

The Process of ISD Methodology Selection and Use: A Case Study

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Abstract

This paper provides empirically-based explanations for the observed low, and partial, use of information systems development (ISD) methodologies. The research reported in this paper examines the process of methodology selection and use in an intensive field study of the early stages of systems development and notes ongoing adaptation of methodologies in response to changing contingencies. The paper concludes that, in many circumstances, methodology adaptation is a necessary part of successful systems development. It also suggests that deeper understanding of the attitudes of different stakeholders to selecting and using ISD methodologies may help to explain this adaptation.

Keywords

Information systems development, ISD methodologies, adaptation, stakeholders

1. Introduction

Information systems development (ISD) methodologies have been proposed as a solution to difficulties in developing information systems. Arguments in support of ISD methodologies include increased management and control of the development process (Avison & Fitzgerald 1995; Russo & Stolterman 2000), communication of successful development practices (Stolterman 1992) and support for inexperienced or unexceptional developers (Shaw 1990). However, ISD methodologies have failed to become an integral part of IS practice. There have been consistent findings over a long period indicating low rates of use of formal, documented ISD methodologies (Dekleva 1992; Fitzgerald 1997; Hardy, Thompson & Edwards 1995; Necco, Gordon & Tsai 1987; Russo, Wynkoop & Walz 1995) and widespread adaptation of methodologies in use (Bansler & Bodker 1993; Fitzgerald 1997; Stolterman 1992), where adaptation may involve omitting, changing or adding tasks (Hardy, Thompson & Edwards 1995).

Explanations based on theoretical analysis have been provided for the low rate of ISD methodology use (Russo & Stolterman 2000). However, there has been little empirical research investigating *why* many information systems are developed without the assistance of an ISD methodology or, where one is used, the methodology is adapted rather than applied in its entirety. Deeper understanding of methodology adaptation is needed to evaluate whether methodologies meet the needs of developers or if their suggested benefits are likely to be achieved (see Russo & Stolterman 2000).

The research reported in this paper has two distinctive characteristics. Firstly, it employs intensive research methods, in particular observation and participant observation. Use of intensive research methods has been suggested to develop understanding of methodology use in practice (Iivari & Maansaari 1998; Wynekoop & Russo 1997). Secondly, an alternative type of research is employed. The *process* of methodology selection and use is studied. Examining one process in depth using intensive research methods provided some explanations for the low and partial use of ISD methodologies. It also triggered reflection on the different views of methodology selection and use within an ISD project team. Existing surveys and interviews have not clearly specified respondents' roles within the organisation or project (see Hardy, Thompson & Edwards 1995; Iivari & Maansaari 1998). It is suggested that distinguishing between the perceptions of managers and experienced analysts may add to our understanding of ISD methodology selection and use.

2. Methodology Selection and Use

This paper examines the selection and use of formal, documented ISD methodologies. An ISD methodology has three key characteristics (Avison & Fitzgerald 1995; Wynekoop & Russo 1997): it breaks the development process into phases and sub-phases, provides tools, techniques and procedures to assist developers in their work, and has an underlying philosophy that represents a view of the aspects of systems development that are important for ensuring a successful project. Examples of ISD methodologies include Structured Analysis, Structured Systems Analysis and Design Method (SSADM), Information Engineering and MultiView.

ISD methodologies were introduced to deal with the size and complexity of systems development projects (Avison & Fitzgerald 1999). Ad hoc methods were believed to be contributing to the software crisis where systems were delivered late, over budget and not meeting customers' needs. Methodologies provide a standardised and transparent process for developing systems. Decomposing systems development into a sequence of phases that provides clear deliverables enables more effective project estimation, resourcing, monitoring and control. Standardising the development process may facilitate the exchange of staff, expertise and techniques between projects but relies on the application of a methodology in a constant way both between developers and between projects. Methodologies also help less talented and experienced developers to perform competently (Fitzgerald 1997; Shaw 1990).

The reasons for selecting an ISD methodology from the many available are poorly understood. There have been suggestions that selection of a methodology should be contingent on project characteristics such as the type of problem situation, organisation, users or developers (Avison & Fitzgerald 1999; Avison & Wood-Harper 1990). A contingency approach to selecting an ISD methodology is used at the start of a project and relates to the *perceived* project situation. Potential problems with a contingency approach include the time needed to learn about the nature of the problem situation and the need for a broad range of skills and experience to select and implement the appropriate methodologies for different contingencies.

Despite arguments in favour of methodology use, many organisations do not use ISD methodologies to develop their information systems. Where methodologies are used, they are often adapted although this process of adaptation is little understood. Whether adaptation occurs before the development project starts or as part of development is not clear from the

literature. It has been suggested that developers choose to adapt methodologies deliberately and consciously rather than through ignorance (Fitzgerald 1997) and that adaptation is guided principally by developers' experience (Hardy, Thompson & Edwards 1995; Wynekoop & Russo 1997). The outcome of this adaptation is a methodology tailored for the particular project. Current understanding of methodology selection and use is represented in Figure 1.

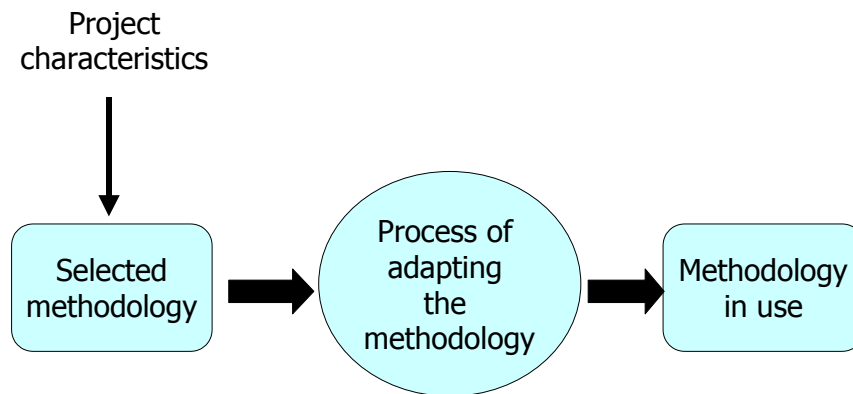


Figure 1. The process of methodology selection, adaptation and use

The initial methodology selection in response to contingency factors and the final rate and types of methodology use have been described in the literature. However, the process of methodology adaptation has received little attention and is poorly understood (Wynekoop & Russo 1997).

3. The Research Study

This research involves a feasibility study in the health and disability domain (Carroll, 2000). The client organisation, a government agency called CARE (a pseudonym to protect its identity), is responsible for the provision of services to people having physical and intellectual disabilities. CARE called for tenders to investigate the feasibility of developing a payment system based on business transactions and emphasised the need to investigate both the social and the technical issues surrounding any proposed new system. Two consultants, an experienced systems analyst and a sociologist, tendered successfully for the project. They attended briefings, undertook preliminary planning and constructed a project team whose seven members had expertise in electronic commerce, systems analysis and social issues. The consultants were joint leaders of the team, with the sociologist acting as the project manager and the analyst managing the face-to-face interactions with the stakeholders. Information was gathered through an intensive program of interviews and meetings with CARE staff and the other primary stakeholders. A feasibility report was written and submitted to CARE, amended and finally accepted almost twelve months after the first team meeting.

3.1 Research approach

The author joined the project when the team was constructed. Data were collected from review of documents (from the stakeholders and the team itself), observation and participation in team meetings and information gathering sessions and multiple interviews with the team leaders. Follow up interviews

were held after the initial and final submissions of the feasibility report. The author recorded notes of conversations and interactions. Her comments and interpretations were also recorded, both during the process and immediately afterwards. Therefore, data were collected on the process, the author's interpretations of the process and the team leaders' interpretations of the process. A summary of the interactions and the number of participants, excluding the author, is presented in Table 1.

Interaction type	Meetings	Participants
Team meeting	3	6
Interview with the sociologist	6	1
Interview with the analyst	6	1
Meeting with CARE staff	1	8
Meeting with other stakeholders	7	31
Total	23	47

Table 1. Interactions in the CARE case

Analysing process data is difficult (Langley 1999). Process research deals with sequences of events over time. Accordingly, it is more ambiguous, complex and imprecise than factor data and often involves multiple levels and units of analysis (Langley 1999). In the CARE case, a single micro-level analysis of the individual analyst who selected and adapted the ISD methodologies was undertaken. A narrative of methodology selection and use in the CARE case was written to organise the data (Eisenhardt 1989). The data were then presented visually in a table (Langley 1999). Four chronological periods of team activities were apparent: tendering for the contract, preliminary planning, detailed planning and acting in the field. In Table 2 these are linked to the three stages shown in Figure 1.

Stage	Team activities	Data gathering
Stage 1: selecting the methodology	Tendering for the contract	Document analysis Interview analyst Interview sociologist
	Preliminary planning	Document analysis Interview analyst Interview sociologist
Stage 2: adapting the methodology	Detailed planning	Briefing by CARE Team meetings Interview analyst Interview sociologist
Stage 3: methodology use	Acting in the field	Meeting with CARE staff Information gathering sessions Team meeting Interview analyst Interview sociologist

Table 2. The stages of the CARE case

4. The Research Results

4.1 Selecting methodologies: tendering and preliminary planning

The team leaders gathered background information about the CARE system prior to constructing the team. The tendering process involved briefings by CARE, document analysis and presentations by the consultants to CARE staff. During the preliminary planning there were further briefings with CARE and the other stakeholders. At this time, the analyst selected Soft Systems Methodology (SSM) and a socio-technical approach for the project. In the first interview with the analyst, he explained why he had selected these methodologies (Carroll 2000). He stated that he planned to use SSM (Checkland & Scholes 1990) in the early stages of the project to identify the technical and user requirements. This is appropriate as there were multiple, diverse stakeholders in the case. The analyst believed that this was “*the obvious way to go*” as there is a limited range of tools with which he is familiar and SSM is suited for this situation where there are “*multiple perceptions and no absolute truths*”.

In addition, the analyst planned to use a socio-technical methodology in the later stages of the project. Socio-technical methodologies include ETHICS (Mumford & Weir 1979) and Multiview (Avison & Wood-Harper 1990). The underlying philosophy of socio-technical methodologies emphasises the alignment of technology with both social and organisational factors (Avison & Fitzgerald 1995). Socio-technical methodologies were especially suited to the project because CARE had specified that consideration of social issues was an integral part of the feasibility study.

4.2 Adapting the methodologies: detailed planning

The analyst adapted the methodologies during the detailed planning: he indicated that he would only use fragments of them so that many of their phases and tasks would be omitted. In this period, the analyst met with the project team and representatives from CARE and undertook deeper analysis of the documents provided by CARE and the other stakeholders. As a result, the analyst identified two problem areas of the project and selected fragments of the two methodologies to deal with these problems.

The first problem area was that there were many stakeholders in the CARE system, including CARE’s head office, regional officers from CARE, service provision agencies, service providers, customers and associations representing the interests of service providers and customers. It was expected that these stakeholders would have diverse and conflicting interests and views of the CARE system. Accordingly, the analyst planned to use aspects of SSM to reach accommodation between the different viewpoints.

The second problem area was related to the characteristics of the project team. There was a marked division in both the expertise and the background of the team members. The team was selected to deal with the technical (systems analysis and electronic commerce) and social (sociology) aspects of the project. The team members with technical expertise were inexperienced in dealing with social domain. The sociologist stated that the analyst “*was anxious about putting a foot wrong on the social and organisational issues.*” The team members with expertise in social issues had no experience of IS projects. The sociologist described her ignorance of “*the building blocks of an IS project*” and felt she was “*blundering blind*” when dealing with the technical aspects of the project. Experience was

not the only issue. The technical and social team members used different language and had different world views.

The analyst selected a particular socio-technical methodology, ETHICS (Mumford & Weir 1979) to deal with the perceived difficulties of aligning and synchronising the different goals, world views, languages, viewpoints and interpretations in a diverse multi-disciplinary project team. In particular, he chose the structure of ETHICS so that the team would “*work on the technical solutions and the social solutions, then tie them together a la Enid Mumford*”. Different team members would work separately on the technical factors and the social factors which would then be combined in the feasibility report produced at the end of the project. The structure of ETHICS appeared to be appropriate to the CARE project, given the team’s lack of knowledge and experience in two different and important domains.

Adaptation of the two methodologies, therefore, was observed to relate to the analyst’s identification of potential problem areas in the project. To address these problem areas, he selected fragments of two methodologies rather than one ISD methodology in its entirety.

4.3 Methodology use: in the field

In the field, neither SSM nor its associated techniques (rich pictures, root definitions or conceptual models) were used. Early in the information gathering sessions it became clear that the views of stakeholders fell into one of two distinct groups: CARE was concerned with accountability and a desire to exert control over service provision and the remaining stakeholders expressed consistent, and similar, views. The analyst suggested that about 80% of understanding was shared by the service provision agencies, service providers and customers. They believed that the problem was poor communication and CARE’s lack of understanding of the practical issues faced in the field (by both service providers and customers). There was no need to use a formal method for reaching agreement between the stakeholders, given the consistency of the views of most of the stakeholders. The choice of SSM seemed appropriate early in the project when most of the information was provided by CARE. However, input from other stakeholders and observation of the context of the CARE system provided a different view. As a result, the analyst believed that his main task was to educate CARE about the nature of service provision practice in the field rather than accommodation of diverse views. Although there was no evidence of SSM being used as a formal approach for tackling the CARE system, it was evident that the philosophy of SSM played a role. It increased the team’s sensitivity to the need to interview a wide range of stakeholders and encouraged consideration of their views, especially those in conflict with the clients.

Similarly, the project team did not adhere to a formal socio-technical methodology and did not follow the structure of ETHICS where the social and technical factors are investigated in parallel. In the CARE case, the social and technical aspects were often tightly intertwined. The team members responsible for technical and social factors worked both together and separately in the field and the team leaders held frequent discussions to share understanding and views. Although the sociologist focussed on social, political and ethical issues and the analyst investigated systemic and technical issues, they worked to co-ordinate their efforts. The sociologist synchronised the different views using intensive communication (telephone, email and face-to-face meetings) with the team members. Therefore, the information gathered in two quite different domains was brought together throughout the project, not as a synthesis but as two complementary views of an unfamiliar problem situation. The team’s approach was developed opportunistically rather than through use of a methodology.

4. Discussion

5.1 Methodology adaptation

The findings from the CARE case extend the understanding of the process of selecting and adapting methodologies represented in Figure 1. It was observed that contingency factors came into play *throughout* the project and were evaluated and responded to by the analyst. This aspect of methodology selection and use has received little attention in the literature. It is argued that methodologies should be selected for the contingencies of a particular project, but this reflects the contingencies perceived in the early stages of a project. In the early stages of the CARE case, most of the information was provided by the clients. The analyst selected two candidate methodologies according to the perceived characteristics of the CARE project. However, as further information was gathered from a wider range of sources, more detailed planning was undertaken and potential problem areas were highlighted. The analyst selected *fragments* of the two candidate methodologies to deal with multiple, diverse stakeholder views and team members' lack of experience in the social and technical domains. Selection of methodology fragments to suit individual projects has been noted previously (Bansler & Bodker 1993; Fitzgerald 1997; Russo, Wynekoop & Walz 1995) but there has been little empirical exploration of such selection.

In the field, dealing with the actual circumstances of the CARE project, these methodology fragments were not needed. The contingencies of the project as it unfolded led to further changes in response to the analyst's growing understanding of the project. As the analyst's understanding of the underlying problems shifted, the need to collect data about clients rather than services became clear and the inadequacy of current reporting systems was noted by various stakeholders. Also, difficulties in coordinating the multi-disciplinary team were overcome informally using intensive communication rather than formally using the structure of ETHICS. The analyst abandoned the fragments of the chosen methodologies and only the underlying philosophy of SSM was evident in his actions. The feasibility study was undertaken using an eclectic mix of tools and techniques that the analyst selected in an ad hoc fashion (see also Bansler & Bodker 1993; Chatzoglou & Macaulay 1996). This was an informal and opportunistic process, neither pre-planned nor reflecting the prescribed steps of a formal ISD methodology.

Fitzgerald (1997) suggests that adaptation of ISD methodologies can be explained by the shortcomings of existing methodologies and the immaturity of the IS discipline. He argues that "*it is perhaps the case that the process was never well enough understood to definitively prescribe a methodology*" (Fitzgerald 1997: 211). This implies that, if only we can understand systems development more fully, methodologies that will work in most situations can be prescribed. The findings from the CARE case suggest otherwise. Contingency factors affected methodology choices throughout the project. Two methodologies were selected according to initial perceptions of a project. However, these initial perceptions of the project were based on incomplete knowledge. As the analyst learned more about the project and build understanding of the underlying nature of the problem situation, he adapted his approach; this reflects the intelligence of human beings who learn from and respond to their circumstances.

There may be little need to adapt methodologies in a stable, well-understood environment or where it is decided to ignore contingencies that become apparent after methodology

selection. However, there will be pressure to adapt methodologies in poorly-understood or rapidly changing environments. Here, the gap between the developers' initial perceptions of a project and its actual circumstances may be so great that the chosen methodology does not support the developers; the methodology may then be adapted or abandoned as observed in the CARE case. Further, it is possible that choosing not to adapt a methodology may lead to project failure. Using procedures, tools, techniques and an underlying philosophy that are not appropriate for a project could be disastrous. One of the promised benefits of methodologies, whereby developers of unexceptional skill are helped to perform competently (Shaw 1990), may not be gained: ordinary developers using unsuitable methods and tools cannot be expected to perform satisfactorily. This is particularly important in those commercial situations where use of a commercial or in-house methodology is considered mandatory for all projects.

Consequently, it is suggested that the need to adapt methodologies lies with the nature of humans and the systems development process. Imperfect perceptions of project characteristics, changing contingencies of a project and the ability of humans to learn from their experiences and adjust their methods provide powerful explanations for the observed adaptation of ISD methodologies. It suggests that formal prescriptions outlining how to perform systems development, as contained in ISD methodologies, may have only limited application in practice.

5.2 Roles in the development process

Comparison of the findings of the CARE case with existing research led to the insight that the participants in a project may have different perspectives on the use of ISD methodologies (see also Verner & Cerpa 1997). One perspective is presented in the ISD methodology literature which contains powerful arguments for methodology use to support the *managerial* aspects of systems development. An implication of using methodologies to manage and control systems development is the importance of applying them in a standard way. However, such standardisation may have negative consequences for developers. It involves some loss of flexibility and creativity (Russo & Stolterman 2000) and may reduce the level of skills required (Avison & Fitzgerald 1999).

A second perspective was observed in the CARE case where the analyst selected and adapted ISD methodologies to help him overcome identified problem areas in the project. He selected fragments of two methodologies as tools to assist him in particular areas of his professional practice rather than as a means of managing or controlling the project. However, a consequence of adaptation of methodologies is that the benefits of standardisation are lost. Also, adaptation places greater reliance on individual analyst's skills and experience to select suitable methodology fragments from a toolkit of methodologies, so losing the benefits of methodologies for assisting less able or inexperienced developers (Shaw 1990).

In much of the IS literature, IS personnel are aggregated without differentiating their roles (see Chatzoglou & Macaulay 1996; Fitzgerald 1997; Hardy, Thompson & Edwards 1995; Iivari & Maansaari 1998; Necco, Gordon & Tsai 1987; Russo, Wynekoop & Walz 1995). If there are diverse and possibly conflicting perspectives on methodology use then future research should investigate and clearly identify these perspectives.

5. Conclusion

This paper describes an intensive case study that examines the process of methodology selection and use. The findings of the case indicate that contingency factors can affect the selection and use of methodologies throughout the development process. In the CARE case, evaluating and responding to the characteristics of a project was not a one-off task but an ongoing activity. This suggests that, in projects where the gap between initial perceptions (influencing the selection of a methodology) and actual circumstances (affecting methodology use) is great, methodologies will be adapted. If, as Fitzgerald (1997) argues, a unique methodology is enacted for each development process, then the CARE case has helped to show *why* this occurs. Systems development is a human activity: humans learn and then adapt their plans and strategies to reflect this learning. Accordingly, methodologies may be adapted in response to increased understanding of a project and its characteristics. More generally, systems development can be viewed as a situated and emergent activity, the contingencies of which can never be wholly foreseen; if this was not the case, IS project management would not be so difficult.

It should be noted that the CARE case was very unusual. It involved a feasibility study rather than a full systems development project and the unit of analysis was a single analyst working in an unusual, multi-disciplinary team. The case allowed intensive examination of one process of selection, adaptation and finally rejection of ISD methodologies. It also led to the insight that the participants in systems development may have different perspectives on the process of methodology selection and use. However, it should be noted that the unusual nature of the case provides only indicative findings and that further research on entire ISD projects is necessary to confirm or disconfirm these findings.

Understanding the process of selection and use of information systems development (ISD) methodologies has significant implications for research and practice. This paper suggests that researchers need to specify the phases and types of problem situation for which a methodology is selected, the purposes of methodology use and the participant's role whose viewpoint is being studied. Further, there has been some debate about both the conceptual and practical value of ISD methodologies for improving the way that systems are developed (Introna 1996; Russo & Stolterman 2000; Truex, Baskerville & Travis 2000). The findings from the CARE case provide some explanations for the low and partial use of methodologies observed in previous research. They raise doubts about the value of seeking to apply methodologies in a standard way in all systems development projects. Finally, analysis of different perspectives on methodologies suggests that, while they may meet the needs of project managers, they are less likely to meet the needs of experienced developers. Conflicting pressures to standardise or adapt suggest that capturing the suggested benefits of methodologies in practice may be difficult.

References

- Avison, D.E. & Fitzgerald, G. (1995), *Information systems development: methodologies, techniques and tools*, 2nd ed., McGraw-Hill: Maidenhead.

- Avison, D.E. & Fitzgerald, G. (1999), Information systems development, in *Rethinking Management Information Systems: An Interdisciplinary Perspective*, W. Currie and B. Galliers (eds), pp. 136-155, Oxford University Press, Oxford.
- Avison, D.E. & Wood-Harper, A.T. (1990), *Multiview: An Exploration in Information Systems Development*, Maidenhead: McGraw-Hill.
- Bansler, J.P. and Bodker, K. (1993), A reappraisal of Structured Analysis: design in an organizational context, *ACM Transactions on Information Systems*, 11:2, 165-193.
- Carroll, J.M. (2000), Examining methodology adoption and use: building understanding from process research, *Proceedings of the 11th Australasian Conference on Information Systems*, Queensland University of Technology. CD-ROM.
- Chatzoglou, P.D. & Macaulay, L.A. (1996), Requirements capture and IS methodologies. *Information Systems Journal*, 6, 209-225.
- Checkland, P. & Scholes, J. (1990), *Soft Systems Methodology in Action*, Wiley: Chichester.
- Dekleva, S.M. (1992), The influence of the information systems development approach. *MIS Quarterly*, 16:3, (September).
- Eisenhardt, K. M. (1989), Building theories from case study research, *Academy of Management Review*, 14:4, 532-550.
- Fitzgerald, B. (1997), The use of systems development methodologies in practice: a field study, *Information Systems Journal*, 7, 201-212.
- Hardy, C.J., Thompson, J.B. & Edwards, H.M. (1995), The use, limitations and customization of structured systems development methods in the United Kingdom, *Information and Software Technology*, 37:9, 467-477.
- Iivari, J. & Maansaari, J. (1998), The usage of systems development methods: are we stuck to old practices? *Information and Software Technology*, 40, 501-510.
- Introna, L.D. (1996), Notes on teleological information systems development, *Information, Technology & People*, 9:4, 20-39.
- Langley, A. (1999), Strategies for theorizing from process data, *Academy of Management Review*, 24:4, 691-710.
- Mumford, E. & Weir, M. (1979), *Computer Systems in Work Design - the ETHICS Method*, Associated Business Press.
- Necco, C.R., Gordon, C.L. & Tsai, N.W. (1987), Systems analysis and design: current practices, *MIS Quarterly*, 11:3, 460-476.
- Russo, N.L. & Stolterman, E. (2000), Exploring the assumptions underlying information systems methodologies, *Information Technology & People*, 13:4, 313-327.
- Russo, N.L., Wynkoop, J.L. & Walz, D.B. (1995), The use and adaptation of systems development methodologies, *Proceedings of the International Resources Management Association*, Atlanta.
- Shaw, M. (1990), Prospects for an engineering discipline of software, *IEEE Software*, 7, 15-24.
- Stolterman, E. (1992), How system designers think about design and methods: some reflections based on an interview study, *Scandinavian Journal of Information Systems*, 4, 137-150.

Truex, D., Baskerville, R. & Travis, J. (2000), Amethodological systems development: the deferred meaning of systems development methods, *Accounting, Management & Information Technology*, 10, 53-79.

Verner, J.M. & Cerpa, N. (1997), Prototyping: does your view of its advantages depend on your job? *Journal of Systems Software*, 36, 3-16.

Wynekoop, J.L. & Russo, N.L. (1997), Studying system development methodologies: an examination of research methods, *Information Systems Journal*, 7, 21-46.