number of employees (approximately)	Number of IT staff (approximately)	IT infrastructure	Website layout standards	Website documentation	Website design techniques used	Website testing procedure
Engineering	42	1	PC	N	N	None	N
Financial services	80	4	PC	N	N	None	Y
Education	2000	30	Mini, PC	Y	N	None	N
Pharmaceutical	90	4	Mini, PC	Y	Y	Hierarchy charts	Y
Manufacturing	600	8	Mini, PC	N	N	None	N
Financial services	3000	300	M'frame, Mini, PC	N	N	None	N
Utility	2500	200	M'frame, Mini, PC	N	N	None	N
Local government	2000	25	PC	Y	Y	None	Y
Engineering	200	4	PC	N	N	None	N
IT services	25	17	PC	Y	Y	Hierarchy charts, web page layout	Y
Health	4000	10	PC	N	N	None	N
Manufacturing	8000	1000	M'frame, Mini, PC	Y	N	None	Y
Education	2000	150	Mini, PC	Y	N	None	N
Education	20	3	PC	N	N	None	N
Financial services	34	1	PC	N	N	None	N
Manufacturing	180	5	PC	N	N	None	N
Tourism	60	2	PC	N	N	None	N
Retail	80	2	PC	Y	Y	Flowcharts	N
IT services	100	13	PC	Y	Y	Hierarchy charts, web page layout	Y
Retail	90	4	PC	Y	Y	Storyboards	N
Shipping	70	1	PC	Y	Y	Storyboards, web page layout	N
Manufacturing	18,000	500	M'frame, Mini, PC	N	N	None	N
Local government	2000	45	Mini, PC	Y	Y	Web page layout	Y
Charity	70	2	PC	Y	Y	Hierarchy charts, web page layout	N
IT services	50	14	PC	N	N	None	N

80% of those interviewed across 25 organisations studied. As discussed in Section 4.2 there was only limited use of a small number of techniques for website design activities within 25 organisations studied as shown in Table 2.

4.1.2. Programming using website development tools

As can be seen from Table 1 a variety of website development tools were in use across 25 organisations researched. The case studies appeared to indicate that most organisations use a combination of tools for website development.

4.1.3. Website testing

The case studies indicated that website testing may involve a number of facets. Website testing will typically involve testing the individual website pages, the links between the individual web pages, and links to and from other websites, and may also involve testing that the website works with different Internet browsers and the different versions of such browsers. Sneed and Goschl [29] had argued that a higher degree of testing skills is required for web-based applications than for client/server and conventional stand alone systems. However, only seven of 25 organisations studied had any formalised website testing procedures in place, as shown in Table 2.

4.1.4. Linking of web pages to back end databases and legacy systems

Nine organisations out of 25 studied had migrated legacy systems to the World Wide Web, as shown in Table 1. A further three organisations stated that they intended to link their websites to legacy systems in the future. Fifteen of the organisations studied had developed websites that linked to back end databases, mainly MS Access and MS SQL Server.

4.1.5. Compliance with relevant legislation and regulation

Compliance with relevant legislation and regulation regarding Internet-based systems was quoted as an important website development activity by 30% of those interviewed across 25 organisations studied. For example, the IT practitioners interviewed in one of the financial services organisations researched stated that their organisation had spent much effort analysing the UK Data Protection Act 1998 with regard to how this applied to them allowing selected organisations and individuals to access personal account details via the company website. As another example, the IT staff in one of the retail sector organisations studied stated the possibility of legal action by customers against the company if misrepresentation of goods or services has occurred via the company's website. For example, if a purchase is made via the company's website at one point in time (based on the website information provided), but the goods delivered to the customer are different to those ordered, due to the website information being out of date, or incorrect, or the website information having changed in that time period, then the customer may consider that misrepresentation has occurred. One solution to this problem is to keep an audit trail of the information displayed on the company's website, as was adopted by the retail company in question. In addition, the case studies at the two retail companies revealed that care has to be taken to ensure that possible terminology and legal differences between countries are catered for when developing a website. For example, a term used in one country to describe a product may mean something different in another country, and taxes added to prices may apply in some countries and not in others. There may also be different advertising standards that apply to advertisements on the Internet in different countries. For example, advertisements from the UK on the Internet should comply with the British Code of Advertising and Sales Promotion.

In order to appreciate the full range of activities that may be involved in website development within a given organisation we shall use the example of an IT services organisation studied that developed websites for client organisations. The IT practitioners interviewed within this organisation quoted a large variety of activities undertaken during website development projects including: determining the needs of client organisations; designing website structure and navigation with clients; designing individual web page layout and functionality with clients; programming in Html, Dreamweaver and Flash; designing and coding to cater for different Internet browsers (and versions thereof) and different Internet search engines and directories; testing and debugging website coding; and optimising website coding to improve performance.

As regards whom within the organisations studied carried out website development activities, in all of 25 organisations studied, actual website development was undertaken solely by internal IT staff, or by external IT agencies. With regard to the involvement of other company staff in website development projects, in 23 of the organisations studied, company staff were stated as being involved in an on going manner during a given project. However, in the charity and small engineering company studied, the IT staff interviewed stated that company staff were only involved in providing text and images for the website, with the actual design and all other development activities being left to the IT staff.

4.2. Techniques used for website development in actual practice

In general, there appeared to be few formalised techniques actually used for website development activities in 25 organisations studied. In the main, website development activities appeared to be undertaken in an ad hoc manner at the discretion of the individual web developer. However, eight of 25 organisations studied did have a limited number of design techniques that were used for website development projects, as shown in Table 2. The website development

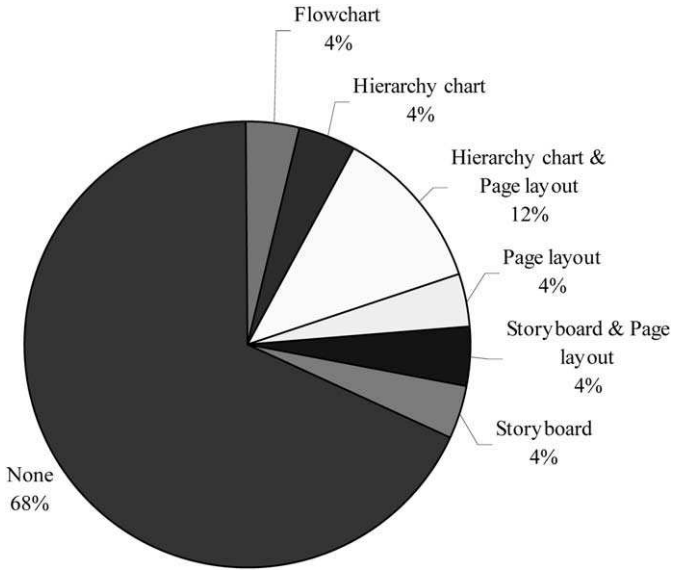

Fig. 1. Use of website development techniques in the organisations studied.

techniques actually encountered covered website structural design and individual web page design.

The techniques actually used for designing website navigational structures encountered within the organisations studied included:

- Website hierarchy charts, which diagrammatically represent the web pages within a website in a hierarchical manner (used by four of the organisations studied, the pharmaceutical company, two of the IT services companies and the charity organisation).
- Website flowcharts [21] which show the logical decisions that determine which web page will next be visited (used by one of the retail organisations studied).
- Storyboards, which show the basic sequence of web pages that a user will encounter within a website (used by one of the retail organisations studied, and the shipping company studied).

Those interviewed in the organisations that used website design techniques stated that the design diagrams generated during development of the website were in general not updated with respect to later amendments.

The main technique used for individual web page design was an outline web page layout approach. IT staff within five of the organisations studied (the shipping company, one of the local government organisations, the charity organisation, and two of the IT services companies) stated that they produced outlines of individual web pages either on paper or on-screen when developing websites. A web page outline in these organisations typically included a sketch of the actual web page layout, which might include the use of templates or frames, as well as the functions to be provided (e.g. email, data entry), and the information to be displayed. IT staff in all the other 20 organisations studied indicated that they tended to create individual web pages directly using the given web development tool rather than plan an outline of the given web page. Fig. 1 shows the proportions of organisations using a particular website development technique.

Roughly a third of those interviewed across 25 organisations studied indicated that they used other organisation's websites for design ideas in order to supplement their website design activities.

As regards pluralistic design [11], only the two higher education institutions studied designed websites to cater for different website user groups. For example, both the higher education institution's websites included different navigation paths for current students, staff, potential students and industry amongst others. All the other 23 organisations studied developed multi-purpose websites that were intended to cater for any type of user.

In 25 organisations studied, little if any use of existing development techniques that were used for other types of IT projects appeared to occur for website development projects. For example, no mention of the use of entity relationship diagrams, object classes, dataflow diagrams, or any other existing development techniques was made regarding website development projects by those interviewed.

Ad hoc approaches for website development were in use in the majority (68%) of 25 organisations studied as shown in Fig. 1. The typical ad hoc approach to website development in these organisations involved firstly discussing the overall content of the intended website with user department staff. Next text, pictures and graphics for the website would be provided by the users involved in the project. These would then be assembled together into a prototype website, and shown to the users. The users would then suggest changes until they were satisfied with the website, at which point the website would be made live.

Table 3
Website layout standards used within the organisations researched

Type of organisation	Number of employees (approximately)	Number of IT staff (approximately)	IT infrastructure	Video/animation standards	Picture/graphics standards	Web page layout standards	Disability standards	Website navigation standards
Engineering	42	1	PC	N	N	N	N	N
Financial services	80	4	PC	N	N	N	N	N
Education	2000	30	Mini, PC	N	Y	Y	N	Y
Pharmaceutical	90	4	Mini, PC	Y	Y	Y	N	Y
Manufacturing	600	8	Mini, PC	N	N	N	N	N
Financial services	3000	300	M'frame, Mini, PC	N	N	N	N	N
Utility	2500	200	M'frame, Mini, PC	N	N	N	N	N
Local government	2000	25	PC	Y	Y	Y	Y	Y
Engineering	200	4	PC	N	N	N	N	N
IT services	25	17	PC	Y	Y	Y	N	Y
Health	4000	10	PC	N	N	N	N	N
Manufacturing	8000	1000	M'frame, Mini, PC	Y	Y	Y	N	Y
Education	2000	150	Mini, PC	N	Y	Y	N	Y
Education	20	3	PC	N	N	N	N	N
Financial services	34	1	PC	N	N	N	N	N
Manufacturing	180	5	PC	N	N	N	N	N
Tourism	60	2	PC	N	N	N	N	N
Retail	80	2	PC	N	Y	Y	N	N
IT services	100	13	PC	Y	Y	Y	N	Y
Retail	90	4	PC	N	Y	Y	N	N
Shipping	70	1	PC	N	Y	Y	N	N
Manufacturing	18,000	500	M'frame, Mini, PC	N	N	N	N	N
Local government	2000	45	Mini, PC	Y	Y	Y	N	Y
Charity	70	2	PC	N	Y	Y	N	N
IT services	50	14	PC	N	N	N	N	N

4.3. Standards/policies/best practice guides for website development

Stroud [30] identified the need for organisations to develop guidelines to assist IT staff using web development tools. However, only 13 (52%) of 25 organisations studied had any formal guidelines for web development projects. These were a pharmaceutical company, two higher education establishments, a manufacturing company, a small financial services company, two local government organisations, two retail companies, two IT services companies, a charity organisation, and a shipping company as shown in Table 2. The IT practitioners interviewed in 13 organisations studied that had website development standards/policies/best practice guides typically perceived the following potential benefits of such standards:

- Providing a framework for website development projects within their organisation, so that IT staff were aware of what needed to be done within a given website development project.
- Aiding the process of website design by helping to determine the website structure required.
- Assisting in ensuring that web pages developed were uniform and compatible.
- Providing guidance on the testing of websites.

The standards for website development encountered in the organisations studied covered website design, website layout, website content, website development tools, and website testing as described later.

4.3.1. Website design standards

The standards for website design encountered in 13 organisations studied that had any formal standards for website development included:

- Website hierarchy charts, used by four of the organisations studied.
- Website flow charts, used by one of the retail companies studied.
- Storyboards, used by two of the organisations studied.
- Individual web page design using an outline web page layout approach, which was used by five of the organisations studied.

4.3.2. Website layout standards

The standards for website layout encountered in the aforementioned 13 organisations included:

- Standards concerning the use of video and animation within websites, which were in place in the pharmaceutical, IT services, and large manufacturing company, and the local government organisations studied.
- Standards concerning the use of pictures and graphics

within websites, which were found in all 12 organisations studied that had any formal website layout standards. For example, in the local government organisation studied all website images were required to be kept as small as possible, and to have a text alternative, which conveyed the same function or purpose as the image.
- Standards concerning web page layout such as the use of banners and menus, which were encountered in all 12 organisations studied that had formal website layout standards. One of the local government organisations studied in addition specified the avoidance of certain colour combinations such as red and green, which could potentially cause problems for the colour blind.
- Website navigation standards such as the use and placement of return buttons, which were present in the two higher education establishments, the pharmaceutical company, the manufacturing company, the IT services companies and the local government organisations.

Table 3 shows a summary of the website layout standards used within the organisations studied. In general, it appeared that IT services and public sector organisations are more likely to have website layout standards than other industry sectors.

4.3.3. Website content standards

The standards for website content encountered in the aforementioned 13 organisations studied included:

- Guidelines for the use of keywords in web pages relating to Internet search engine and Internet directory registrations, which were in place in one of the IT services companies studied.
- Guidelines for the actual content of web pages, which were in place within one of the local government organisation studied. This organisation developed web pages for local community groups, and contained text and pictures of local citizens, some of whom were children. In consultation with the police and relevant children's welfare organisations, the local government organisation had developed guidelines for what was permissible on their local community web pages and what was not. For example, addresses of individual citizens or pictures of individual children were not allowed.

4.3.4. Website development tools standards

Standards regarding the tools to be used for web development projects were in place in the two higher education establishments studied. In all the other 23 organisations studied there were no formal guidelines as to which web development tools should be used by web development staff. The use of a combination of tools for developing a given website appeared quite common.

4.3.5. Website testing standards

Guidelines for website testing were in place in the pharmaceutical company, two of the IT services companies, a small financial services company, a manufacturing company, and the two local government organisations studied as shown in Table 2. The website testing standards encountered in these seven organisations included the testing of all links between individual web pages, the testing of all functions provided by a given web page, and the testing of all links to other websites. The website testing standards in the IT services companies studied further included standards for testing the website with different versions of different Internet browsers and standards for testing that the site was found by the appropriate Internet search engines and Internet directories with which it had been registered. The website testing standards in one of the local government organisations also included standards for testing the website with different versions of different Internet browsers. In addition, the website testing standards in one of the local government organisations studied stipulated that web pages were reviewed by a range of people with various abilities and disabilities, such as colour blindness, to test the pages for ease of use.

Guidelines for the performance of websites in terms of download times were in place within the two IT services companies studied, which developed websites for client organisations.

An interesting research finding was that none of 13 organisations that had any formal website development standards actually had standards that covered the analysis of the requirements for a given website or for the actual coding phase of website development. The use of documentation from previous web development projects was mentioned in only one of the IT services companies and the pharmaceutical company studied. Only nine of 25 organisations studied actually produced any website development documentation, these being the pharmaceutical company, the two retail companies, two of the IT services companies, the two local government organisations, the charity and the shipping company as shown in Table 2. Lin and Henderson-sellers [31] had commented upon the lack of documentation associated with web development projects in general, but had not actually investigated the use of such documentation in actual practice.

All of the standards for website development encountered within the organisations studied were developed in-house. None of the IT practitioners interviewed in 13 organisations studied that had any formal web development standards mentioned the use of academic or professional literature for creating their organisation's website development standards. All of the website development standards encountered in 13 organisations that had such standards were quite separate from the existing IT standards within those organisations. All the website development standards encountered were new creations,

and did not really overlap with any of the existing IT standards already in use.

5. Conclusions

In this paper the activities involved in website development, the techniques used for website development and the use of standards/policies/best practice guides for website development activities has been examined based on case studies in 25 UK organisations. The main conclusions from this research exercise are follows.

There can be a wide range of activities undertaken within a given website development project and these may involve both technical and business aspects. However, website development still appears to be the preserve of IT specialists.

The twenty five case studies appeared to indicate that few UK organisations have much in the way of formal frameworks/standards/best practice guides for assisting IT staff in web development projects. Ad hoc approaches to website development appear to dominate.

There appeared to be few techniques actually used for website design in 25 organisations studied. An implication of this finding for academic theory is that given the increasing size and complexity of corporate websites, the development of effective website design approaches needs further research. The implications for IT management of this finding are that without appropriate website design techniques being available to website developers, there is the real risk that overly complicated and messy websites will be developed, which may not only frustrate website users, but also may mean that future website maintenance activities may be unnecessarily complex.

There appeared to be no formalised approaches to website analysis activities in any of 25 organisations studied. In particular, there appeared to be no formalised approaches to determining the overall purpose of the organisation's website, or determining the business processes to be supported by the website. An implication of this finding for academic research is that if organisations are to move an increasing amount of their activities to web-based IT systems, this area desperately requires further research in order to develop approaches that can assist organisations in effectively identifying the purpose and requirements of their web-based systems. The implications of this finding for management are that the organisation's website may not properly support existing business processes, and in addition separate web based and traditional business operational processes may cause potential difficulties and disruption to the organisation. For example, will goods ordered through the website and goods ordered through traditional means be processed in a manner that ensures availability is not compromised for either route.

The apparent lack of coding standards for websites encountered in 25 organisations studied has the implication for IT management that poor website coding may hamper future website maintenance activities.

Only one of the organisations studied actually considered disability issues when designing their website. The Disability Descrimination Act 1995 section 21.1 Duty of providers of services states that "where a provider of services has a practice, policy or procedure which makes it impossible or unreasonably difficult for disabled persons to make use of a service which he provides, or is prepared to provide, to other members of the public, it is his duty to take such steps as is reasonable, in all the circumstances of the case, for him to have to take in order to change that practice, policy or procedure so that it no longer has that effect". Organisations should attempt to make more effort to design their websites so as to cater for those with colour blindness and partial sightedness, for example, by avoiding certain colour combinations.

None of the IT practitioners interviewed within 25 organisations studied mentioned academic literature or standards bodies as a useful source of website development guidance. This suggests that academics and those involved in the administration of standards bodies need to do more to promote the relevance of their work to the IT industry.

It is hoped that the results of this research exercise may be of benefit to organisations intending to develop methodologies/standards/policies/best practice guides for their website development staff, and to training agencies and higher education establishments that cover website development in their courses.

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