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The effect of external contextual factors on the choice and usage of methods in Web development projects

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Abstract — **The decision of which Web development method to choose, and how that method is enacted for a particular project, is subject to the influence of a number of factors. This paper looks specifically at external contextual factors which may potentially effect the behavior of the development team. The findings of an empirically-grounded analysis of a field study of Web developers in Ireland is presented.**

Keywords — situated action, Web development, Web engineering, method enactment, method tailoring

I. INTRODUCTION

In recent years, there has been a growing acceptance that the enactment of Web development methods may be characterized as "situated action", typified by improvisation, opportunistic "bricolage", and even apparently "amethodical" behavior [1-8]. The foundation of the "situated action" view of design is that, "rather than attempting to abstract action away from its circumstances and represent it as a rational plan, the approach is to study how people use their circumstances to achieve intelligent action" [3]. The theory of situated action rejects the assertion that formalized design methods can be executed objectively. Moreover, it recognizes that no method can ever be better than the people who apply that method, and design methods must always be uniquely interpreted within the distinct context of the situation and consider the people involved [4-8]. As Essinck [9] puts it, "in a real life project one has to puzzle together one's own specific method, tuned to the problem at hand and the situation the designer is in". The enacted design process "emerges" from the dynamic interaction of the development context, the developer, and the development methodology.

Web development practices might be affected by the intervention of contextual factors, the influence of which may be to cause the team to pursue a course of action they might not otherwise normally take. This paper is concerned with *external* contextual factors, – such as political, legal and environmental considerations, – as opposed to factors that are *internal* within a project, – such as the application domain, project timeframe, team characteristics, and the nature of requirements. As such, these external contextual factors are outside the immediate control of Web developers and project managers, yet they are compelled to consider these factors at all times and respond as needs be.

II. RESEARCH METHOD

To investigate the potential influence of external contextual factors on Web development practices, a field study consisting of semi-structured qualitative interviews with 14 Web developers was conducted in Ireland. The selection of interviewees was theoretically driven, chosen so as to seek out similarities and dissimilarities, looking at both typical and atypical cases. They varied according to organisational size, organisational type, application domains, client location (in-house versus external Web development houses), and the interviewee's professional background. In most of the organizations visited, one personal interview was conducted with the team leader, typically convened during the mid-day break so as not to encroach upon busy work schedules. In one organization two developers were separately interviewed, and in another the managing director brought five staff members into the meeting room. Where available, secondary data sources were also consulted. Data gathering continued until a point of reasonable "theoretical saturation" was reached. The data was analyzed using a hybrid method, mainly based on the procedures of grounded theory [11-12], but also informed by the principles laid down by Miles & Huberman [13]. For a more detailed exposition of the research method, see [6].

III. DISCUSSION OF FINDINGS

The main findings are analyzed and discussed in the following sections, which identify a number of external contextual factors: mandate by the client, organizational imperatives, the locus of power, control and reward mechanisms, organizational culture, and covert political roles of formalized development methods.

IV. MANDATE BY THE CLIENT

In some cases, it was found that clients insist that certain procedures are to be rigidly followed (e.g. because of statutory requirements to comply with certain standards, or the existence of binding protocols for procurement or software testing), or not to be followed (e.g. political pressure to complete, "just do it!"). In a previous phase of this research [6], it was found that it is quite common for clients from highly regulated business sectors such as financial services, pharmaceuticals, and government/public sector to insist that certain procedures, standards, and/or nomenclature are used. Indeed, the motivation to put formalized, accredited development processes and procedures in place largely derives from a client-driven imperative, as explained by the Quality Assurance Manager at Bizweb Solutions:

> *"In our own experience, we have had situations where a supplier said they did such and such, but when they actually came on board it turned out to be a disaster. A lack of consistency affects confidence, and that's been recognised where a lot of companies especially in the*

government sector have now decided that unless you are accredited, they won't even look at your proposal. So BS7799 / ISO-17799 is no longer a luxury, it's becoming a prerequisite in our business." (QA Manager, Bizweb Solutions)

Indeed, our findings suggest that the presence of externally visible development methodologies is a factor in assuring clients and winning contracts; of course, as Bizweb's QA Manager was keen to emphasise, it is important not just to "say what you do" but even more to "do what you say".

V. ORGANIZATIONAL IMPERATIVES

Organizational prerogatives such as perpetual immediacy, statutory and regulatory imperatives, a commercial desire to maximise revenue/throughput, a need to be internally flexible with schedules and requirements, or a focus on quality above time and cost considerations can impact development processes. These are explained as follows:

A. Perpetual immediacy

Where a development team constantly faces imminent deadlines, such as at BroadCorp, a "just get it done" attitude prevails. Even in the worst case scenario for a development team, where they face the dreaded "backs-to-the-wall" combination of acute time and resource constraints, a tactic herein coined as "pragmatic satisficing" is engaged, meaning that a previously tried-and-tested solution or pattern is re-used with modifications. Thus the solution is an acceptable one even though it is rarely the best possible outcome.

B. Statutory and regulatory imperatives

As was revealed in a number of cases, the adoption of organizational policies and procedures is sometimes required by law or industry regulation, particularly to do with such aspects as quality, accessibility (e.g. accessibility and equality legislation, WAI, US "Section 508"), and security (e.g. ISO-17799, data protection legislation). Though basic compliance is therefore usually the reason why formalized processes to consider these aspects are initially put in place, most of the companies interviewed were firmly committed to improving their standards in these areas anyway. There is a genuine belief that compliance is beneficial, unlike the cumbersome tribulations of ISO-9000 accreditation, which seems to be generally regarded as something that is done just for its own sake.

C. Desire to maximize revenue

Most of the Web design agencies interviewed were unashamedly and understandably sales-driven. In a number of cases it was mentioned that where disagreements arise between the sales and marketing team and the development team over deliverables, the sales team always "win" the argument. The imperative to maximize revenue means that streamlined production processes are essentially mechanisms to bring about efficiency gains and rapid closure, while usefully serving the secondary purpose of assuring prospective clients that the company "knows what it is about", thereby helping to secure contracts. Gasson [5] also noted a similar pressure to gain "quick wins" in her study of situated information systems development practices. The pursuit of efficiency gains means

that routine activities, such as code generation for standard requirements, are now automated to a high degree. Experientially-based patterns and time-saving heuristics are also used as best possible to speed up analysis and design, thereby permitting more time to be spent on the more creative and resource-intensive aspects of projects. On the downside, a short-sighted obsession with revenue/throughput maximization can mean that programmers may be coerced into working overtime and taking shortcuts to meet promised deadlines, thereby compromising quality. As one survey respondent scathingly commented,

"In many companies, delivering what the NASDAQ expects for the quarter is more important than developing in a structured, robust fashion a system that can be easily maintained into the future." (Web Editor, FJI)

A revenue-driven focus can also mean that the sales team is more tolerant of, and perhaps even encourage, out-of-scope requirements changes because, as mentioned by a few interviewees, they look on feature creep and re-work as "extra cash" and an opportunity to earn additional commission. On the other hand, the development team are much less happy when late requirements changes are submitted. This ties into organizational reward and control mechanisms, discussed later.

D. Need to be internally flexible and react quickly

It is common practice for Web design agencies to use the practice of phase-product sign-offs to control feature creep and to manage negotiations with clients [6]. While in-house Web development teams, such as at Broadcorp and JobsPortal, also aim to tie down requirements as best possible, they are fundamentally different from external agencies in that they do not charge work on a time-based rate but instead must make optimal use of whatever resources are internally available. Otherwise put, when a change request is received, they cannot adopt a policy of "We agreed to freeze things, so you're not getting it unless you pay more and give us more time". Rather, in-house teams must be sufficiently flexible to be able to accommodate rapid, sometimes dramatic, changes to requirements and schedules based on volatile business priorities. This requires an ability to improvise because plans are constantly subject to change:

"We don't manage projects in the same way as Web development houses. You know, they timeline it out and prepare breakdowns and all those kinds of stuff. But we wouldn't do that in here, because we can't. Say if we're doing a large site for a department, we couldn't promise them that it would be done next Tuesday, because we could be told tomorrow that something is happening. Because we're so small, we'd have to drop everything to get it done, so that's why we don't have a timeline as such." (Web Project Manager, BroadCorp)

This may explain why none of the three in-house development teams visited have formalized processes, unlike Web design agencies where it is quite normal to have clearly laid-out plans and processes. Rather, in-house projects are managed by reference to a priority-ranked backlog sequence where placings can shift frequently. The means by which ends are achieved are improvised from one project to another. Systems development in this environment is essentially a creative problem-solving activity where best use is made of

available resources, techniques and tools to get the job done as well as possible on time:

"We redesigned the children's Web site not so long ago, but we've just found out that the whole of children's TV is being changed. So we were left in the position of having to create 16 new Web sites for September (next month) on top of all the other things that we're doing. So, after a cup of tea, you go 'How can we do this?', 'How is it going to be maintained?', 'What are they looking for?'. So basically I went away and talked to people and came up with a plan, so I could go to a meeting and say 'Well, because of the timeframe, because of (short) notice, because of the need for it to be updated, it will have to be in such a kind of design frame'." (Web Project Manager, BroadCorp)

"We are an Internet advertising company, not a core software development company, so if the business says 'We need it this way, not the other way', you have to be flexible and react quickly. We try to get requirements signed off as much as possible, but we are in-house developers, it's not that there's a client. You have to act according to business needs rather than technical perfectness ... We do use the traditional design techniques which a software development company would use, but we wouldn't really be strict about it because we have to get it working quickly and in the best possible way." (Web Project Manager, JobsPortal)

E. Primary focus on quality

OEG is an example of a not-for-profit organisation where work schedules, though always busy, are typically not constrained by hard deadlines. Because of the altruistic ethos of the organisation, the strategic priority is on delivering high quality services:

"We're not driven by profit, so that subtly changes our focus. The focus is more on quality, so we would spend more time making sure that our user base really benefit from the functionality that we add to the system ... Yes, a 30-day turnaround is possible for most things on the Web, but being under-resourced as we are, the last thing we want to do is a go-slow because you'd pay for it for the next month. We turn around things as quickly as we can, but not at the risk of releasing shoddy work." (Chief Web Technologist, OEG)

VI. LOCUS OF POWER

To an extent, most of the aforementioned examples are somehow related to the locus of organizational power, a factor that Powell et al [10] also allude to as having a potential influence on the design approach for Web-based systems. For example, one of the reasons why design practices at BroadCorp are characterized by last gasp improvisation is because the fledgling in-house Web development unit is under-resourced, of lesser perceived standing than the longer established TV departments, and so is often left to fend at the thin end of the wedge:

"We feed off from the graphics that would be used for television. That's good, as in it gives you an identity, but the problem is that the guys in television are under pressure to get their stuff done, so they don't really think about how a logo will work on the Web site. But that's just because we're still the new kids on the block. It's still not a priority." (Web Project Manager, BroadCorp)

Likewise, the conflict that sometimes arises in Web design agencies because of the competing motives of the sales team (revenue/throughput maximization) and the development team (quality optimization) ultimately breaks down to a power struggle. With regard to statutory and regulatory imperatives, the extent to which they are complied with is also partly influenced by the powers of reprimand vested in enforcers. Elsewhere, the locus of power is a common issue for client organizations, where the politics, indecision, and communicative difficulties arising from the "design-by-committee" syndrome can frustrate even the best laid project plans.

VII. CONTROL AND REWARD MECHANISMS, AND ORGANISATIONAL CULTURE

Organizational control and reward mechanisms and the general culture of an organization might affect design practices by encouraging certain types of behavior and discouraging others [14]. Some evidence of this phenomenon was indeed found in the interviews, both within development organizations and client organizations, summarized as follows:

A. Cultural emphasis on accountability of individual actions

A number of cases were cited where clients, mostly in the public sector, insisted that certain signed-off documents and deliverables were to be produced. This seems to be motivated by a covert political motive whereby recommended bureaucratic protocols must be seen to be followed, not so much for the sake of efficiency but moreso as a defensive shield against fall-out in the event of failure:

"Many government departments require systems that keep people busy and keep them covered in case of accountability. No matter how 'cludgy' the system is, if no-one can be blamed for a mistake in its operation, the system 'works' for the department concerned." (Web Editor, FJI)

Likewise, for in-house development teams, sign-offs may serve an ulterior role as collateral in the event of a "blame game", being a mechanism by which the risk of censure by management and end-users can be mitigated.

B. Cultural emphasis on personal responsibility, innovation and creativity

In all of the award-winning Web design agencies visited, the prevalent culture is more supportive of process innovation than punitive. Individuals are encouraged to take personal responsibility for their work schedules, there is an ethos of collective ownership, and collaborative knowledge-sharing is actively encouraged. For example, Webshop have a policy of operating at about 75%-80% of production capacity. This buffer zone is used to absorb scope creep and over-runs, but if employees have free time they are encouraged to conduct research into new technologies and methods. Generous wage bonuses are awarded to employees who impart fresh, useful knowledge to the rest of the team. Similar policies exist at most of the other firms interviewed. As such, employees are encouraged to continually seek out innovative ways of enhancing design processes and procedures.

C. Cultural emphasis on staff welfare and continuous improvement

An important issue in high-speed Web development environments is how to sustain pace over time without suffering fatigue and loss of morale. At Bizweb Solutions, an

organizational culture that places a premium on employee satisfaction and commitment has led to a drive to eliminate all inefficiencies that give rise to the need for overtime. The standardization of procedures, such as systematic coding conventions that facilitate collective code ownership, and an emphasis on continuous process improvement has thus far yielded appreciable gains. Interestingly, these values and practices are consistent with those of the Agile Manifesto, though at no point in a lengthy interview involving a number of staff did anyone explicitly refer to agile methods. It would appear that Bizweb Solutions, like many of the other organizations visited, have largely of their own volition evolved practices that are markedly similar to those of the agile methods family (e.g. XP, Scrum).

D. Use of material incentives

As another means of boosting staff motivation and commitment, a number of firms operate profit-sharing schemes, or pay commission based on timely delivery of projects or levels of sales. The potentially detrimental impact of commission-based rewards, which might encourage shortcuts or lead to unsustainable overtime demands, has already been noted. It should be mentioned that none of the project managers interviewed who use commission-based schemes reported any problems with their operation, but this issue was not probed in depth and therefore cannot be properly discussed here.

VIII. COVERT POLITICAL ROLES OF FORMALISED DESIGN METHODS

As with the Method-in-Action model [4], it was also found in this study that design methods may fulfill a number of covert political roles. These have already been mentioned in passing but can be summarized as:

- helping to raise the status of in-house Web development departments (e.g. the creation of internal policies to "legitimize" or "professionalize" operations);

- establishing a power-base for method champions (e.g. the XP, WAI, or ISO-17799 "expert");

- providing assurance that correct and "proper" practices are being followed (e.g. public-sector tenders), which is a factor both for initially winning contracts and also for retrospective accountability;

- documented requirements specifications are often used as bargaining chips in negotiating responsibility for change requests or delays with clients, thereby insulating project managers from political fall-out;

- the outward visibility of the existence of structured development processes is a relevant factor in winning professional awards and gaining accreditation, both of which are beneficial in raising the public profile and reputation of an organization.

IX. CONCLUSION

The findings of this paper further embellish the growing body of literature illustrating the point that Web development is essentially a socially negotiated process. It was shown that the selection and usage of Web development methods can be heavily influenced by organizational culture and prerogatives, to the extent that a particular method might be used or overtly followed for no reason other than that it is mandated by the client or by in-house regulations. The theory of situated action recognizes that a method, being a planned course of action, must always take cognisance of the particular needs and nuances of the problem situation within which it is being deployed. Much of the previous work on methods and method engineering within the Web engineering research community has focused on methods in isolation of their socio-technical environment. As yet, this interesting aspect remains a persistent gap in the literature, and it is worthy of further research.

REFERENCES

[1] R. Baskerville, J. Travis, and D. Truex, D. "Systems without method: The impact of new technologies on information systems development projects", in IFIP Transactions A8, The Impact of Computer Supported Technologies on Information Systems Development, K. E. Kendall, K. Lyytinen and J. DeGross, Eds. Elsevier Science Publishers, 1992, pp. 241–269.

[2] D. Truex, R. Baskerville, and J. Travis, "Amethodical systems development: The deferred meaning of systems development methods". Accounting, Management & Information Technologies, 2000, 10(1), 53-79.

[3] L. A. Suchman, Plans and Situated Actions: The Problem of Human-Machine Communication. Cambridge: Cambridge University Press, 1987.

[4] B. Fitzgerald, N. L. Russo, and E. Stolterman. Information Systems Development: Methods in Action. London: McGraw-Hill, 2002.

[5] S. Gasson, "A social action model of situated information systems design". DATA BASE, 1999, 30(2), 82-97.

[6] M. Lang and B. Fitzgerald, "An empirically-grounded conceptual framework of situated web design practices". Requirements Engineering Journal, 2008, 12(4), 203-220.

[7] N. Jayaratna, Understanding and Evaluating Methodologies, NIMSAD: A Systemic Framework. London: McGraw-Hill, 1994.

[8] R. Vidgen, D. Avison, B. Wood, and T. Wood-Harper, Developing Web Information Systems: From Strategy to Implementation. Oxford: Butterworth Heinemann, 2002.

[9] L. J. B. Essinck, "A conceptual framework for information systems development methodologies", in Information Technology for Organisational Systems, H.-J. Bullinger, E. N. Protonotarios, D. Bouwhuis and F. Reim, Eds. Amsterdam: North-Holland, 1988, pp. 354-362.

[10] T. A. Powell, D. L. Jones, and D. C. Cutts, Web Site Engineering: Beyond Web Page Design.Upper Saddle River, NJ: Prentice Hall, 1998.

[11] K. Locke, Grounded Theory in Management Research. London: Sage, 2001.

[12] A. Strauss and J. Corbin, Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory, 2nd ed. Thousand Oaks, CA: Sage, 1998.

[13] M. B. Miles and A. M. Huberman, Qualitative Data Analysis: An Expanded Sourcebook, 2nd ed. Thousand Oaks, CA: Sage, 1994.

[14] K. Kumar and N. Bjørn-Andersen, "A cross-cultural comparison of IS designer values", Communications of the ACM, 1990, 33(5), 528-538.