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Tom Butler

University College Cork, tbutler@afis.ucc.ie

David Sammon

University College Cork, dsammon@afis.ucc.ie

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Life in the Data Warehouse: A Case Study of Second Phase Implementation Problems and Solutions

Tom Butler and David Sammon, Department of Accounting, Finance and Information Systems, University College Cork, Ireland, tbutler@afis.ucc.ie, dsammon@afis.ucc.ie

Abstract

It is clear from the literature that the process of implementing applications around data warehouses is not well understood. One reason for this may be that practitioner and research emphasis has tended to focus on technical issues rather than on identifying the social web of factors that influence the successful implementation of data warehousing applications in organizations. This case study of a data warehouse project that drifted perilously close to failure illustrates the importance of organizational and social factors, such as the existence of end-user computer skills to leverage the data made available to the business users, coupled with a deficiency in end-user experiential knowledge and understanding of business-related data.

Keywords: Case study, IS, user participation, user training.

Introduction

With the proliferation of *ecommerce*, and vast quantities of business-related data currently being captured by organisations, it is certain that data warehousing systems will play a vital role in the success of commercial enterprises in the 21st Century. Data warehousing projects involve significant investments for business enterprises. However, implementing a data warehouse solution is a risky undertaking as failure rates of over 50% are reported (Demarest, 1997). The high number of data warehousing project failures has been attributed to a range of technical, organisational, cultural, non-technical, economic, political, and socio-technical factors (Wells and Thomann, 1995; Kelly, 1997). The dominant focus has, largely, been on technical issues at the expense of social contexts, and has centered on the construction of technical platforms to store data from diverse sources within the organisation (see McFadden and Watson, 1996; Taha *et al.*, 1997). One reason offered for this situation is that data warehousing projects are actually two separate development undertakings. The first is an infrastructure project; while the second concerns the development and implementation of applications to exploit the business value of data stored in the warehouse (Kelly, 1997). Significantly, Devlin (1997) argues that “*more data warehouses fail through a badly planned implementation approach than for architectural reasons.*” This point illustrates that social and institutional factors

predominate in dictating the trajectory of corporate data warehousing system development and implementation.

This paper presents the findings of an interpretive case study of a data warehouse implementation in Ireland’s largest telecommunications operator, *eircom*. The choice of case was purposeful in that while the data warehousing solution implemented by the organisation was an initial success, many of the subsequent applications developed around the warehouse platform were never used to their full extent. As such, they would be considered system failures (Lyytinen and Hirschheim, 1987). While not an interpretive research vehicle, the much-respected Ives, Hamilton and Davis (1980) research framework was employed to inform and provide an analytic structure to the case findings, where appropriate. The framework has been extensively used by IS researchers (Teng and Galetta, 1991) and Visala (1991; pp. 348) argues that “*it is perhaps the most promising and most widely accepted.*” In the context of the present study, the framework was useful in highlighting the environments and processes surrounding the development, implementation, operation and use of *eircom*’s data warehousing solutions. The Ives *et al.* (1980) framework posits two general environments, three IS environments, and three IS processes, as being of relevance to information systems. According to Ives *et al.*, environmental characteristics define the resources and constraints that dictate the scope and form of information systems: the five environments suggested are the *External Environment*, *Organisational Environment*, and the *User Environment*, *IS Development Environment* and the *IS Operation Environment*. Three processes characterize the interactions between information systems and the environments mentioned: these are the *Development Process*, the *Operation Process* and the *Use Process*. In essence, elements of the framework provided a lens with which to view, analyze, and report on the phenomenon of data warehousing in the case. Accordingly, the development and implementation of *eircom*’s data warehouse is conceptualized as being influenced by events in the aforementioned environments. Thus, a complex web of socially constructed conditions and factors are posited to shape the features of the development product and the attitudes of associated end-users (see Kling and Scacchi, 1982; Butler *et al.*, 1999).

The salient finding offered by the present study is that *eircom* did not begin to fully leverage the business potential of its data warehouse or obtain a return on its

investment until the issue of end-user computer literacy and related political factors in the systems use environment and process were resolved. In order to understand fully the complex issues involved, a detailed explication of the case analysis is now undertaken.

The Case: Corporate Data Warehousing in *eircom*

The organisation chosen for study is *eircom*, the Republic of Ireland's largest, telecommunications company (telco). Formally state-owned and trading under the name of Telecom Éireann, it is now a publicly quoted company with three minority shareholders; Telia—a Swedish telco—and KPN—a Dutch telco; and *eircom*'s employee labour unions. *Eircom*'s Corporate Data Warehouse (CDW) has played a central role in informing management decision-making throughout the late 1990s and has contributed to *eircom*'s dominant competitive position in the Irish market. It is significant that the present IT Director played a key role in the introduction of the company's CDW while acting as a senior marketing executive. Despite the initial success of the CDW in justifying its business value, it is only of late that *eircom* has begun to receive a full return on its investment. The following sections outline the reasons for this.

Influences from the External and Organizational Environments

Eircom's Corporate Data Warehouse grew out of a business need to have accurate, timely end-user access to specific information for decision support. According to the warehouse's user project manager, "...under the existing information systems arrangements, defining report requirements and waiting for the existing systems to deliver the information meant that the information was generally out of date by the time it arrived on your desk; such was the delay from the time we asked for it, to the time it was delivered." Hence, the genesis of the CDW project stemmed from the realization that *eircom*'s management information needs were not being supported. In 1991, a strategic planning report drawn up by an independent consulting agency, the INDEX Group, confirmed the requirement for an information 'superstructure' or 'gateway' to be established between the organisation's transaction processing system and organisational DSS. A high-level management decision resulted in the investigation of an IT solution to this problem. Business and IT managers concluded that the establishment of a CDW could be one such solution. Subsequent contact with a number of prospective vendors introduced the business and IT communities to the concept and potential of a corporate data warehouse.

The initial obstacle was cost: for example, in the year of its introduction, the CDW consumed 1/3 of the total IT budget in the organization. Another important factor was the absence of a well-defined business need and

associated benefits to support the business case for such a system. It was also recognized that obstacles of a 'political nature' would have been a considerable impediment to the trajectory of the project without the existence of the project champion. Thus, according to the user project manager "...the most important thing was project sponsorship on the project, if it was left to us middle managers it would not have succeeded in getting approval." Any opposition within the organisation was also mitigated as "political positioning did not impede the projects progress due, chiefly, to the sponsor's role": it was also stated that "while the IT department contributed the necessary technical resources to do the technical research work...[the project] was too big and too expensive to run with for IT without the commitment of a senior end-user." In addition, some business managers were of the opinion that the system not technologically viable, while senior IT managers held that "...putting so much power into the hands of the end-users, as opposed to the traditional approach to systems development" would alter power relationships with respect to the provision of corporate IS. Nevertheless, as the user project manager pointed out, the initial project team had to illustrate, using examples of the type of application that the CDW could enable, the utility and potential of the system in terms of "the pay-back we [in *eircom*] could expect." The original IS development team became very much involved with the user community in order to illustrate the systems potential and the experience of several US and New Zealand telecommunication companies (telcos) in the area of data warehousing was cited in support of the project. The IT director pointed out that the stimulation of "a fear factor in senior management...whereby, it was argued that we couldn't survive in a competitive market without the [CDW]" coupled with the potential of a "data gold-mine" on the customer base, convinced senior management and the company's board of directors to sanction the project.

The marketing function was selected to be the first beneficiary and user of the new warehouse. The rationale behind this choice was indicated by the IT project manager, who stated that "the marketing function was the most developed in terms of IT" and, hence, would provide a fertile source of potential applications for the proposed CDW. Accordingly, the head of strategic marketing acted as project sponsor for the initial implementation and application development stages; this individual later became company secretary, nevertheless, he continued to champion the project. Since its inception, the CDW has had a strong overall project sponsor in place to head the development steering committee; this committee has typically consisted of system co-owners from senior corporate management. Thus, since the original need was defined and implemented as the CDW (in mid-1993), there has been, at least at top management level, a continuous degree of interest and support for the project.

The Effect of Policies in Organizational and User Environments on the Development Process

A 'Sponsorship Model' for application development was adopted in order to provide a mechanism for the managerial levels below top management to become involved with, and participate in, the development of applications to extract data for decision and product support activities. This type of participative structure at managerial level helped developers "*ensure that the users [were] aware of the various development issues involved in application development.*" Accordingly, the IT project manager maintained that "*change management is something the business owner(s) of CDW applications have to be conscious of all the time...they must be aware of what the impact of systems development will be, and they need to address the issues that need to be resolved if the systems are to implemented.*" Business managers were therefore encouraged to sponsor business applications for their area. Nevertheless, while the business community became actively involved, a user representative on the CDW project team claimed that there were flaws in the way the model was applied on the business side. He argued that "*the benefits of the CDW have not been marketed by the business owners to the wider business community.*" This was said to have negatively influenced the attitudes of business end-users toward the applications provided to support them in decision-making. For example, user representatives maintained that "*in quite a number of areas there [were] applications on desks that are not being used.*" One factor at work here was said to be the absence of "*a serious commitment*" at business unit level to training end-users and because "*there [was] little effort, or commitment to keeping skilled, trained people in the relevant areas.*" It is interesting to note that this was considered to be a serious matter within the user constituency; nevertheless, some, but not all, developers seemed unperturbed by the situation and appeared to be more concerned with the technical feasibility of solutions that with factors that would influence their eventual use. Ultimately, user-representatives and developers felt that the on-going success of the CDW would depend on the competencies of business end-users in making appropriate use of the data provided: this was considered to hinge on two factors—(a) user understanding of the data required to inform their business activities and (b) computer skills in personal productivity software that would help users analyze the data. However, in 1996, there was a clear paucity of end-user computer skills in relation to decision support productivity tools and the use of existing data warehouse applications: as one user-representative stated, "*it is incredible what is going on in the [business units]...the end-users are just not computer literate.*" In the opinion of one of the developers, "*there is no sense in supplying huge chunks of data to users who can't*

manipulate it or make sense of it and use it for their benefit." In relation to this last point, the IT project manager stated that "*a good application sponsor guarantees success*" in that he/she should ensure that there is an adequate level of computer literacy/expertise among business end-users. However, this level of computer literacy/competency was slow to emerge within *ircrom*. It required a major reorientation at all levels of management and the labour unions before the full effects of end-user knowledge and IT competencies were realized in order to tap the potential of the warehouse data.

The Influence of the Development and User Environments on the Development Process

While the initial phase of the warehouse was effectively project managed, when senior IT staff moved on project management and direction suffered. In 1995, an experienced developer remarked that "*removing good project management and leadership runs the risk of more failures than would otherwise have occurred...there is no project plan for the next month, this point in time is a particular low*" in the life of the project. The latter comment reflects the then mood among the majority of team members who felt that the absence of formal project management indicated a lack of interest, by senior IS management, in the project. Nevertheless, other developers were of opinion that "*the CDW [was] a mature project and doesn't need as much attention and a hands off attitude...is OK*" All this led to a situation whereby the user-representatives on the team felt marginalised in terms of full participation and input into the project. Hence, 1995/1996 was a significant watershed in the life of the CDW. What had once seemed a promising technology was now beginning to lose both its luster and direction. However, the appointment of a new IT project manager saw a change in emphasis. This individual argued that no matter how skilled developers were in analysis and design techniques, tools etc., "*it is more and more the case that knowledge of the business area is critical...it is not just a matter of finding out what the users want and modeling their requirements, [developers] must know and appreciate what the business issues are and see things from the business point of view; e.g. why things need to be provided in a particular way or time-frame, and the drawbacks of not being able to deliver to the business what is required and when.*" This was an especially important consideration given the then state of end-user knowledge of business-related data. True to his philosophy, over the next year or so this individual managed to inject new vigor into his project team and to the trajectory of the project as a whole.

User participation in the development process

In keeping with the organisation's participative policy toward systems development (see Butler and Fitzgerald, 1998), the CDW project has seen a high degree of end-user participation from its inception to the present stage of its development. Active end-user participation throughout the systems development process was, and still is, perceived as being a critical factor in successful IS development and implementation of applications in *eircom*. In regard to the initial phase of the CDW project, where it was critical that an accurate data model was constructed, one developer commented that *"I didn't have a background in TIS [the user-representatives] were of great help in the modeling process...it was absolutely essential to have users who know what the data meant."* According to several developers, what has underpinned the successful use of user-representatives since then has been the use of *"an iterative development approach with prototyping, this has improved analyst/user communication and analysts' knowledge of the business."*

Enabling End-users Understand the Data Content of the Warehouse

Both developers and user representatives were of the opinion that end-users perceived the CDW as being the source of limitless information on business operations. This had the potential to generate false expectations by users and lead to unrealistic informational demands on the warehouse in terms of user information for decision support. Comments made by one user representative broadly reflect the views of other team members viz. *"there is a lot of confusion out there about what the CDW should do...there are huge gaps in peoples knowledge of the core systems, TIS and TIMS, people don't understand the data, therefore, there isn't much point in throwing applications at them."* According to an analyst on the team, this situation has resulted in *"applications being requested, delivered, and not used"*. One user representative stated that line managers *"called on senior business management to support the development of sub-optimal applications."* Developers and user representatives felt that constructing applications under these circumstances was a waste of their time and effort. Therefore, it could be said that blame for the unsuccessful development of *"sub-optimal"* or *"unused applications"* did not lie with either developer or user representative, rather fault was attributed to end-user ignorance of the business data used for decision making and to the aforementioned problem of computer literacy.

Managing the Use Environment and Transforming the Use Process

Many of the changes in the use environment and process that took place between 1996 and 1999 reflected a change in commitment by management and staff brought about by the IT-enabled transformation of the company (see Butler and Fitzgerald, 1998). For example, the so-called Joint Strategic Consultative Process involved high-level partnership between unions and company management on all matters. This participative forum presided over the IT-enabled company restructuring and downsizing. One of the goals of this strategy was to entice older staff to leave the company. This, it was argued, would allow for the internal promotion and external recruitment of bright, young IT literate staff. Another of the stated aims of this policy was to increase IT competence in all areas the business, particularly in the area of staff computer literacy. This was considered vital in several areas of the company where the absence of a computer literate staff meant the ineffective use of IT and, in particular, of data warehouse applications in the business community. For example, while business functions responsible for technical operations were relatively computer literate, commercial and administrative functions outside of corporate marketing and finance were significantly less so. To help address this situation, the company's in house training centers in Dublin, Cork, and Sligo became involved in a company-wide program to build competencies in personal productivity tools such as Microsoft Excel, Access, and Word. This program began in 1996 and culminated in the delivery of training courses that enabled staff to acquire the European Computer Driving License (ECDL) qualification in computer literacy. It was hoped that the widespread use of tools like Access and Excel would help business users interpret the warehouse data with greater effectiveness. In addition, general warehouse applications developed since 1996 were supported by regionally based, specially trained, IT staff who were seconded to facilitate end-user training in the applications and the data underpinning them. Existing user representatives and IT developers continued to educate business users on the data content and structure of the now expanded, and increasingly complex, data warehouse. Thus, the last three years has seen intense activity around raising awareness among the business community on the importance of developing IT-related competencies and building knowledge of the corporate data resource. The consensus among management and staff at the end of 1999 was that this program has been a success; thus, the business goal of maximizing the return on the warehouse investment has finally been achieved.

Conclusions

Despite the existence of (a) exemplary participative structures and processes that enabled full involvement of end-users; (b) distinctive IT competencies in providing data warehousing solutions; and (c) top management support for the project, many of the data warehouse applications developed in *eircom* were, for all intents and purposes, failures. More surprising is the fact that deficiencies in the business knowledge and end-user computer skills of so-called 'knowledge workers' were responsible for this situation and could, therefore, have threatened the viability of one of *eircom*'s strategic IT investments. Whether or not this state of affairs exists in other knowledge-intensive organisations remains to be seen, but with such high failure rates in warehousing projects, it seems to be a likely contributory cause.

The findings of this case study underline the fact that the successful first-phase implementation of a data warehouse gives no guarantee that users will come to live in and use it happily ever after. Hence a '*Field of Dreams*' approach to data warehouse implementation, which holds that '*if you build it they will come*, just will not work. Not only do IS professionals need a clear business case to justify construction of a data warehouse; they also need to ensure that business managers recognize the importance of buying into the project from the beginning. Practitioners should also take into account the IT-related competencies of end-users, and provide more in the way of training, not only in respect of the data warehouse applications developed, but in the range of computer-based personal productivity tools used to analyze and make sense of the data produced. The findings should also be of especial relevance to researchers and practitioners operating in emergent, fast-growing economies like Ireland's Celtic Tiger where large companies like *eircom* cope with the challenge of informing their business processes through data warehouse applications. In conclusion, this study's use of the Ives *et al.* (1980) research framework to report and analyze the findings presented helps highlight the web of conditions and factors that influence the development, implementation, and use of data warehousing solutions. Hence, it alerts researchers to the potential influence of issues external to the IS development process. Finally, the framework can be used to inform future studies in order to establish a cumulative body of research on the phenomenon.

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