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KNOWLEDGE-BASED DIFFUSION - A CASE STUDY EXPERIENCE

LA DIFFUSION A BASE DE CONNAISSANCE – UNE ETUDE DE CAS

Completed Research Paper

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Abstract

This paper builds upon the previous research of Beynon-Davies and Williams (2003) and their knowledge-based model of the diffusion of Information Systems Development Methods (ISDMs). Through the lens of the implementation of a UK government IS development project we consider how a Rapid Application Development approach was unbundled and contextualized and highlight the problems experienced. We further reflect how evidence from this empirical case confirms the efficacy of many of the elements of the diffusion model and suggest a number of directions for extending this framework, enabling better understanding of the practical application of ISDMs within organizations.

Key Words: ISDM, knowledge-based diffusion, technological innovation, RAD.

Résumé en français

Ce papier mobilise le modèle basé sur les connaissances de diffusion des Méthodes de Développement des Systèmes d'Information (ISDMs) au travers du cas de l'implémentation d'un projet SI par le gouvernement britannique. L'étude de cas souligne l'efficacité de nombreux éléments du modèle qui permettent une meilleure compréhension de l'application pratique de l'ISDM à l'intérieur des organisations.

Introduction

The sustained growth, rapid change and the increasing complexity of organizational knowledge is reflected in the need for new types of efficiency based on adaptability and innovativeness (Clarke and Staunton 1989; Hollingsworth 1991). Previous empirical research on Information Systems Development Methods (ISDMs) has tended to focus on the evaluation of ISDMs or parts thereof (Wynekoop and Russo 1995). Additionally interpretive research, practice descriptions and case studies or evaluations of how ISDMs are selected, adapted or used are limited (Beynon-Davies and Williams 2003; Fichman 1992). In terms of Information Systems (IS) and Information Technology (IT) more widely, Fichman (1992) maintains that '*no critical review exists that focuses specifically on the application of diffusion to the adoption of information technologies* (p. 195). Kishore and McLean (1998) further suggest that within the IS success literature '*there are still no commonly accepted process models and terms to capture, describe and measure the phenomenon of the adoption of IS/IT innovations* (p731).

ISDMs play a central role in the construction, adaptation and renewal of an organizations' IS infrastructure and consequently upon organizational performance. Although the IS domain traditionally portrays the diffusion of ISDMs as an overtly rational process, Beynon-Davies and Williams (2003), utilizing the work of Newell *et al.* (2000), hold that the diffusion of ISDMs is a key example of knowledge-based diffusion. In the knowledge-based perspective, an ISDM is considered as a de-contextualized knowledge bundle that needs to be contextualized and unbundled germane to the relevant situational purposes, and this may prove problematic for a number of reasons. Such an approach is a useful conceptual device for understanding '*how development methods shape the community of practice in the IS development domain*' and, in particular, '*how organizations adapt, deploy and use such knowledge*' (p2). Their research focuses on understanding the diffusion experience of a particular ISDM (Dynamic Systems Development Method - DSDM) across two adopting organizations. They suggest that the success of ISDM adoption involves interplay between the shape of the ISDM itself as a 'knowledge bundle' and key facets of the organization such as structure and culture. Their findings concur with Jones and King (1998) who found, in their research on the adoption of Rapid Application Development (RAD) by organizations, that RAD as an ISDM is problematic for highly centralized and bureaucratic organizations.

We respond to the call by Beynon-Davies and Williams (2003) for further studies to substantiate the work on the knowledge-based perspective of ISDM diffusion. Through the lens of the implementation of a UK government IS development project we consider how a Rapid Application Development approach was unbundled and contextualized. We reflect how evidence from this empirical case confirms the efficacy of many of the elements of the diffusion model and suggest a number of directions for extending this framework aimed at enabling better understanding of the practical application of ISDMs within organizations.

The paper has the following structure. First, we introduce an understanding of ISDMs, next we describe the rationale for a knowledge-based model of diffusion and examine knowledge based diffusion and knowledge bundles. Second, we describe our research approach. Third, we describe the case study and how this is illuminated through use of a knowledge-based conceptual focus. Fourth, and finally, we review the lessons from the case in suggesting areas of refinement for the knowledge-based model of ISDM diffusion.

Information System Development Methods [ISDMs]

Information System Development Methods (ISDMs) specify an approach for developing an Information Technology System within its larger Information System. Thus, ISDMs are used as mechanisms for constructing, adapting and/or renewing an organizations' IT infrastructure, and as such they have a critical strategic impact on organizational performance (Beynon-Davies and Williams 2003). Typically, an ISDM encompasses a model of the ISD process, a set of development techniques, a documentation method, a perception of how these would fit into the development process and a philosophy of assumptions about what constitutes information, an IS and the place of IS within organizations (Beynon-Davies 2002). Veryard (1987) equates an ISDM to an information system itself and portrays the implementation of an ISDM as an instance of both technological as well as an organizational innovation.

ISDMs are typically perceived by practitioners as packets representing 'best practice' (Beynon-Davies and Williams 2003). However, literature suggests that ISDMs are rarely adopted as specified by organizations. Development organizations either do not use any ISDM in practice, or adapt and use existing ISDMs to meet their specific

requirements (Button and Sharrock 1993). Indeed, it is often the case that practitioners adapt development practices to respond to the exigencies and situational requirements of the organization and the IS development project they find themselves within.

Diffusion of Innovation

It is useful to portray the adoption of an ISDM as a diffusion process in which development approaches are promoted, taken up, adapted and used amongst development organizations (Beynon-Davies 2002). Mustonen-Ollila *et al.* (2004) suggest that the process of adoption is a function of an individual firm's strategic choice in conjunction with externally-induced professional and legal boundaries. A review of the diffusion literature by Fichman (1992, 1999) emphasizes that it is the context in which the adoption occurs that influences what, and how innovation is adopted.

The most common definition of diffusion is that provided by Everett Rogers (2003) who defines it as the process by which an innovation is communicated through certain channels over time among members of a social system. Indeed Roger's (2003) Diffusion of Innovation Framework is frequently used as a basis for research studies. However its broad focus on the way communication channels and thought leadership influence adoption does not necessarily '*illuminate the network mechanisms by which variables and constructs interact and become important during adoption*' (Hovorka and Larsen 2006, p160). Diffusion is a process by which an innovation spreads across a population of organizations beginning with the initial awareness of the innovation, and progressing through stages to formal adoption and full-scale development. Innovation diffusion adoption refers to the decisions within a company to make full use of a new idea as the best course of action (Rogers 2003). Innovation can de defined as an '*idea, practice or object that is perceived as new by an individual or other unit of adoption*' (p11). It is the implementation or use of new ideas, practices or objects that makes them innovations, it need not be new in that it may exist elsewhere but it must be new to, and both adopted and implemented within the organization (Van de Ven 1986). Mustonen-Ollila and Lyytinen (2004) suggest that for large scale operations where Roger's (2003) Diffusion of Innovation Theory is combined with understanding an organizations culture and information infrastructures, then implementation challenges can be managed.

Beynon-Davies and Williams (2003) suggest that the diffusion of technological innovations can be considered either as an overtly rational process or subject to social forces (Interpretive). Interpretive approaches, concerned with the social construction of technology, emphasize the way in which technologies are 'configured' during the diffusion process by the parties involved. Thus adoption or rejection of technology is subjective and can be influenced by actors and their conflicting ideas or requirements (Beynon-Davies and Williams 2003), as well as the related social system and environment that impact upon the unfolding adoption process (Gharavi *et al.* 2004; Kishore and McLean 1998). However, Light and Papazafeiropoulou (2004) argue that within a rational perspective emphasis is placed on the innovation itself rather than upon any social influences that impede or facilitate the process of adoption. Thus Rogers' theory has been criticized for not taking into account the particularities of other actors and complex information technologies (Iacono and Kling 1996; Lyytinen and Damsgaard 2001). In contrast, interpretive approaches, concerned with the social construction of technology, emphasize the way in which technologies are 'configured' during the diffusion process by the various actors, or relevant social groups involved such as professional bodies (Beynon-Davies and Williams 2003; Light and Papazafeiropoulou 2004).

In this view, the adoption or rejection of technology can be influenced by actors and their conflicting ideas or requirements and as such is subject to many factors and multiple interpretations. The diffusion of innovation is affected by antecedents and characteristics of potential adopters as well as the related social system and environment that impact upon the unfolding adoption process (Gharavi *et al.* 2004; Kishore and McLean 1998). Rogers (2003) refers to four general approaches of the diffusion of innovations (*innovation decision process theory, individual innovativeness theory*, *rate of adoption theory* and *perceived attributes theory*) where five attributes are specified upon which an innovation is judged (*complexity, trialability, observability, relative advantage and compatibility* - Fichman 1999). Further research (Moore and Benbasat 1991), has expanded to include *voluntariness* and *result demonstration* (Valier *et al.* 2004); and *intention to use* put forward by Van Slyke and Day (2002).

Literature uses terms such as *institutionalization, routinization and incorporation* to denote the final stage in the adoption of innovations. However, Kishore and McLean (1998) draw a distinction between *success of adoption* (when an innovation is successfully adopted and used by most/all of adoption units within a community of potential

adopters) and *success from adoption* (realization of the potential benefits). The former being a prerequisite of the latter. They suggest that an *'innovation will become institutionalized, routine and incorporated in the organization when two conditions are met.* First, when most or all of the individual members of the adopting organization utilize the innovation such that it becomes an integral part of their regular work-routine. Second, the use of the innovation is fully and completely used routinely. Thus when an innovation is adopted by a large number of potential adopters it is said to be diffused, and if it is used by its adopter(s) in a full and complete manner, then it can be said to have infused. Although they do not specifically define success in their context they draw a distinction between diffusion as the breadth of use amongst the community of potential adopters, and infusion as the depth of use of the features and functions from the situation perspectives as two dimensions of the success of adoption of IS innovations in situ. We carry this notion of success through into the conclusions of the case study setting in terms of how the success of ISDM adopted was influenced by the situational interplay between development activities specified in the ISDM adopted, and how it was affected by the structure of the organization and the culture of the actors involved.

Knowledge-Based Diffusion and Knowledge Bundles

Newell *et al.* (2000) focus upon the diffusion of knowledge between and within organizations where a process of complex ideas relating to organizations and technical processes are bundled together and packaged in particular ways by technology suppliers to create solutions for organizational problems. They can be presented by technology suppliers as relatively simple 'best-practice' fixes in a wide-variety of contexts that become de-contextualized or commoditised in 'black-boxes' that hide complexity. Such black-boxed solutions are described as a process of supply push that involves direct communication to potential users. However, a process of user pull can be applied where 'boundary-spanners' search out new ideas by connecting with external bodies.

However, when knowledge arrives in an organization it has to be unbundled and contextualized. This process may prove problematic for a number of reasons. For example, an organization may lack an established knowledge-base of people and skills for understanding and applying the 'technology', or difficulties of internal networking may prevent people with the requisite knowledge and skills of being involved. In such cases consultants may frequently be called in to manage the knowledge implementation process.

Beynon-Davies and Williams (2003) propose that an ISDM should be treated as a knowledge bundle because they act as devices for communication and adoption of IS development practice. However, the increasing uncertainty and dynamic nature of current business environments necessitates an ISDM that embodies the situational social structure and culture (economic, political, social and technological aspects) in the adopting organization. More specifically an environment that extends adaptability and flexibility, responds to speed and scalability (Baskerville *et al.* 2001, 2005), and can mitigate the risks of unexpected and perhaps unprecedented business changes (Sharifi and Zhang 2000).

Theoretical Backdrop

In our attempt to interpret the case material we have adopted various elements of previous theoretical work in the area of technological diffusion. We generally take the knowledge-based model of technological diffusion as our starting point for understanding the way in which a commercial ISDM (here an agile RAD-type approach) was adopted and applied within a particular organizational setting. RAD is one of a number of development methodologies that sit under the umbrella of 'Agile' development. Others include SCRUM (Schwaber and Beedle 2002), Extreme Programming (Avison and Fitzgerald 2006), Dynamic System Development Methodology (DSDM 2001). Emphasis is placed on lightweight methods/frameworks compared to the 'heavy weight' techniques of the traditional waterfall model (Miller and Larson 2005) where high value is placed on human roles and relationships rather than on tools and processes (Cockburn 2002; Highsmith 2002). Key characteristics are iterative development, intensive user involvement, joint collaboration and co-operation between stakeholders. The focus is on customer collaboration and team spirit (Avison and Fitzgerald 2006). We consider the particular ISDM adopted as a de-contextualized knowledge bundle which undergoes a process of contextualization within the organization under study. To help us theorize some of the problems and successes experienced in the process of institutionalization within the organizational setting we also utilize perspectives from Rogers (2003) and Van de Ven (1986) which emphasizes antecedents and characteristics, to ascertain the extent of the success of adoption and success from adoption of the ISDM in the case. This allows us to make judgements as to the breadth and depth of the knowledge diffusion (Kishore and McLean 1998).

Research Approach

This research adopted an interpretive stance (Walsham 1997) within a case study setting (Yin 2003) where ethnography (Beynon-Davies 1997; Hammersley and Atkinson 2000; Myers 1999) utilizing observations, was used as an initial immersive method of empirical data collection in the field. This was subsequently complemented with a variety of qualitative practices such as informal semi-structured interviews, shadowing of key participants and informal discussions and conversations. An inductive approach was aimed at creating new ways of seeing and thinking about current concepts and practices that may ultimately contribute to theory through the investigation and analysis of case materials (Alvesson and Deetz 2000). The suitability of research design is reflected by its association within the IS domain and other development projects (Beynon-Davies 1997; Myers 1999; Walsham 1997; Yin 2003). Such research facilitates a broad understanding of the organizational environment of the IS with particular reference to cultural and contextual situations, and the wider external context in which the IS is related (Gill and Johnson 1991; Walsham 1997). It is necessary to explore why individuals act the way they do, and what common understandings and behaviours result (Hammersley and Atkinson 2000; Myers 1999).

Literature recognizes that rigorous and relevant interpretive case study research can make a valuable contribution to both IS theory and practice (Beynon-Davies *et al.* 2000; Darke *et al.* 1998*;* Fitzgerald 2000; Walsham 1997; Yin 2003). For guidance and direction we utilized Klein and Myers (1999) Model of 7 Principles '*that are grounded in one direction of interpretive philosophy'* (p87) relevant to the evaluation of interpretive field studies associated with case studies and ethnographies. (1) *Human understanding* was achieved through iterative enquiry of both the 'parts' and the whole in terms of individuals and the environment. (2) C*ontext* was achieved though the critical reflection of the social, cultural and historical situational backgrounds. (3) *Sustained interaction* occurred between researchers and subjects through the iterative and reoccurring nature of the research approach. (4) The *theoretical framework* is concerned with generalizations of an ecological nature that specifically relates to the extent to which conclusions and lessons drawn from this research study are significant to comparable social contexts. (5) *Dialogical reasoning* was applied through the recognition of possible contradictions and preconceptions and subjected to subsequent cycles of revision. (6) *Multiple interpretations* were achieved through the diverse nature of the research approach that was informed by Alvession's (2000) advice on conducting critically informed research. (7) *Suspicion* - empirical materials were examined in terms of social and political interests of the stakeholders/actors to acknowledge any socially created biases and distortions by participants.

Observations

The case study consisted of a longitudinal research approach over three years where the researchers were situated within the project environment on a daily basis. The initial nine months of the 3 year study focused on continual non-participatory observations where people were observed during their day-to-day activities (Gill and Johnson 1991, Walsham 1997). The aim was '*to show how particular realities are socially produced and maintained through norms, rites, rituals and activities'* (Alvesson and Deetz 2000, p34). This was instrumental in getting close to the organization and participants being studied, in understanding the substance of the system being developed, and also facilitated the analysis of participants behaviour by observing events as did, or did not occur, in practice within their natural context (Silverman 1985 cited in Alvesson and Deetz 2000; Hammersley and Atkinson 2000; Myers 1999). Observation activities involved attending formal/informal, regular/ad hoc meetings, workshops and discussions between senior managers, business managers, developers and other project stakeholders/actors to maintain an intensive watching and listening stance. However due to the time constraints involved and the high degree of personal involvement that is required it was not possible to observe concurrent activities. Consequently, indirect observation occurred where the researchers, unable to attend some events, sought feedback and information from a number of different participant informants either orally or in writing (Gill and Johnson 1991). Subsequent observations continued on a more general basis throughout the 3 year study. Extensive field notes were recorded regularly in a project diary to facilitate the auditing and tracking of data and events (Myers 1999). During this period the research stance was effectively as a 'fly on the wall', as neutral observers free from research bias or expectations. No action research was involved. In this way ethnography was used as an initial immersive method of empirical data in the field as the principle means of grounding the qualitative study. Literature emphasizes '*observation of social process as the most fundamental element of qualitative research'* (Silverman 2005; Miller and Dingwall 1997)*.*

This 9 month period was followed with the complementary data collection practices as previously stated i.e. semi-structured interviews, shadowing of key participants and informal discussions and conversations that occurred during

the natural flow of interaction between the researchers and project participants during the project. Informal semi-structured interviews were conducted with all project participants. 126, one-to-one interviews of approximately one hour's duration were conducted iteratively throughout the project duration that sustained anonymity and confidentiality (Alvesson and Deetz 2000). The number of interviews per person was dependent upon their status within the project, their potential contribution, their availability and willingness to participate. For example key actors such as project and business managers were interviewed approx 5 times during the project. The aim was that through repeat interviewing over time not only to gather sufficient data but also to validate the consistency and reliability of the empirical data to facilitate rigorous analysis.

Interviews

Interviews were audio-taped, transcribed within two days and validated with respondents for added rigour and to offset unintentional bias (Patton 1990). Thus an ethical stance was maintained that afforded interviewees the opportunity to clarify, delete or amend inaccurate or incorrect data. Additionally key participants (identified by the Client Project Manager) were shadowed for 1- 2 day periods to gain deeper understanding and to gather explanation of what had been observed but not necessarily understood (Patton 1990) in order to accomplish mutual understanding (Alvesson and Deetz 2000). Although the aim was to maximize neutrality and minimize interviewer influence, interviewing does not guarantee 'truthful' statements or provide realistic pictures (Alvesson and Deetz 2000). Alvesson and Deetz (2000) maintain that knowledge claims on everyday life are politically loaded therefore it is important to *'challenge the 'taken for granted' situational goals, ideas and discourse which affect organizational actors within/experiencing the situational phenomena'*. Responses may be oriented by personal or situational experiences and values. Thus the analysis of interview materials was aligned to the concept of Alvesson's (2003) *'eight alternative conceptualizations of the interview'* (p14) such that iterative reflection was undertaken from different angles to allow multiple interpretations. This allowed us to consider a range of different possible meanings rather than simply accepting conventional or situational dominant understandings. The project diary was maintained with daily field notes together with a diversity of supporting project documentation. Furthermore triangulation occurred across the variety of empirical materials as advised by Alvesson and Deetz (2000). Our aim was to enhance reflection and provide rich data from breadth, depth, plausibility and variation perspectives (Alvesson and Deetz 2000).

Empirical Materials – Management

A case study database was created using QSR NUD*IST Vivo, a qualitative analysis software tool that facilitated dynamic interrogation of data. This aided audit trails important for conceptual development (Myers 1999; Yin 2003) and assisted triangulation across the diverse empirical data. All observational and interview materials were subject to critical reflection that added depth of understanding across local, situational and cultural contexts to provide a broad and rich picture for robust interpretations (Alvesson and Deetz 2000). Initial analysis involved methodically 'open coding' of data through an iterative process of sharing, reflection and enquiry to understand and organize the empirical materials into conceptual structures conformant with the research focus. Axial coding then established how categories might inter-relate and link to sub-categories to uncover any relationships and links (Kelle 1998). Secondary research involved an in-depth and systematic analysis of published literature, project documentation and artefacts that facilitated cross-checking such that strong substantiation of analysis and conclusions drawn could be established. To increase validity and provide meaningful insight the real-life context, experiences and commentary from individuals directly involved is applied. The researchers believe that the research activities carried out achieved the research method proposed. The inductive approach and cyclic nature of the data gathering and analysis facilitated understanding and discovery to emerge from iterative evaluation that could subsequently develop or contribute to theory as a result.

Generalization and Validity

In terms of generalizing conclusions drawn, we adopt Orlikowski and Baroudi (1991, p5) view that *'Generalization from the setting (…) to a population is not sought; rather, the intent is to understand the deeper structure of a phenomenon, which it is believed can then be used to inform other settings'*. In support of this view Remenyi *et al.* (1998 cited in Saunders *et al.* 2007) argue that there is no space for generalizability because of the dynamic nature of the world and its organizations but that it is necessary to discover *"the details of the situation to understand the reality or perhaps a reality working behind them"* (p84). Consequently this research study applied ecological validity that specifically relates to the extent to which conclusions drawn from this research case can be significant to

comparable social contexts. Thus a 'lessons learnt' approach can be applied for future like developments in similar environments.

Case Study

The case study concerns a UK Regional Government Department (the Client organization) that is responsible for managing the administration and expenditure of the European Commission's (EC) Common Agricultural Policy (CAP) schemes through a number of grants and subsidies across the region. Scheme management is the responsibility of scheme-specific Process and Scheme Managers (referred to as Business Managers) who attend to the business needs and administration of the schemes under EC guidance and control.

The structure and culture of the case study organization is best described as bureaucratic in that it is strongly hierarchical, highly procedural and risk averse. Work is conducted in a highly regulated and control-oriented manner, supported by clear management lines of responsibility within a culture which interviewees described as a 'blame culture' (Carnell 2003; Hofstede 2003; Morgan 1986; Wallach 1983; Weber 1964). Individual work is highly specialized causing specific sets of skills and domain knowledge to be seen to belong to particular discrete individuals.

Historically, a separate IT department within the organization dealt with the maintenance of the existing legacy system. This IT service department consisted of 120 Operations Support staff, and extended across three Divisional Offices. They had a perceived reputation within the organization for delivering development work late and that did not always meet user needs. An internal evaluation of the service and the legacy system revealed poor customer satisfaction and an increasing inability to meet the EC's changing requirements. One Business Manager reported that the need for a new system was long overdue and described the legacy system as *somewhat antiquated and outdated... it had had so many little add-ons, bolt-ons and new programs added to it, it must have been creaking at the seams'* (Business Manager 4). On the basis of this background, the business case for a new replacement IT system was produced. The case for the new IT system was intended to move away from the previous individual scheme administration procedures towards a Generic Process Model which integrated the core processes of separate CAP schemes. The business case specified the need for an integrated set of re-designed and standardized processes that facilitate automated data capture, data validation and speedier payments to customers.

Entry into the project environment was sought through the Senior Management Board of the development project. The researchers were granted access to the project environment and across the project community that consisted of a core team of 50+ developers and the organizational people who were co-located on the same site for the project duration.

Selection of the Developers and ISDM Approach

It was decided by Senior Managers of the Client Department that due to lack of skills and expertise in-house the development of a New IT System should be undertaken by an external supplier who would work in partnership with Client Department. Thus project development was outsourced to a commercial company (the Developers) who adopted their own in-house commercial RAD-type Iterative Application Development (IAD) approach which they believed was particularly suited to the development environment. The similarity of the IAD approach to that of RAD refers to the use of the same main features i.e. intensive user involvement, Joint Application Development (JAD) workshops, time-boxed development, iterative and incremental delivery. The aim was to provide early visibility of the system being developed with the potential to incorporate user feedback, and the flexibility to handle new and changing requirements. The developers were selected on their experience in the field of systems transformation and of developing customized software and hardware.

A project structure was established consisting of a Senior Management Board and teams of integrated project participants working within a pre-defined reporting structure. These teams consisted of CAP scheme managers, business managers/stakeholders, CAP administrative personnel, and the outsourced IT specialists (analysts, designers, developers, testers). We use the term 'project community' to refer to the core team of stakeholders/actors of the IS project as described here.

A RAD ISDM

As mentioned above, the ISDM adopted in this context was the vendor-specific IAD development approach. The Developers referred to IAD as a RAD method. Table 1. below presents the 9 key principles of the RAD approach as specified by DSDM (1994).

DSDM Principles	Case Study Project		
	Year 1	**Year 2**	**Year 3**
1. Active user involvement	Yes/No	Yes	Yes
2. Empowered decision-making	No	Yes	Yes
3. Frequent delivery of products	No	No	Yes
4. Fitness for business purpose	No	Yes/No	Yes
5. Iterative and incremental delivery	No	Yes/No	Yes
6. Changes are reversible	Yes	Yes	Yes
7. High-level requirements – based lined	Yes	Yes	Yes
8. Integrated testing during life cycle	No	Yes	Yes
9. Stakeholders co-operation and collaboration	No	No	No

Table 1. DSDM Principles as Applied to the Case Study Project
(Adapted from DSDM 1994)

However, the literature does not present any definitive interpretation or prescriptive application of the individual principles, as a consequence the researchers draw on previous research studies and the acceptance and following understandings of these principles as a given (Beynon-Davies 1996; Beynon-Davies *et al*. 1999; Elliott 1997; Hirschberg 1998; Jones and King 1998; Martin 1991). Active user involvement, empowered decision-making and integrated testing relate to the extent to which system users (here we mean stakeholders/actors of the case study system being developed) are involved throughout the different development stages (requirements negotiations, system design, testing and so on) rather than just reacting to the system at the end of the development lifecycle. It is an active involvement rather than a passive one (Santosa *et al.* 2005).) Indeed user involvement in terms of participative decision-making is particularly relevant to this research study where the scope of user involvement is expanded to a representative role such that Business Managers articulated and negotiated in the design and development of the systems specifications (Ives and Olson 1984; Purvis and Sambamurthy 1997).

Stakeholder's co-operation and collaboration is considered key because requirements are initially based at a high level necessitating negotiation and consensus to reach a system that is fit for purpose. The principles of frequent delivery of products, iterative and incremental delivery, reversible changes refer to the iterative and flexible nature of development process in contrast to the more structured approach of the linear Waterfall Model development lifecycle. This is commonly referred to as the 'traditional' development model that concentrates on specifying requirements up-front before development begins followed by a number of sequential but fixed linear phases. This meant that there was often no active user involvement in the development of the system under construction.

Through the systematic analysis of empirical materials (observations, interviews and discourse) we present a comparison (see Table 1.) of the degree to which the application of these principles, as understood above, was achieved within the project over the three years of our research. The table clearly shows that the initial measure of 'fit' between the IAD approach and DSDM within the development environment was lower than anticipated by both the Developers and the Clients. However, over the life of our study it is evident that the application of the ISDM evolved. We believe that this reflects both an acclimatization of the environment to the approach, and a familiarization of the approach within the environment. Principle 9 is an apparent area of difficulty and refers to problems experienced with inflexibility of the EC as an external stakeholder; however this is not the focus of the paper.

Application of IAD

The application of IAD involved a sequence of short, time-boxed iterative development cycles that adhered to a 'fit for purpose' philosophy rather than building 100% of business needs. The Developers were provided with a Requirements Catalogue at procurement that formed the basis and scope of their planned development activities.

Figure 2. presents aspects of the life-cycle model adopted in the IAD ISDM and applied within the case study project. It can be seen that IAD adopts both notions of iterative development and incremental delivery. The Developers envisaged completing the initial development work during stage 2 and then revising and modifying the system to incorporate new business needs during iterations in stages 3 and 4.

Figure 2. Planned Iterative Development Stages of the IAD Development Approach
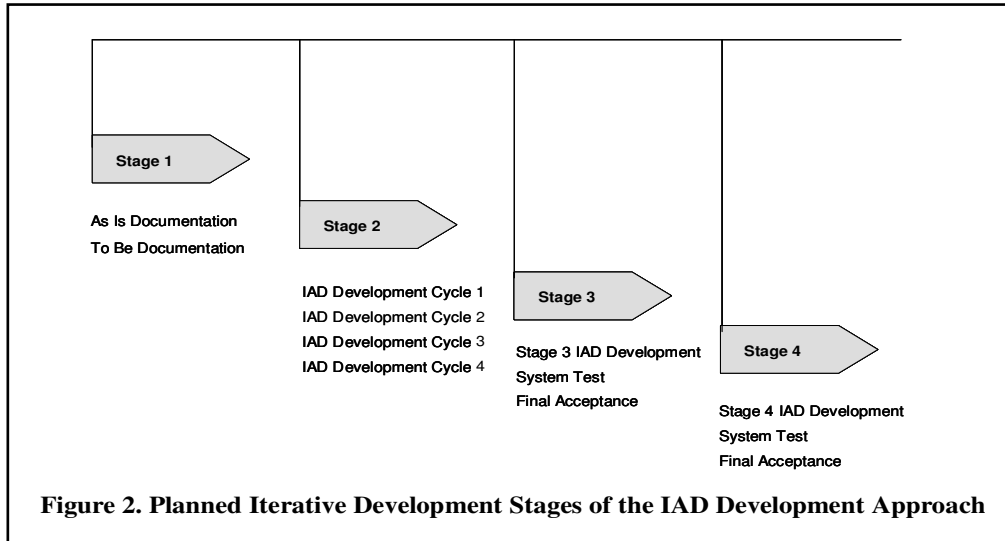
However, the iterations did not occur as intended. Stage 1 was completed as planned but towards the end of stage 2 the EC imposed a directive that radically changed major requirements of the system (Sharifi and Zhang 2000). Thus development on the case study project was halted and a revised project emerged (version 2) to accommodate the new development direction. This research study concentrates on the initial development project over its' three year duration. Developers imported their customary technique of JAD workshops for requirements gathering purposes.

Case Study Analysis

In this section we analyze the case from two perspectives. Firstly, we identify the factors/antecedents that influenced the level of diffusion of the ISDM itself, and secondly we examine factors that influenced the success and/or failure of the ISDM adopted (Gharavi *et al.* 2004; Kishore and McLean 1998; Rogers 2003; Van de Ven 1986).

The Level of Diffusion of the ISDM

Through the analysis of the case study materials we identified a number of key factors that impacted significantly upon the successful diffusion of the IAD approach. We propose the antecedents of user involvement, requirements negotiation and decision-making activities as factors affecting the diffusion process. Additionally, we also consider characteristics of the JAD workshops used for requirements negotiation. The interaction of some of these factors with the culture of the Client organization proved problematic, particularly in terms of some of the evident behaviour and attitudes of business participants in the development process

User Involvement

For this case study user involvement proved significant as an antecedent that influenced the application of principles specified in the adopted IAD ISDM. Such approaches necessitate regular and prolonged user involvement, availability and high levels of commitment from those involved. There is clear evidence in our case material that in the early stages of the development project, although Business Managers were assigned to development teams it proved difficult to insulate them from their daily 'Business as Usual' activities. This meant that they were not always available to participate when required. The Client Project Manager commented *'it is often those people maintaining the day-to-day activities, who were the least likely to be available, but who were the key knowledge contributors. I think we had this gap … the business expertise at that time we needed them they were all off doing other things to keep the organization running. So*

we suffered really not having the right expertise available to us and, necessarily that expertise has to be available on demand. That is the conflict, people have their jobs to do'.

The consequences of this were two-fold. Firstly, key domain knowledge was sometimes lacking in design sessions. Senior Manager (2) reflected *'One of the things that we've learnt … is the need for their* (Business Managers) *involvement during analysis'*. Secondly, the need to meet day-to-day work tasks reduced levels of user commitment to the project that had a knock-on effect upon user acceptance of the technology innovation. As a consequence in the early stages business motivation and commitment were reduced at a time when the foundations of the project were being created. For example *'One of the things that seemed to happen before, probably nearer the start, was trying to get information* (from Business Managers) *by a certain deadline and if it wasn't there by that deadline there were implications on all the other deadlines'* (Developer 11). This meant that the planned IAD development processes did not iterate effectively from the start of the project affecting the project's development and anticipated progress schedules.

Analysis of the case material further suggests that perhaps too much faith was placed by the Clients in the expertise and experience of Developers at inception. Their projected capability to comprehend the highly complex requirements that were characteristic of CAP schemes did not materialize early enough in the project. *'I remember them* (Developers) *saying, scratching their heads and saying that they didn't know that these things* (CAP scheme) *inter-linked … and they were scratching their heads and trying to find a technical solutions'* (Developer Manager 21). Likewise *'… you could see the faces of developers, the penny's dropping as to how complex some of these schemes really are. The disbelief in their faces when they find out what the EC are actually obliging us to do...'* Business Manager (6). Thus when the business expertise was 'lacking' in the design / development workshops those present were not able to progress development forward, and delays occurred.

Requirements Negotiation and JAD workshops

The volatile nature of the development environment meant that it was not possible to define fully the changing business needs. Consequently the Client organization produced a high level 'To Be' vision of the business requirements that conceptualized the Generic Process Model from which a Requirements Catalogue was formulated prior to procurement and given to the outsourced developers. The Developers utilized JAD sessions as the mechanism for negotiating the crucial business knowledge underlying the new IT system. JAD is a systems development technique involving workshops at which both developers and business stakeholders articulate system requirements, negotiate and prioritize said requirements to develop system specifications.

Observations, documentary material and evidence from interviews confirm that within the project environment integrated teams of developers and stakeholders were established. However, in the first instances, the size of these joint design sessions was larger than the typical 4-6 people characteristic of JAD. Large gatherings of 12+ people were assembled in an attempt to involve representatives from all business areas. As a consequence, there is evidence that they were less productive than expected.

All participants describe early JAD sessions as '*difficult'*. Problems were experienced with the level of attendance by business stakeholders. Additionally communication proved challenging. Participants, used to line management, felt outside their 'comfort zones' and were unwilling to openly voice opinions in sessions in front of their colleagues. This was seen as unhelpful by the Developers. For example '*There's definitely an attitude of not wanting to criticize your boss … that would just be a comment that is not of the same opinion of your boss, that seems to be perceived as a criticism so there isn't that openness of being able to comment or speak their mind'* (Developer 6), and '*…having 20 people to a workshop where only one person speaks and they happen to be the most senior person in the room isn't helpful'* (Developer 1).

Additionally, Business Managers not only perceived themselves to have ownership of the assigned decision-making business processes, they also expressed ownership of the domain scheme specific knowledge appropriate to the operation of such processes. This made sharing knowledge across processes and reaching consensus as to the shape of new integrated processes difficult. Developer (21) commented *'… actually what happened was everybody was still saying 'my priority is first, mine's the first', from 5-6 different Business Leaders.'* Consequently, little team identity, unity or spirit developed causing lack of trust between developers and business stakeholders.

Decision-making

IAD as a RAD-type ISDM requires fast, authoritative decision-making from development teams. However, it is evident that this was not achieved in many aspects of the project environment. We propose that inherent organizational protocols embedded in the bureaucratic tradition of the Client organization were a significant antecedent shaping the way in which this particular ISDM was adapted for use within the project environment. Interviewees frequently referred to the culture of the Client organization as a 'Blame Culture'. For example the Client Project Manager commented *'The ability to make effective decisions is a cultural aspect of the Department in that people don't particularly want to (I'm glad you are recording this actually) people don't want to make decisions because they don't want the blame attached to them if something goes wrong'*. By this they meant that decision-making was circumscribed and compartmentalized in terms of the hierarchical role structure of the organization. Business Managers were rarely prepared to make decisions seen to be outside their direct area of responsibility without first referring them up the chain of command. Thus they were often reluctant to make decisions in workshops. For example *'…they* (Business Managers) *were empowered to make decisions but they just couldn't. It was very frustrating we were trying to meet deadlines but this, well it just make it very difficult'* (Developer 21).

The speedy requirements negotiation of JAD sessions require decision-making processes that are 'fit for purpose'. In other words, decision-making needs to be fast, authoritative and open to compromise. This proved difficult to achieve because such characteristics ran counter to the conventions of decision-making operated by Business Managers in their normal work patterns. Although representatives were empowered to make decisions, they were unaccustomed to the speed required, preferring in some instances to defer decisions up the hierarchical management structure. As a consequence, many Business Managers resisted making such speedy decisions in joint design sessions. Project commentary confirms this *'…the difficulty in the workshops was that people didn't want to make decisions or couldn't'* (Business Manager 7). This affected the ability of the developers to meet their development and delivery schedules. These delays cascaded throughout development and ultimately influenced the success of the project.

Traditionally, within bureaucratic environments it is the time-horizons of the inherent culture that determine the speed decisions can be made. In contrast, the decision-making model specified in IAD focuses on activities and objectives rather than people and behaviour. This analysis concurs with the conclusion drawn by Beynon-Davies and Williams (2003) that the success of ISDM adoption is influenced by the interplay between activities specified in the development method and the structure and culture of the organization. Jones and King (1998) also found that an ISDM can be negatively affected by the behaviours and attitudes of organizational personnel such that they impact upon the overall trajectory of a project.

IAD as an ISDM - success and/or failure?

Application of an ISDM is clearly tempered by the nature of the organization in which it is applied. In the case analysis described above it was the relationship between the development approach and the nature of the organizational structure and culture that proved problematic. An ISDM does not necessarily map directly onto an understanding of the organization, its rationality or the context of its users (Coughlan and Macredie 2002). Literature shows how a host organization can influence the adoption, embedding and institutionalization of new technology (Huang *et al.* 2002).

This was evident in our case both in terms of the bureaucratic nature of the organization concerned and the way in which this shaped the attitudes and behaviour of Business Managers in the project environment. Problems experienced reflect the nature of the traditional hierarchical-driven business policies and procedures governed through line management. Difficulties were clearly experienced with integrated working, and of fostering the collaborative and co-operative working ethos required by this particular ISDM. This confirms previous work on ISDM adoption (Beynon-Davies 2005; Cockburn 2002).

However, there is also some suggestion that the Developers selected the development approach before a realistic understanding of either the organizational culture or the nature of the system being established. Thus, problems emerged with the development approach over time that were not clearly visible in the planning stages. Nevertheless opinions voiced towards end of the research study state that although the journey has been difficult, the application of the ISDM approach was seen as successful, particularly because it enabled the project organization to deal with an evolving and volatile sets of business requirements. Thus we believe that this case demonstrates that a supportive

project culture can evolve in situations where the organizational culture is not immediately conducive (Schwalbe 2006) to such an ISDM approach.

Conclusions

This paper builds upon and extends the work of Beynon-Davies and Williams (2003) on the diffusion of ISDMs between and within organizations. They hold that the diffusion of ISDMs is a key example of knowledge-based diffusion where an ISDM is considered as a de-contextualized knowledge bundle that has to be unbundled and contextualized when adopted. This un-bundling process consists of interplay between the form of the ISDM itself as a 'knowledge bundle', and key facets of the organization such as structure and culture. We have tested the knowledge-based model of diffusion against an empirical case in which a RAD-type ISDM promoted by an outsourcing IT supplier was unbundled and contextualized within the case study scenario. We carry Kishore and McLean's (1998) interpretation of success through to the case study setting in terms of how the success of ISDM adopted was influenced by the situational interplay between development activities specified in the ISDM adopted, and how it affected by the structure and culture of the organizational actors involved.

The evidence from this case confirms the general efficacy of the conceptual framework in the sense that it supplies rich detail as to what 'un-bundling' means in practice. Aspects of the knowledge embedded in the specification of the ISDM IAD proved difficult to employ within the project environment. This aligns to the views of Newell *et al.* (2000) who hold that the unbundling and contextualization of an ISDM in situ may prove problematic. Indeed, adaptation of development practices occurred to respond to the exigencies experienced in the development environment (Button and Sharrock 1993; Mustonen-Ollila *et al.* 2004). Key areas of concern were the difficulties associated with the management of user involvement and decision-making processes necessary for the effective operation of JAD workshops. This also confirms the findings of Jones and King (1998) who found that RAD as an ISDM is problematic for highly centralized and bureaucratic organizations. For this case study the context in which the adoption occurred influenced what, and how the innovation was adopted (Fichman 1992, 1999).

However, the evidence from our case also suggests a number of rich directions for extending the sophistication of the framework to better understand the practical application of ISDMs within organizations. We have used Kishore and McLean's (1998) concepts of the 'success of adoption' and 'success from adoption' of IS innovations. We have utilized their dimensions of 'breadth' of use' amongst the community of potential adopters (diffusion), and 'depth' that represents the level of use of the features and functions as designed representing (infusion). The ISDM innovation described in the case only partly diffused in the early stages of the project amongst project participants. The developers, senior mangers, and to a certain extent business personnel were receptive to adopting the practices of the ISDM. However, in its early stages infusion of some of the features of the ISDM by Business Managers was less than straightforward. Attitudes and behaviours characteristic of the day-to-day practices of the organization initially jarred with those required for effective application of the ISDM. Thus adoption or rejection of technology is subjective and can be influenced by actors and their conflicting ideas or requirements (Beynon-Davies and Williams 2003), as well as the related social system and environment that impact upon the unfolding adoption process (Gharavi et al. 2004; Kishore and McLean 1998).

However, any development project, particularly of the scale of the one described, evolves in terms of its interaction with the holding organization. There is evidence in our case of an evolving rate of diffusion and infusion of aspects of the ISDM which initially proved problematic. As the project matured and development evolved through the subsequent second project environment (year 3 onwards), Business Managers appear to have begun to infuse and accept some of the initial, problematic elements of the ISDM. As Mustonen-Ollila and Lyytinen (2004) suggest implementation challenges can be managed. For instance, as familiarization with the approach developed, interviewees report a greater acceptance of the need for collaboration and effective decision-making. A corollary of this is that there are high expectations of success with the subsequent version 2 of the Project that is continuing to evolve. A senior manager reflects *'I think over the last 12 months it has become more effective but as usual you learn as you are going along'* (Senior Manager 13).

As the IT system itself was developed and delivered in an incremental manner we can also speak of the degree of diffusion and infusion of this artefact. Due to the incremental build involved it is difficult to confirm that the new system has been diffused and infused in its fullest sense. Nevertheless, it is possible to say that those development modules of the Generic Process Model that are implemented across a number, but not all EC schemes are fully utilized within the organization.

We should hence not assume that the diffusion and infusion of an ISDM is a necessarily linear, all-or-nothing process. Indeed, we might infer from the evidence of our case that there are clear benefits to being large in an outsourced development relationship, at least as far a ISDM diffusion is concerned. Within small-scale projects of a few months duration and consisting of small project teams there is little scope for outsourced developers to engage with the organization in the active promotion of the practices of its chosen ISDM. This may partly explain some of the difficulties experienced in RAD or agile practices more generally (Beynon-Davies 1998). However, in a large-scale project environment there is scope for a wider range of stakeholder involvement and greater time for practices to diffuse and infuse within the holding organization.

Limitations

This research pertains to a single case study consequently there is a need for other studies of similar environments to be conducted such that our findings may be confirmed, argued and extended. In particular where we present a theoretical perspective, drawn from a single case study, further real world research is required in order to substantiate and argue the conclusions drawn. Therefore we must recognized that the facts and data presented in this paper only make sense in the context of a particular framework and relate specifically to the research case study (Alvesson and Deetz 2000). Additionally empirical data as such are emergent and 'interactionally' formed, and are thus described as intersubjective. In this way the researchers have been provided with the understanding and skills necessary to conduct the research. This paper is part of a much larger study and thus it is not possible to reproduce the 'reality' and broad analysis but to concentrate on the focus of this paper (Alvesson and Deetz 2000)

It is also recognized there was potential for influence to be imposed over the analysis and presentation of findings. However this has not been the case and the researchers confirm and assure the reader that no influence was exerted over any of, or of input into the analysis and findings presented in this paper. Additionally due to a commercial aspect that is attached to the technical infrastructure and utility of the technology deployed, the researchers were not party to, or had access to any financial or contractual issues of the project.

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