

Facilitating co-evolutionary adaptation through evaluation: the case of an information system project in a public sector organisation

Justin Fidock & Jennie Carroll

Justin Fidock

Justin.fidock@dsto.defence.gov.au

Joint Command Analysis Branch, Command and Control Division, DSTO

Dr Jennie Carroll

jcarroll@staff.dis.unimelb.edu.au

Department of Information Systems, The University of Melbourne

Paper presented at the Australasian Evaluation Society 2004 International Conference, 13-15 October-Adelaide, South Australia www.aes.asn.au

Abstract

Information systems (IS) pervade modern organisations, and often represent a sizeable investment. But despite the pervasiveness and cost, many IS implementation projects experience significant problems. Problems are often generated by the significant complexities and uncertainties surrounding both the technology and the social and organisational context. Evaluation has an important role to play in providing feedback to key stakeholders involved in the implementation of IS projects, however these evaluations can suffer from not taking proper account of the complexities and uncertainties and therefore have limited impact. This paper describes the evaluation of an electronic document management (EDM) system in an Australian public sector organisation from the perspective of co-evolutionary adaptation. Co-evolution is a term that originated in biology and refers to changes among two or more unique but ecologically interdependent species such that the evolutionary development of each species is intertwined. From this perspective, evaluation practitioners are part of an ecosystem that also contains the stakeholders involved in the implementation of the system and the system itself. Evaluation practitioners perform the function of facilitating the evolutionary adaptation of both the stakeholders involved in the implementation of the system and the system itself, but must also be prepared to evolve their evaluation practice. The utility of undertaking an evaluation informed by the idea of co-evolutionary adaptation is explored.

Introduction

IS pervade modern organisations, and often represent a sizeable investment of time, money and human resources. Davidson (2001) estimated that in the year 2000 US \$1 trillion was spent on information technology (IT) worldwide. However, many IT implementation projects experience significant problems. A study by Clegg et al. (1997a), which collated the views of major researchers and consultancies in the United Kingdom, found that 80-90% of IT projects fail to meet their performance objectives. A US study showed that just 28% of IT projects met their objectives (Standish 2001). Australian public sector organisations have also made considerable investments in IT, and have faced similar issues in meeting performance objectives.

Problems are often related to the significant complexities and uncertainties surrounding both the technology and the social and organisational context (Willcocks 1989, Clegg et al. 1997a, Carlopio 2003).

Evaluation has an important role to play in providing feedback to key stakeholders involved in the implementation of IS projects (Davis 1989, Willcocks 1989, Davis 1993). However, the evaluation of IS implementations is often immature and not widely practiced in organisations. Even when evaluations are undertaken, there is little evidence that the outcomes are used to inform future implementation practice. Furthermore, evaluations can suffer from not taking proper account of the complexities and uncertainties of the technology and context and therefore have limited impact (Fidock 2002).

This paper describes the evaluation of an electronic document management (EDM) system in an Australian public sector organisation from the perspective of co-evolutionary adaptation. From this perspective, evaluation serves the function of facilitating the evolutionary adaptation of complex socio-technical systems. The EDM system was selected to meet user requirements for improved information and document management. The EDM system was introduced as a pilot within three sections of the organisation in order to explore its utility prior to rolling it out to the rest of the organisation. The manager of the project established an evaluation framework, in order to provide an assessment of whether or not the EDM system pilot met the requirements identified. Utilising this framework as a starting point, an evaluation was undertaken in collaboration with key IS personnel from each of the three sections.

The paper is structured as follows. First, co-evolutionary adaptation, the philosophy underpinning this evaluation work, is described. Second, the evaluation context is considered. Third, an account of the evaluation experience is provided using concepts from co-evolution. Finally, the utility of undertaking an evaluation informed by these concepts is explored.

Co-evolutionary adaptation

As a philosophy or frame of reference, co-evolutionary adaptation represents a reaction against the “top-down, deterministic, rational and mechanistic world view, which demands concrete evidence before taking action” (Fidock 2002 p.148). Instead, it supports the “bottom-up, non-linear, intuitive, creative, uncertain, and human centric world view” (Ibid.) where actions, both intended and unintended, unfold over time. The term *co-evolution* originated in biology.

“It refers to successive changes among two or more ecologically interdependent but unique species such that their evolutionary trajectories become intertwined over time...The result is an ecosystem of partially interdependent species that adapt together.” (Eisenhardt & Galunic 2000, p.92).

Co-evolution is a term that has been used in domains such as leadership (Avolio et al. 2001), management (Eisenhardt & Galunic 2000), IS development (Remenyi et al. 1997) IT acquisition (Mathieson 2001) and IS evaluation (Fidock 2002) to convey the importance of considering interdependence, system dynamics, and evolutionary change.

The application of co-evolutionary adaptation to evaluation practice is consistent with the view of researchers in the IS domain who argue that the uncertain, dynamic and social nature of IS and the wider organisational context needs to be addressed when undertaking IS evaluation and development projects (Farbey et al. 1993; Orlikowski et al. 1995; Serafeimidis & Smithson 1998). Co-evolutionary adaptation provides a useful metaphor for communicating the importance of these factors and provides a lens through which to view and shape the experience of evaluating the EDM system. The utility of such metaphors is that they can influence people's perceptions of the way the world is, and can lead to new possibilities for action (Lissack, 1999).

The three components of the evaluation context (the EDM system, stakeholders, and evaluators) can be viewed as a co-evolving system that interacts with the organisational environment. Together they can be thought of as an organisational ecosystem.

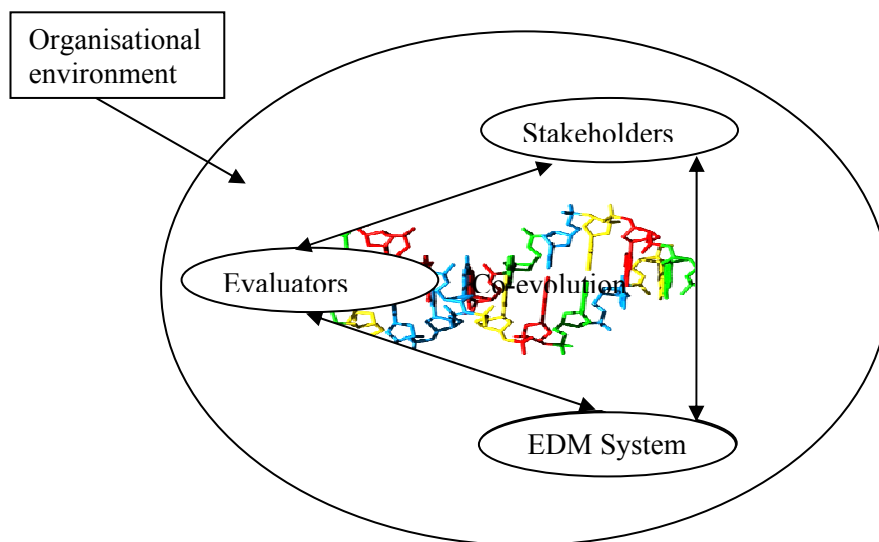


Figure 1 Co-evolutionary adaptation

In figure 1, the three components are like species:

- that evolve over time. For example, the beliefs, attitudes and behaviours of people toward technology are dynamic and changing, as are the processes, practices and structures generated by people to support work.
- whose evolutionary trajectories are intertwined. The nature of the EDM system, in terms of how it is configured and used, co-evolves with the beliefs, attitudes and behaviours of stakeholders toward the EDM system. This idea has parallels with the structuration model of technology (Orlikowski 1992) and the theory of technology appropriation (Carroll et al 2002).
- that are ecologically interdependent but unique species. For example, the EDM system and stakeholders are unique but together combine to create a socio-technical document management system.
- that are embedded within an organisational environment that both enables and constrains the behaviour or evolution of the species, and which provides energy and nourishment to support survival.

The evaluation approach was also informed by ideas from action research (Barton Cunningham 1993). The first author set out to become actively engaged with the organisation in order to generate change, rather than adopting a traditional scientist stance of trying to maintain distance from the object of inquiry. In particular, the goal was to facilitate improvements in the integration of IT in the organisation through engaging members of the organisation in the development and implementation of a change strategy. From a co-evolutionary perspective I set out to become part of the organisational ecosystem, through establishing an interdependent relationship with the stakeholders, other evaluators, and the system.

Evaluation context

The evaluation context was comprised of three components: the EDM system, stakeholders, and evaluators, which were situated within a particular organisational environment. The EDM system was introduced as a pilot within three sections of the organisation in order to explore its utility prior to rolling it out to the rest of the organisation.

Organisational environment

Every employee in the organisation has a personal computer connected to a wide area network and loaded with a standard suite of applications including Microsoft Office, Internet Explorer, electronic mail, Lotus Notes databases and a range of other applications. The majority of the employees contribute in a variety of ways to the creation, modification, distribution and storage of documents. Common document types include e-mails, reports, faxes, minutes, and web pages.

EDM system

EDM systems are designed to support the entire document life cycle of both electronic and physical documents. The lifecycle starts with the creation of a document and ends with its disposal. Intervening steps in the lifecycle include drafting, registration, document tracking, workflow management, version control and distribution control.

The EDM system provided functionality to facilitate: the management of correspondence (e-mails, faxes, and minutes); the scanning and management of paper documents; collaborative document development and version control; electronic document sharing; file management; and web authoring and publishing.

Document management represents a core part of the business of the organisation. The introduction of a system to improve document management therefore introduced the potential for significant efficiency gains, but also introduced a significant risk related to moving from the old business practices to the new.

Stakeholders

Three key stakeholder groups in this evaluation were: members of the organisation who contributed to the creation, management and distribution of documents; the EDM

project staff, who were responsible for the implementation of the system; and the organisation's IS support personnel, who were responsible for managing the organisation's IS and information infrastructure.

Evaluators

The manager of the EDM project developed an initial evaluation framework, which included a range of questions designed to determine whether or not the EDM pilot provided the various capabilities identified in the user requirements document. This framework was distributed to key individuals in the organisation at each of the three pilot sites. Each of the key people was requested to provide their views (not necessarily system users' views) on whether or not the EDMS pilot provided the various capabilities identified in the requirements document. At the time of the evaluation framework being received, the system had been in use for a couple of months. The project manager then planned to consolidate the inputs before presenting the results of the evaluation to management.

Shortly after the evaluation framework was distributed, I became aware of the EDM project. I had undertaken a number of IS evaluations in the organisation. The site evaluators were happy for me to provide support designed to facilitate improvements in the organisational development, project, and change management practices associated with IT integration in the organisation. My approach was informed by action research and ideas from co-evolution (Fidock 2002), with the second author providing research guidance and support in undertaking the project.

The evaluation experience

Establishing interdependence

The initial aim of the evaluation of the EDM system, from the viewpoint of the manager of the EDM project, the site evaluators, and stakeholders, was to provide a mechanism for assessing whether or not the system met the requirements. However, the perception of most of these people was that the system was fit for purpose and would be rolled out further into the rest of the organisation. The evaluation was not expected to highlight issues that would compromise further rollout. From a co-evolutionary perspective, the EDM system was viewed as a mechanism for improving the health of the organisational ecosystem in terms of information and document management.

I met with the site evaluators, and explained that my goal was to facilitate the integration of the EDM system into the organisation through modifications to the EDM system and associated business practices; and to influence and improve the organisation's technology implementation process in order to reduce the risks associated with future IT integration efforts. I had expected my contribution to be mainly focused on facilitating technology integration, but instead it was agreed that I would assist in evaluating whether or not the system had met requirements. At that time, the evaluation had not progressed very far, with only one of the sites collecting some information via a short email questionnaire. As the site evaluators had limited experience in conducting evaluations, my expertise in evaluating IS would assist in making the evaluation more comprehensive and independent.

After these discussions an evaluation group was formed that include the site evaluators and myself. An evaluation methodology workshop was held to review the evaluation framework (the focus of the framework was to assess whether the requirements had been met). The criteria were expanded, based on prior work on evaluation of IS (Fidock 2003), to include attitudes, usability, usefulness, business impact and so on. The evaluation methodology that was agreed upon, resulted from the co-evolution of my beliefs and the beliefs of the site evaluators about what should be included in terms of questions and method, and who should be invited to participate. The involvement of the site evaluators helped me to establish a niche in the organisational ecosystem, which made it much easier to obtain relevant background information, gain access to suitable participants, share the data collection load, and establish links with stakeholders..

Next, meetings with the EDM project team and the organisation's IS support personnel were held. The meetings were designed to elicit their views on the feasibility and scope of the evaluation, to explore how their needs might be met by the evaluation, and provide an opportunity for them to influence and contribute to the evaluation process. These meetings were critical in establishing interdependence between myself and the EDM project manager, so that he felt his needs in relation to the evaluation framework were being met, and he had awareness of the proposed evaluation methodology. The meetings also helped to establish interdependence between the evaluation group and the IS support personnel. The creation of interdependence with the project manager and the IS support personnel was designed to increase the likelihood of evolution occurring in response to issues raised in the evaluation.

Evaluation methodology

The data for this evaluation was primarily collected by means of a questionnaire and interviews with personnel from across the three sites. The evaluation methodology had two aims:

- to assess whether the user requirements had been met, and
- to examine the users' perceptions of the system.

The questionnaire covered many of the questions raised in the original evaluation framework, but in addition further questions were included to address user attitudes to computers in general, system usability, system usage, demands placed on users by the system, perceived system usefulness, expectations about the future impact of the system on the organisation, and competence (Davis 1989, Davis 1993, Clegg et al. 1997b, Igbaria et al. 1997). The questionnaire included a number of rating scale questions and space for written comments. A total of 55 responses were received. In addition, a separate questionnaire was distributed by one of the site evaluators to users at his site, with 33 people responding. This questionnaire provided information on the utilisation of specific system features, and whether or not the system had improved aspects of document and information management.

A total of 30 interviews were conducted with 27 personnel from the three sites. The interviews were conducted primarily by using the repertory grid technique. This technique was used because it enabled an unstructured comparison of the 'previous

IM [Information Management] practices', 'IM using the EDM system' and 'Ideal IM practices', as perceived by the interviewees. This technique is designed to minimise the influence of researchers when eliciting people's views (Grey & Creed, 1993; Whyte & Bytheway, 1996; Stewart, 1997). This approach yielded a wide variety of views that helped to answer many of the questions in the original evaluation framework, but in addition, many other issues outside of the scope of this framework were raised.

The evaluation methodology that was employed did not match the original beliefs or expectations of the project manager, the site evaluators, stakeholders or myself of what would occur. I started with the belief that I probably would not be involved in evaluating whether or not the system had met requirements. The project manager started with the belief that his evaluation framework would simply be filled out by the site evaluators and returned to him for consolidation. And the site evaluators, started with the belief that they would have to complete the evaluation themselves. Our beliefs therefore co-evolved over time.

Findings

The findings of the evaluation were unclear as can be expected from such a complex context. The findings indicated that:

- some of the functionality provided by the EDM system was viewed favourably by evaluation participants, and met the requirements,
- other features relating to system maturity fell short of the requirements.

The results therefore did not provide a neat go/no-go or yes/no against the requirements. In particular, the results highlighted issues that potentially compromised the likelihood of further rollout, which was counter to the expectations of many people. Peoples' beliefs of what the evaluation would provide therefore evolved in response to the evaluation results, and through participation in the evaluation process.

The evaluation findings, which captured people's beliefs and attitudes toward the EDM system, had an interesting impact on the extant decision making process. Discussion of some of the preliminary findings with members of the project team indicated that the decision making process was designed to determine the success or otherwise of the pilot, based on the evaluation findings, but was not geared toward determining future actions. These discussions ultimately led to the establishment of a decision making body that was set up to explicitly decide what to do next in relation to the EDM system. The decision making process therefore evolved in response to the evaluation findings.

Discussion

The initial purpose of the evaluation was to check if the EDM system met the requirements. The purpose and judgement criteria were believed to be fixed. However, co-evolution of the purpose and criteria of the evaluation occurred.

- First, the scope or purpose of the evaluation for the stakeholders and evaluators evolved through participation in the evaluation process.
- Second, the requirements changed as users tried the technology and built understanding of the technology. Peoples' beliefs about what they needed

from the system coevolved with how the technology was configured and manifested through use. Through capturing these beliefs, the evaluation therefore served the purpose of eliciting new requirements and modifying existing requirements. It also provided a vehicle for facilitating organisational learning, or adaptation, around the use of IT to support work.

- Third, some of the criteria for judging the success of the system emerged over time as a result of interactions between components of the organisational ecosystem. Therefore, flexibility was needed in deciding what criteria to include.
- Fourth, new requirements emerged as a consequence of engaging people in reflecting on the system and its stated purpose.
- Fifth, the organisational ecosystem was composed of a variety of components that could be viewed as ecologically interdependent but unique species. This uniqueness was manifested in the variety of viewpoints held by people about the impact of the system, their requirements for a system to support EDM, the priorities they placed on different requirements, and whether or not the requirements had been met. It was therefore important to ensure inputs were obtained from multiple stakeholders about the evaluation scope and criteria, rather than privileging one particular stakeholder group or person's beliefs.

Conclusion

This study raised some interesting questions about how evaluators engage organisations. Do we just provide a response against the user requirements? Should we seek to broaden the scope of evaluations to consider issues that we believe, from our experiences, are important indicators of system success? Should we seek to influence the decision making process? Do we attempt to maintain independence or interdependence? In this study the metaphor of co-evolutionary adaptation provided a way of addressing these questions. It provided a useful lens through which to view and shape evaluation practice. The metaphor provided an effective way of taking account of the dynamic, complex, uncertain and social nature of an IS project in a public sector organisation.

References

- Avolio, B, Kahai, S & Dodge, G 2001, "E-leadership: implications for theory, research, and practice", *Leadership quarterly*, vol. 1, no.4, pp.615-668.
- Barton Cunningham, J 1993, "Action research and organizational development", Praeger.
- Carlopio, J 2003, "Changing gears: the strategic implementation of technology", Palgrave MacMillan, Great Britain.
- Carroll, J, Howard, S, Vetere, F, Peck, J & Murphy, J 2002, "Just what do the youth of today want? Technology appropriation by young people", *Proceedings of the 35th Hawaii International Conference on Systems Sciences*, pp.1-9.
- Clegg, C, Axtell, C, Damodaran, L, Farbey, B, Hull, R, Lloyd-Jones, R, Nicholls, J, Sell, R & Tomlinson, C 1997a, "Information technology: a study of performance and the role of human and organizational factors", *Ergonomics*, vol. 40, no.9, pp.851-871.

- Clegg, C, Carey, N, Dean, G, Hornby, P & Bolden, R 1997b, "Users' reactions to information technology: some multivariate models and their implications", *Journal of Information Technology*, vol.12, pp.15-32.
- Davis, F 1989, "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, vol.13, no.3, pp.319-339.
- Davis, F 1993, "User acceptance of information technology: system characteristics, user perceptions and behavioral impacts", *International Journal of Man-Machine Studies*, vol.38, pp.475-487.
- Davidson, J 2001, "Surviving the tech stock debacle", *The Australian Financial Review - Weekend*, 6-7 January, pp. 22-23.
- Eisenhardt, K & Galunic, D 2000, "Coevolving: at last, a way to make synergies work", *Harvard Business Review*, January-February, pp.91-101.
- Farbey, B, Land, F & Targett, D 1993, *How to assess your IT investment: A study of methods and practice*, Butterworth-Heinemann.
- Fidock, J 2002, "From evaluation to action: supporting the co-evolution of business practices and IT in the government sector", Paper presented at the 9th European Conference on the Evaluation of IT: Paris, pp.145-153.
- Fidock, J 2003, *Factors influencing user acceptance of a mature and embedded computer system*, School of Psychology, University of South Australia, unpublished Masters thesis.
- Grey, E & Creed, D 1993, "Knowledge elicitation for the design of complex human-computer systems", *OZCHI 93 Proceedings: Interfaces working for people*, 211-223
- Igbaria, M, Zinatelli, N, Cragg, P & Cavaye, A 1997, "Personal computing acceptance factors in small firms: a structural equation model", *MIS Quarterly*, vol.21, no.3, 279-305.
- Lissack, M 1999, "Complexity: the science, its vocabulary, and its relation to organizations", *Emergence*, vol. 1, no. 1, pp.110-126.
- Mathieson, G 2001, "Co-evolutionary acquisition", Plenary presentation given at the 18th international symposium on military operations research (ISMOR), Oxford.
- Orlikowski, W 1992, "The duality of technology: rethinking the concept of technology in organizations", *Organization Science*, vol.3, no. 3, pp.398-427.
- Orlikowski, W, Yates, J, Okamura, K & Fujimoto, M 1995, "Shaping electronic communication: the metastructuring of technology in the context of use", *Organization science*, vol. 6, no.4, pp.423-444.
- Remenyi, D, Sherwood-Smith, M & White, T 1997, *Achieving maximum value from information systems: a process approach*, John Wiley & Sons: Chichester.
- Serafeimidis, V & Smithson, S 1998, "Rethinking the approaches to information systems investment evaluation", Department of information systems working paper series no. 65, London school of economics and political science.
- The Standish Group 2001, *CHAOS 2001: A Recipe for Success*.
- Stewart, V 1997, *Business Applications of Repertory Grid*, Enquire Within Developments Limited, <http://www.EnquireWithin.co.nz>, accessed 28 July 2004.

Whyte, G & Bytheway, A 1996, "Factors affecting information systems' success, International Journal of Service Industry Management, vol.7, no.1, pp.74-93

Willcocks, L 1989, "Information technology in public sector settings: towards effective systems", International Journal of Public Sector Management, vol.2, no.3, pp.15-29.