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Issues Impacting on the Project Management of a RAD Development Approach of a Large, Complex Government IT Project

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Abstract

As a systems development approach, RAD has both critics and supporters whose opinions have led to considerable debate about its application for large, complex information systems (IS) development. Literature supports the view that RAD is not suitable for all types of project but that is generally associated with small/medium projects that have low levels of complexity.

Contrary to these published beliefs, a RAD-type approach is being adopted for a large complex IS currently being implemented within UK Regional Government that is being used as a longitudinal case study over 3 years. This provides an interesting and atypical opportunity to analyse the use of RAD within such milieux.

This paper provides an analytical viewpoint of RAD as a development approach within such a large, complex development environment. It examines the project management issues that impact upon, and influence the success of the RAD approach. It concentrates on key RAD concepts relating to the management of primary knowledge holders and decision makers, the influence of major stakeholders, involvement of end-users and communication issues.

Keywords: RAD, Systems Development, Project Management

1. INTRODUCTION

Rapid Application Development (RAD) as a development methodology has its origins based within the commercial arena. As a result individual philosophies and perceptions of its rationale and applicability have led to considerable debate about its appropriateness for large complex Information Systems (IS) development. Even though RAD is becoming an increasingly accepted approach to IS development, much of the existing literature tends to focus on small to medium size projects that does little to clarify the position, and continues to question its suitability across large complex development projects (Beynon-Davies *et al*, 1996, 1998, Boehm 1999, Elliott 1997, Howard 2002, Osborn 1995,)

This research in progress paper provides an analytical viewpoint of a RAD project management approach with respect to identifying the factors influencing success or failure from a development approach viewpoint. It aims to observe the issues that impact on the project management of the RAD development approach within the large complex case study environment. In conclusion it presents some preliminary analysis that enables the researcher to respond to some of the views and opinions expressed in the literature reviewed.

The researcher is conducting an on going interpretive, longitudinal ethnographic case study over 3 years. The case study concerns a large, complex IS development project adopting a RAD-type approach that is currently being implemented within UK Regional Government.

Analysis is drawn from both primary and secondary research practices. Primary research concerns direct non-participatory observation, indirect observation, informal/formal semi-structured interviews, shadowing of key informants, focus group meetings and spontaneous conversations. Secondary research reflects an analysis of published literature from both academic and practitioner perspectives and examination of existing project documents, discourse and artefacts. This is more fully described in section 4.

2. RESEARCH RATIONALE

The nascent status of RAD as a development approach and its commercial emphasis has resulted in individual philosophies and perceptions of its rationale and applicability. Although there is considerable debate about its application for large systems development, existing literature does little to clarify this issue. This can be further demonstrated through the beliefs of Graham (1989), Hirschberg (1998) and Beynon-Davies *et al* (1996, 1999, 2000) who posit that further evaluation of RAD in Information System (IS) development through ethnographic studies is needed to increase existing knowledge.

Although the lack of provenance is reflected by the limited availability of published academic material, there is substantial reporting of its application from the commercial sector. Literature advises that RAD is not suitable for all types of project informing that it is generally associated with small/medium projects that have low levels of complexity, thus raising the scalability of RAD as a key area of discussion. (Osborn 1995, Beynon-Davies 1999, 2000). For example, Beynon-Davies *et al* (1999, 2000) report on 7 small/medium studies of RAD development projects, and Jones and King (1998) on 2 RAD implementations. This can be compared to extensive coverage of RAD's application by practitioners reporting on small/medium commercial projects that are too numerous to detail. Other published work concentrates on discussing RAD's purpose in small/medium environments with little analysis or assessment across larger contexts. For example Eva (2001) looks at RAD techniques and requirements acquisition, whereas Maner (1997), Highsmith (2002) and McConnell (1996) reflect on its' speed and prototyping properties.

However, there is no similar body of literature or knowledge regarding RAD's application across larger and more complex development environments, and particularly there is a lack of reporting of the project management issues that influence its application. Furthermore existing literature exposes particular themes of discussion within the RAD arena and a prominent area of debate concerns project management in terms of people management, cultural and human issues.

3. RAPID APPLICATION DEVELOPMENT

RAD was first formalised by James Martin (1991) and originated during the early 1990s from rapid prototyping approaches. It evolved out of the commercial need for faster systems development than traditional methodologies such as the 'Waterfall Method' could deliver. Consequently RADs development was driven by the IT industry and as such it has had little influence from the academic world.

RAD is an iterative and incremental development approach that compresses the analysis, design, build and test phases of the development project into short, iterative development cycles. It is these cycles that are able to accommodate the growing uncertainty and increasingly volatile nature of current development environments. This approach necessitates the collaboration of small, diverse teams of developers, end-users and other stakeholders working to tight deadlines in an effort to optimise speed, unity of vision and achievement of

the development process. (Martin 1991, Beynon-Davies *et al* 1996, 1999, 2000, Elliott 1997, Tudhope *et al* 2001).

Martin (1991) characterised the main features of RAD as user involvement, prototyping, CASE tools, SWAT teams (skilled with advanced tools), JAD workshops and time-boxing development. Since then RAD's characteristics have been largely described dependent upon its purpose i.e. a development method, project management approach or use of RAD techniques and tools (Beynon-Davies 1998, Boehm 1999, Elliott 1997, Bates 1995).

Early RAD was seen as reactive, fragmented and sometimes considered as hype (DSDM 2001), such that in 1994 the DSDM (Dynamic Systems Development Method) Consortium was formed to develop and promote a public domain method. More recently the DSDM Consortium have established 9 fundamental principles (1994) that they consider to constitute a RAD approach within the public domain (see Table 1.) The aim was to provide a framework that combined the best elements of existing methods with the practical experience of RAD developers.

1 Active user involvement	6 Changes are reversible
2 Teams enabled to make decisions	7 High level requirements (base-lined)
3 Frequent delivery of products	8 Integrated testing during lifecycle
4 Fitness for business purpose	9 Stakeholders collaboration/co-operation
5 Iterative & incremental delivery	

Table 1. DSDM 9 Principles Applied to the Case Study Project

These 9 principles incorporate the essence of the original features and extend to address some of the evolving management, cultural and human issues that impact heavily on systems development environments that inform the debate and these were verified against the case study to certify that a RAD approach was being applied.

However the specific RAD-type development approach described in the context of this case study is Iterative Application Development (IAD), a vendor specific method which is described and justified in the context of the case study (see Section 6).

4. RESEARCH METHODOLOGY

This case study research adopts a qualitative data gathering method using an interpretive stance (Walsham 1997, Gill and Johnson 1991) together with an ethnographic approach. There is no single recognised method of doing qualitative research because it depends on a number of different factors such as the nature and characteristics of the knowledge and how it can be acquired, as well as the purposes and goals of the research involved (Ritchie and Lewis 2004).

The approach chosen is aimed at producing an understanding of both the context of the information system (IS) being developed and the process in which the IS influences and is influenced by its context. By this the researcher refers to a broad view of the organisational environment of the IS and the wider external context within which the IS is related. Its suitability to this research study is reflected in the argument that the social world cannot be understood in terms of simple causal relationships or assumptions of universal laws because experiences are based upon or infused by social meanings and not upon random reflections of individuals (Loftland & Loftland 1984, Strauss 1990, Hammersley and Atkinson 2000). This

enables the researcher to more fully understand the nature of the problem than statistical analysis would allow.

The research strategy adopted not only takes account of these philosophical issues but also the structural issues involved. This refers to the way the research is sensitive to the understandings of the subjects being researched, and also that interpretative consideration is given to the social and organisational contexts in which the actions take place.

There are many instances of this research style being adopted within IS research by authors such as Beynon-Davies (2000), Myers (1999) and Walsham (1997). The intent of interpretative research is not to generalise but to understand the deeper structure of a phenomenon such that it can be used to inform other similar settings. (Orlikowski & Baroudi 1991), In other words, to get an increased understanding of the phenomenon being investigated within its cultural and contextual situations inside their natural setting.

Ethnography was selected as a style of interpretative qualitative research because it promotes the intensive data gathering whose depth allows a broad and rich interpretation to be gathered (Myers 1999). Its suitability is reflected by its association with IS research (Loftland 1984, Strauss and Corbin 1990, Beynon-Davies 1997). Consequently, an on going IS development project is being used as a longitudinal case study approach over 3 years that provides a unique opportunity to investigate the research question within a 'live' project environment. Observer participation is the key characteristic of ethnography, analysing behaviour by observing events as they occur in their natural context. However, due to time constraints and degree of personal involvement required it was not be possible for continuous observations to take place therefore a diversity of primary data collection techniques were undertaken. This included direct non-participatory observation and indirect observation, informal and formal semi-structured interviews, shadowing of key informants, focus group meetings and spontaneous conversations. Secondary research reflects an in-depth analysis of existing literature from both academic and practitioner perspectives to present a foundation to understand the current status of RAD, plus an examination of existing project documents, discourse and artefacts.

Literature recognises that case study utilisation is especially suited to interpretive research of information systems because it encompasses similar qualitative research techniques, consequently it falls comfortably within the proposed ethnographic stance of this research design (Yin 1993, Myers 1997, Orlikowski and Baroudi 1991). Furthermore it also enables a more detailed 'picture' to be developed than would be available through statistical analysis.

Myers (1999) and Yin (2003) stress the importance of storing and organising the volumes of data gathered. Consequently a case study database is being created using a qualitative software product to store and analyse the range of data collected. Initial data analysis is driven by the data rather than the researcher and concerns 'open coding' involving content analysis where data are analysed and categorised into themes that are linked to the research aims and objectives. To uncover the relationships within the categories and establish how they might inter-relate and link into sub-categories, axial coding that reflects the associated dimensions and conditions is planned. Strauss and Corbin (1990) substantiate that in order to comprehend the phenomenon being studied it is important to understand the relationship between structure and process, which they believe are inextricably linked.

Access was established through the Project Board and access granted to the project environment and the project team comprising of a core team of client staff and developers. To avoid potential ethical problems confirmation was sought from the Project Board at the onset that participant confidentiality would be maintained, and that analysis from information gathered would not be used out of context by them.

5. THE CASE STUDY

In 1999 under the UK Government's Devolution legislation a UK Regional Government department took on the devolved functions formally carried out by the Welsh Office. It became responsible for managing the expenditure of EC grants and subsidies to customers through a number of Common Agricultural Policy (CAP) schemes across the region. Head Quarters is centrally located and operations run from a number of Divisional and Area Offices acting as powerhouses of management functions. The customer base consists of farmers, farming businesses, and other citizens.

The case study concerns the development of the new IT system that is aimed at improving the current administration of the EC's Common Agricultural Policy (CAP) grants and subsidies schemes. Improvements were deemed necessary due to a history of late payments, poor customer satisfaction and an increasing inability to meet the EC's changing requirements. The case study project was initially planned for 2 years, March 2001 to March 2003, but is currently in its 3rd year and still on going.

Although development was outsourced to a commercial company the project environment remains within a central location where both clients and developers are co-located on the same site for the duration of the project. Project structure comprises of a Project Board, project manager and teams of integrated project workers that are subject/specialist specific according to need.

The size and complexity of case study project are reflected by an initial cost estimate of £10m; a core project team of 50+; an excess of business rules aligned to business processes (4,000+) and extent of the customer base that is measured in terms of 100,000s of grant and subsidy applications.

Previously, the CAP scheme administration was organised into different departments that dealt with specific schemes individually. These were the responsibility of individual managers and teams attending to their separate business needs and administration. The new system moves away from the former individual scheme administration procedures towards a Generic Process (see Figure 1.) that integrates the core processes of the common activities of the separate schemes.

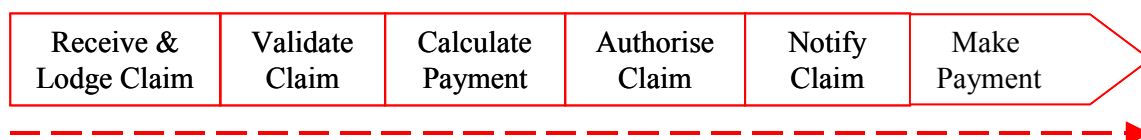


Figure 1. New System Generic Process

However the new Generic Process requires an integrated team approach that necessitates a change in the working patterns and mindsets of the organisational workforce.

Due to the nature of the EU's agricultural policy, schemes are frequently changed with new schemes being drafted as required. Every scheme must conform to the EC legislation and regulatory control mechanisms that apply, however the schemes do not exist independently of each other, but acquiesce to a complex 'network' of interdependent relationships. This means that even a simple change to one scheme will have a knock on consequence across one or more other schemes. Thus the constantly changing EC rules and conditions that are attached to the grants and subsidies introduce an evolving and dynamic nature to the business environment that in turn affects the project development.

6. CASE STUDY DEVELOPMENT APPROACH - RAD

This section describes the case study development method used, the researcher's aim is to emphasise aspects of the development process that are distinctive as far as RAD is concerned not to focus on the product.

The developers adopted their own in-house commercial Iterative Application Development (IAD) approach to promote a controlled, structured but flexible development method aimed at providing incremental delivery that can be aligned to RAD. They believe that this method offers all the main benefits of a RAD type approach and that it is suited to the uncertainty of, and continually changing business requirements. IAD, like RAD, involves prototyping and iterative delivery but without the problems of lack of rigour, creeping feature scope and overrun that are thought to be associated with a RAD approach.

The similarity of the IAD approach to a RAD approach is extended to using the same main features i.e. JAD (Joint Application Design) workshops, time-boxing, prototyping, intensive user involvement, iterative development and incremental delivery, which they maintain are increasingly used for system functionality development. Within the case study context the IAD approach involved the developers and the organisational people working closely in small teams together to develop a joint understanding of business needs and functional requirements through JAD workshops involving key business users to define the new system design.

The project development was broken into development modules that involved process definition that represents the analysis stage, a module specification that represents the design stage and a series of time-boxed mini iterations that involve a number of software build, test, release cycles. These then undergo integration testing, system testing and user acceptance testing (UAT) that provides the flexibility to meet the recognised volatile and changing EC requirements of the business environment. (see Figure 2. below)

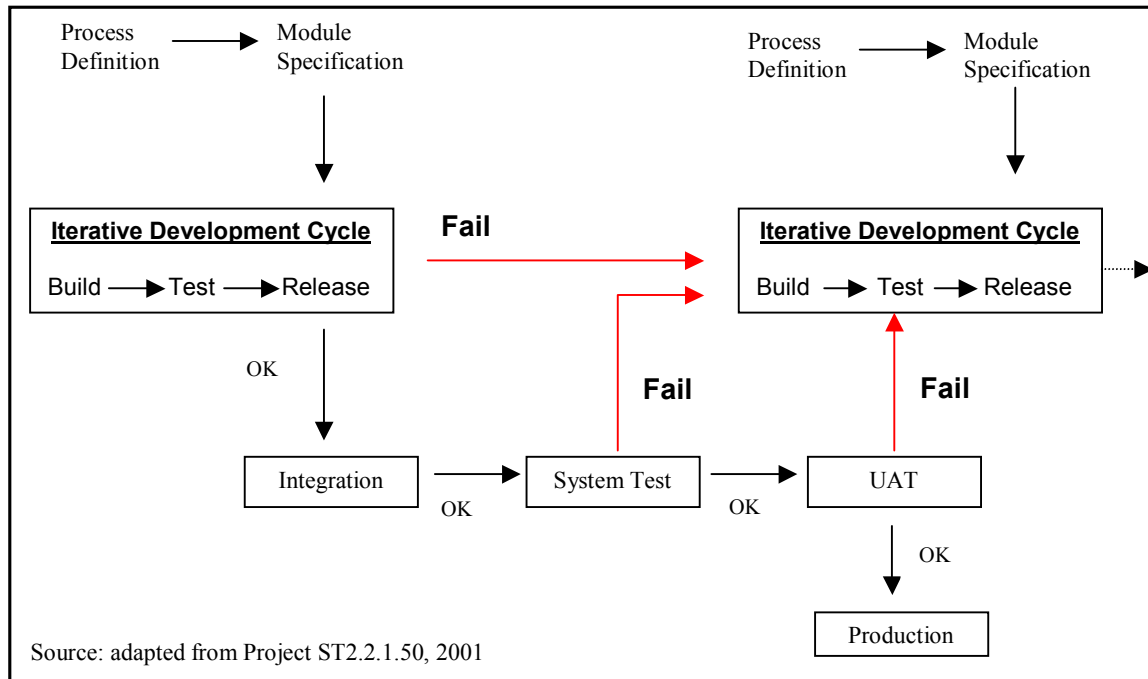


Figure 2. Case Study Project Development Cycle

The developers believe that a major benefit of this iterative approach to development is that it affords early visibility of the system being developed. Thus early validation by the users and the business analysts of the modules being developed provides the flexibility to incorporate user feedback and deal with any new or changing EC requirements – a key goal of the RAD approach

7. PROJECT MANAGEMENT ISSUES AFFECTING THE RAD APPROACH

This section focuses on the analysis of key issues that relate to the management of primary knowledge holders and decision makers, the influence of major stakeholders, involvement of end-users and communication issues.

Although project management is considered weak by project workers because of the perceived mis-management of key decisions makers and missed deadlines, the Project Board believe that it has been strong citing examples of good practice as evidence. Preliminary analysis is drawn from research data concerning these issues as explored through the case study project.

Hirschberg (1998) and McConnell (1996) believe that without radical shifts in organisational attitudes, structures, and peoples' mindsets many RAD projects fail because the change to new methodologies, methods and techniques does not fit within the organisational culture. Moreover, with a RAD approach, it is thought that success is linked to project control through a strong project management approach that incorporates a high level of management commitment, stakeholder collaboration increased involvement of end-users and the ability of the development teams to make fast authoritative decisions (Martin 1991, Osborn 1995, Beynon-Davies 1996, 1998, 2000, Elliott 1997, Cross 1998, Boehm 1999, Highsmith 2000). Thus these issues are particularly relevant within the specific case study, as the new system requires a change in working patterns and attitudes of the organisational workforce.

The analysis of people management, which had a significant impact on project development, is discussed first followed by stakeholder issues, end-users involvement and communication problems that impacted across all areas. For reasons of clarity some overlapping in the analysis of these issues may occur due to the commonality of factors involved.

7.1 *People Management*

In the past the CAP Schemes were dealt with on a scheme basis and were the responsibility of individual Scheme Managers and Process Managers. They attended to the scheme business needs and administration and were deemed to have ownership of the business processes involved. These people were identified as the key knowledge holders and decision makers who held the necessary understanding and detailed business knowledge that was required for the Generic Process of the new system. They are seen as the indirect users of the system compared to the direct end-users who perform the day-to-day scheme activities.

A key concept of the RAD approach is the ability to make fast authoritative decisions without frequent recourse to higher management. Even though key people were empowered to make fast decisive decisions this proved to be a major problem.

Historically the organisational structure was typical of most Government departments and organised into a hierarchical line management structure where people reported directly to line managers working within a perceived 'blame culture' environment. Thus decision-making was deferred up the management line. Evidence of case material exposes the difficulty that managers had in moving away from their previous work culture of deferring decision-making to the highest level. Additionally the members of staff who felt unable to change their mindsets had difficulty 'buying into' the Generic Process concept as they saw it as counter cultural, comparing it to previous work patterns. This can be further illustrated through the inability of managers to prioritise scheme development work, as each manager believed their own priorities were paramount. Although the project consisted of an integrated development environment the managers were still working with mindsets of the former scheme specific management, which meant that in development meetings they were not able to prioritise development work. The lack of visibility and interaction of the project management towards this level of managers meant that there was no-one present with sufficient influence to make a decision and direct development. It is believed that these concerns could have been managed better through the presence of the project manager exerting a stronger influence upon the decision making processes. Additionally a more effective communication to 'educate' organisational people into understanding the benefits and advantages to be gained by the business section would have reduced this risk.

However a related difficulty was getting agreement from the managers about what was core to development and what was secondary. The inability to make empowered decisions about business needs was a key concern for the developers who needed prioritisation of development work to meet time-boxed development deadlines. There is evidence that for some managers cosmetic changes to the system were as important as getting a fundamental aspect of the system working. It is felt that more consensus about the ability to descope development work in order to meet timeboxed deadlines would have resulted in a greater ability to meet development schedules. Considerable delay resulted from the reluctance to make empowered decisions that, it is felt, could have been controlled through a more direct and focused supervision and stronger influence exerted over the key decision makers.

Although project management is considered weak by project workers due to the perceived mis-management of key decisions makers, the Project Board believe that the project management has in fact been strong both from a technical delivery point of view, and from a business point of view and cite examples of good practice as evidence.

A lot of the project management and high level decision-making occurred behind ‘closed doors’ and was not exposed to the wider audience. The researcher feels that this demonstrates a disadvantage of the inherent civil servant culture where people need to be reassured by, not only the actual presence of project management but also its visibility. The researcher equally believes that it is the low visibility of the project management rather the perceived lack of project control that may be the issue but acknowledges that this area needs to be explored and analysed further within the context of the case study.

Evidence was put forward that despite the initial project delays and difficulties as set out above both the development approach and the system are seen as successful because the new system is meeting EC payment deadlines on the first day of schemes opening, this has never occurred before.

7.2 Collaboration of Stakeholders

A tenet of a RAD development approach is the cooperation and collaboration of all stakeholders. Within the context of the case study this was impossible to achieve. A serious constraint on project management was the inflexibility of the EC as a major stakeholder. Linked to this is the concept of ‘fit for purpose’ where development work is descoped to deliver core functionality to meet time boxed deadlines.

Smith and Fingar (2002) state that RAD means ‘fit for purpose’ rather than the former interpretation of traditional methods as ‘zero defects’ at the expense of business need. They believe that systems are no longer built to last, they are built to change, that application development has moved away from ‘starting all over again’ to ‘transforming what already exists’ and developing systems where it is the process that has centre stage not the product. However here, from the point of view of the business people it is the functional processes of the product that are paramount not the development process.

It is responsibility of the Government department involved to administer the EC grant and subsidy scheme payments within the payment periods of each scheme. These payment ‘windows’ are different for each scheme and are completely inflexible. Thus the department is answerable directly to the EC, and any failure to comply with the fixed deadlines, or non-payment of EC monies results in financial penalties imposed by the EC.

This is the major drive behind the business people. It is imperative that they meet the payment deadlines and this contributes significantly to their reluctance to make empowered decisions for the new system. Even though they are empowered to make decisions they do not feel able to 'sign off' development work if it does not completely enable them to meet the requirements of the EC legislation and regulations. Thus conformity to EC legislation and regulations where the 'fit for purpose' requirement reflects almost 100% of business needs means that the descopeing and time boxing elements of a RAD approach are difficult to achieve. They are regarded as external stakeholders, and as such this represents an external issue that severely impacted on project development and was difficult to control through project management.

7.3 User Involvement

A high degree of end user involvement that is sustained throughout the project is a key goal of RAD approach. However this proved problematic as it was also affected by external factors outside the project management control.

An outbreak of the Foot & Mouth Disease affecting the agricultural industry during the first 6 months of the project impeded development work considerably. Key project personnel from both the management level and the user community left the project environment and were re-assigned to deal with it. The crisis became the government's prime objective and both focus and control were shifted away from the project that introduced a level of risk into the project that was outside the control of project management

As a result the unavailability of end-users with detailed user knowledge meant that the users who were involved in the initial JAD workshops were not from the user end of the environment and unable to provide the necessary end-user detail and this resulted in less functionality than the end-users expected. Consequently, the project suffered from the lack of early participation of these knowledge keepers that contributed to project delays and an unrealistically high expectation of the end users of the system. User expectation is linked strongly with communication problems and is discussed in the following section, 7.4 below.

7.4 Communications

A final area of project management for discussion is that of communications. A criticism that is acknowledged by the Project Board is that communications were ineffective and therefore problematic.

Case material analysis reveals that despite a continued drive to communicate by project management to the workforce, the communication approach did not work. Regular reporting through progress reports, highlight reports, newsletters, information emails, workshop presentations and some face-to-face disseminations throughout the project was unproductive. It resulted in a one-way communication channel that did not stimulate any exchange of information. This culture of hierarchical communication is characteristic of project management in large projects, but proves challenging within the small teams that are characteristic of RAD. It only produced limited feedback such that the users had an unrealistically high expectation of the system functionality and therefore had initial difficulty in accepting the evolving system. This suggests that RAD may not work well in bureaucratic cultures that tend to emphasise hierarchical communications.

To resolve this problem a number of end users were brought onsite to make use of a system prototype towards the end of the first year. However the experiences and knowledge of the developing system they disseminated back to their colleagues was unfavourable because their perception of the system was limited. They were not able to transform that knowledge into understanding and this affected their attitudes and acceptance of the system. It is felt that attempts to resolve this issue should have been applied from the beginning of the project and that a more ‘hands-on’ approach would have reduced this risk.

8. SUMMARY

Table 2 below summaries data gathered through interviews à propos the management issues of a RAD approach as discussed above. It concentrates four key RAD factors within the context of the case study project. These are identified as the management of key knowledge holders and decision makers, the influence of major stakeholders, involvement of end-users and communication issues. It shows these issues from the points of view of the Project Board, project workers and developers.

RAD Approach – Project Management Issues			
	Project Board	Project Workers	Outsourced Developers
Key knowledge holders and decision makers	Strong	Weak	Weak
Major Stakeholder Influence	Weak	Weak	Weak
End User Involvement	Strong	Strong	Strong
Communications	Weak	Weak	Weak
Overall Project Management	Strong	Weak	Strong

Table 2. RAD Approach – Project Management Issues

At first glance it appears that the project management has been weak but it does not take account of external factors that impacted upon project management and which it was not possible to control through project management. This relates to areas such as the impact that the Foot and Mouth crisis had on user involvement, and more specifically the EC as an inflexible major stakeholder. RAD needs flexibility in requirements acquisition, the inflexibility of this external domain seems to challenge this need (Jones and King 1998). Additionally the culture of hierarchical communication is also characteristic of project management in large projects, but not in the small teams that are characteristic of RAD.

Another key problem seems to be the insufficient empowerment of the project teams to make fast authoritative decisions. This was problematical due to hierarchical communications inherent within such a governmental environment.

However an overall opinion is that it has been strong, and that it has contributed to the success of the system that is measured in terms of meeting EC payment deadlines for this year on time.

9. CONCLUSION

The case study is significant as it presents an atypical and valuable insight not only into the application of a RAD-type development approach within a large and complex environment, but also of internal and external issues that shape the effectiveness of the project management.

However, within the context of this case study, project management was reactive rather than proactive and only partially effective in managing the cultural and managerial changes necessary for such an approach. The culture of a hierarchical communication structure that is characteristic of project management in large projects, together with the bureaucratic culture that is common within government settings suggests that RAD may not work well in the small teams that are characteristic of such an approach.

Problems experienced reflect the inherent 'civil servant' culture common within government environments. A focus on 'thought leadership' could have motivated and influenced people to move away from their previous working mindsets to the new integrated working culture. The problems were compounded by poor communications that impacted across the whole project. Thus it is necessary to establish an effective collaboration and communication structure to reduce risk factors particularly where the new system brings about a fundamental change in working methods, patterns and attitudes.

However External influences outside the projects control provided further serious constraints on the project management. The inflexibility of a major stakeholder, the EC, whose rigidity necessitated high levels of conformity to business needs impacted severely on development deadlines. Nevertheless within the context of this case study where it is not possible to negotiate with legislation this issue will remain a challenging one.

It is believed that this case study research has provided a useful starting point to critique the utility of using a RAD-type development approach for large complex IS development with particular reference to issues of project management. The researcher expects to continue to clarify this issue further through the ongoing case study research analysis and by presenting further findings through academic paper submission.

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