To use or not to use: Investigating web methodologies

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Currently numerous information systems development (ISD) processes exist. Little evidence has been provided that these processes have evolved to meet the requirements for web development, specifically e-commerce development. Web development (and e-commerce development) is, however important to many organizations. This paper discusses work related to web ISD processes, and secondly, lists the findings obtained by a study into the usage of ISD processes by web development companies in New Zealand. Thirdly, the paper reports on a method for choosing a web development process out of a given set of ISD processes. Finally, a prototype tool that implements this method is briefly described.

Keywords

Web development, development processes, e-commerce development.

1. INTRODUCTION

There has been a rapid growth in the use of the web for commercial purposes, which includes the need for companies to develop and use web sites and/or e-commerce sites (Cheung 1998; Taylor, McWilliams, Forsyth and Wade 2002; Vidgen, Avison, Wood and Wood-Harper 2002). The same challenges and problems that existed with the development of "traditional" IS, also exist when developing web information systems (WIS) and e-commerce information systems (eCIS) (Butler 2003). WIS and eCIS therefore require a mix of web development techniques (such as user profiling) with traditional IS development competencies which includes database and program design (Gruhn and Schope 2002; Vidgen 2002). WIS and eCIS development require quick project completion, yet demand quality software (Sharma, Sugumaran and Rajagopalan 2002). An attempt has been made to conceptualise the term WIS as opposed to IS (Kaschek, Schewe, Wallace and Mathews 2004).

This paper reports findings of a small survey of 31 respondents conducted in March 2004 amongst 55 web developers on their usage of web IS processes. In section 3, a method is introduced that can be used to choose between different web ISD processes, whilst in section 4 a prototype selection tool is briefly defined. Finally, some conclusions are drawn in the last section.

2. ISD PROCESS USAGE RESEARCH RESULTS

A survey, with web developers, was conducted to determine the usage of web ISD processes. Several developers participated in the survey. Fifty percent of the developers interviewed had been involved in the development of web pages, whilst 28% indicated the development of large interactive websites and 22% developed e-commerce sites - of this latter group, 9% used predefined software to do the development. The development was done for a range of companies that included the health sector, government, SMEs, tertiary sector and large companies.

The work environment of developers included single person development (37%), private company (29%), Small-to-medium sized business or SMEs (21%) and larger business (13%).

A fifth of the people do their development in teams of between 4 and 10 people, whilst two-fifths do their development as part of a team of up to three people. Two-fifths of the developers do individual development.

As seen in Figure 1, 20% of the developers do not use a structured development process; whereas

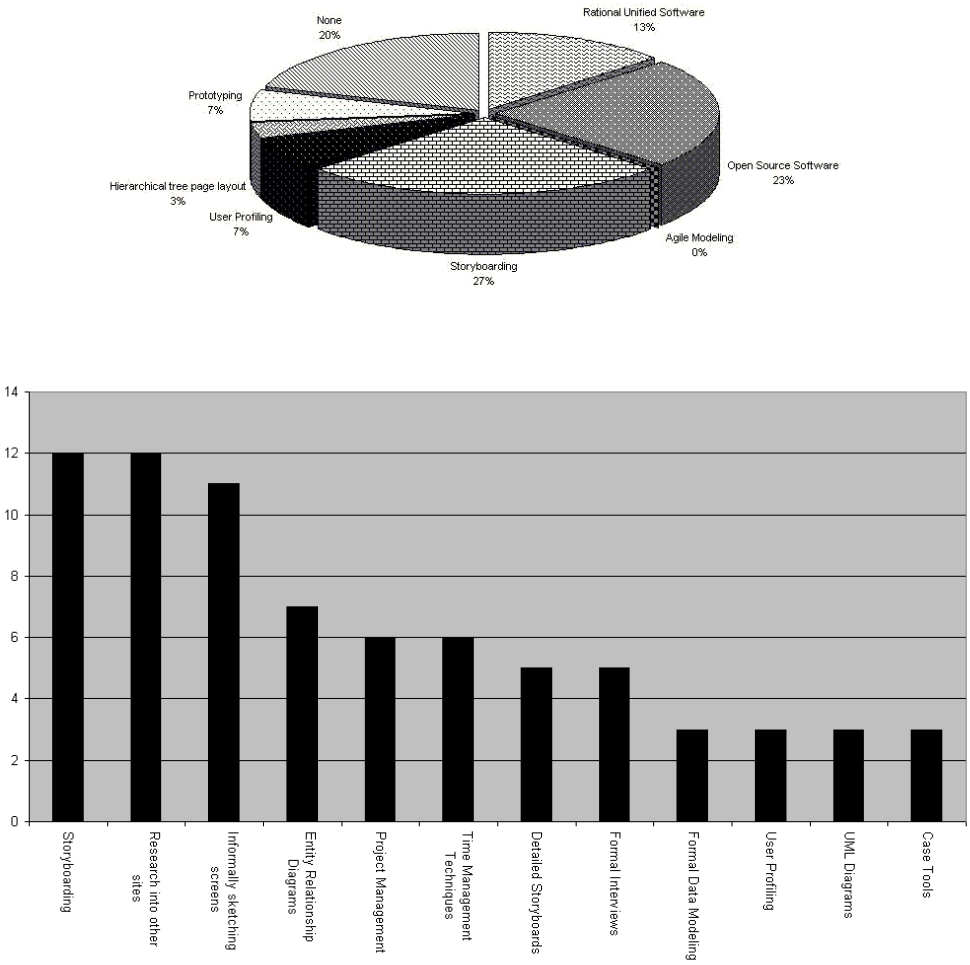

Figure 2: Specific methods used by developers

27% use storyboarding, 23% use open source software, 13% use rational unified software, 7% use prototyping and 7% use user profiling. Only 3% developers use a hierarchy tree layout and no one uses agile modelling.

Respondents were asked to indicate all the development methods they had used for web ISD (See results in Figure 2). Upper most in their responses was storyboarding, sketching screens and research into other sites. The larger teams/projects included data modelling and entity-relationship diagrams as well as project management and time management techniques in their list of modelling methods used. User profiling, UML diagrams and case tools are used by some of the developers, but these methods are not extensively used.

The feedback received from some of the larger development companies indicated that there is a need for using a formal web ISD process, especially when developing larger sites. Elementary sites require at least extensive prototyping. The developers further commented that for complicated sites, that require extensive database or e-commerce work, there is a definite need to do complete analysis, scoping and documentation before any development work. Functional requirements need to be defined and agreed upon with the user. Some of the companies set up a staging server that allows the client access to the site at will before formal testing and going live.

3. SELECTION METHOD

An attempt is made to define a Process Selection Methodology, which can be used to choose between different web ISD Processes. For each of the web ISD Processes, their characteristics are specified in the form of a list of concepts. It is proposed that a structured list of quality aspects (characteristics) are used to choose between different web ISD processes. Each characteristic will be weighted to show its importance, with the weighted values

adding to one. The characteristics and a brief discussion of contributing elements follows:

Application:

Quality - targeting the intended system quality include characteristics such as adaptability, availability, completeness, correctness, cost, ergonomics, interoperability, maintenance, performance, safety and security.

Economics - the available development budget, the expected running costs, benefit, and amortization time.

Conception:

Domain of method application - focusing on the development process used.

Process - the activities and life cycles recommended.

Documentation:

Material - the availability and quality of teaching- and documentary material, including case studies, adequate definitions and explanations.

Publicity - targeting the likelihood with which new staff can be expected to be capable of applying the methodology.

Methodology:

Artifact analysis - the support given for analyzing development artifacts and includes maturity, accuracy and reliability.

Team support - the support given for group-wise development and include characteristics such as understanding, ease of use, ease of learning and accepting.

Design primitives - the support for controlled evolution and transformations such as change management.

Modeling system - the concepts offered for systems development, how to apply and represent these, i.e. development for re-use, documentation and deliverables

Organization - targeting the enterprise culture, the business strategy followed, the employed technology with characteristics such as infrastructure, enterprise culture, technology, current level of business, external exposure, current client base, personnel internet experience and geographic interaction.

Project - IT strategy, business strategy, future plans, objectives, requirements and implementation strategies.

Team, - focuses on skills, education, experience of the development team as well as its composition and load due to involvement in other projects.

Time - the intended development time.

Tool support - the availability of the tool within the company, quality (including the degree of coverage of the modelling system and utility of the tool), trustworthiness of the tool vendor and robustness of the tool.

The Process Selection Methodology will associate with each web ISD process profile a vector of numbers for the specified process and for each characteristic a weighting factor. This will enable the user to quantitatively compare web ISD processes and chose the one with the largest weighted sum. Applying sensitivity analysis and weak-point analysis (see (Böhm and Wenger 1996) for more detail about how to apply this method in general) will help to further confirm that the recommended web ISD process is valid.

The heuristic in this paper does not have the purpose of guiding users to a final decision. Rather it aims to introduce terminology that can be used to make the decision and document reasons for deciding in a particular way. The proposed heuristic provides expert users of the tool with the capability of adding to and documenting new heuristics.

4. PROTOTYPE TOOL

Figure 3 describes the prototype tool that has been developed. The developer using this prototype tool is thus assisted to make a decision on the web ISD process that will best suit their needs. This tool is used to assist the decision-making process. The final decision choice will still lay with the actual decision-makers e.g. developer or manager.

5. CONCLUSIONS

As seen in this paper, there is a definite need for developers to use a formal web ISD process and the need exists to provide developers with support in making the decision on which web ISD process to use when developing web- or e-commerce sites. It is a difficult task to ensure that the formal web

The prototype tool, that implements the selection method, uses the subset of characteristics {c1….c54}. The prototype tool uses 4 Development Processes {Rational Unified Process (RUP), Agile modelling with extreme programming (AM/XP), Open Source System Development (OSP), Storyboarding with user profiling (SBU)}. For each characteristic c_i, $i \in \{1, \ldots, 54\}$, and each process P_j, $j \in \{1, \ldots, 4\}$, an enterprise staff, who is an expert in the field, is asked to determine the weight w(1), …, w(54) of characteristics c(1), …, c(54). The expert in the field specifies the performance p(1,j), …, p(m,j) with respect to this process for each characteristic. The numbers w(i) are chosen in such a way that w(1) + … + w(n) = 1. A third factor namely a factor specified by the developer specifying importance of that characteristic to that enterprise d(1),…,d(54), is also brought into the equation.

The identification of the most suitable web ISD process for a specific application can then be obtained by following this sequence of stepwise procedures:

1. C : = ∅
2. Choose $J \subseteq \{1, \ldots, n\}$ such that for $j \in J$ the number $S(j) = \Sigma_{i \in \{1,\ldots,n\}} w(i)*p(i,j)*d(i)$ is maximal and define C : = J, observe to chose J maximal. Set C : = C ∪ J.
3. For all $j \in \{1, \ldots, n\} \setminus J$, $k \in \{1, \ldots, m\}$ perform a sensitivity analysis, i.e.,
   a. Calculate $S(k,j) = \Sigma_{i \in \{1,\ldots,m\} \setminus \{k\}} w(i)*p(i,j)*d(i)$
   b. Choose sets W, P, D such that $w(k) \in W$, $p(k, j) \in P$, $d(k) \in D$ and determine $T(k,j) = \max\{w*p*d \mid w \in W, p \in P, d \in D\}$. It will often be convenient to chose W and P such that $W = \{c_W + h_W*\Delta_W \mid h \in \{0, \ldots, r_W\}\}$, $P = \{c_P + h_P*\Delta_P \mid h \in \{0, \ldots, r_P\}\}$.
   c. If S(k, j) + T(k, j) > S(j), then the values w, p, d for which the maximum T(k, j) was achieved need to be investigated. If they are reasonable, then redefine C : = C ∪{k}, w(k) : = w, p(k,j) : = p, d(k) : = d.
4. Do a weak point analysis for each candidate in $j \in C$, i.e., determine those characteristics with high impact (weight higher than for, e.g. 70 % of the characteristics) and low performance (performance lower than for, e.g. 70 % of the characteristics).
   a. For each of the weak points consider the performance assessment and weight. If one of these should be corrected then do so.
   b. If weak points remain after a. then either C : = C \ {j} or replace P_j by an improved version Q scoring no less than P_j, and assess it.
5. If the weak point analysis in 4 does not change anything then chose among the candidates in C according to a predefined strategy. Otherwise go back to 3.

Figure 3: Prototype description

ISD processes have evolved sufficiently to meet the developers' requirements for web ISD processes. Further research into this is required. Further research is also required into how to best determine and prescribe the most suited web ISD process for a specific application.

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