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Abstract

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Managing collaboration across boundaries in health information technology projects

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Abstract. One reason that it is so difficult to build electronic systems for collecting and sharing health information is that their design and implementation requires clear goals and a great deal of collaboration among people from diverse social and occupational worlds. This paper uses empirical examples from two Australian health informatics projects to illustrate the importance of boundary objects and boundary spanning activities in facilitating the high degree of collaboration required for the design and implementation of workable systems.

Keywords: Boundary objects, boundary spanning, project management

1. Introduction

The design and implementation of electronic systems for collecting and sharing health information requires effective communication and collaboration across occupational and social boundaries. While technical know-how is important so too are the 'softer' organisational skills of project managers who need to ensure the *integration* of knowledge from diverse specialisations while also *satisfying* the demands and preferences of system sponsors and users. The difficulties associated with this task are formidable and an inability to reconcile divergent perspectives has been cited as a major source of project failure [1,2]. Using historical data from two attempts, one regional and one national, to build electronic health information systems in Australia we show how progress is influenced by (1) the nature and utility of the objects that participants use to co-ordinate knowledge and action across occupational boundaries ('boundary objects') and (2) the resources devoted to and effectiveness of boundary spanning activities. Health ICT project managers, especially those developing national systems, would benefit from paying more attention to these aspects of their work.

2. Background and Literature Review

The concept of boundary objects was developed by sociologists Star and Griesemer in the United States in the late 1980s during their research into the establishment and management of a museum of vertebrate zoology in California [3]. While investigating

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how diverse individuals (scientists, administrators, amateur trappers, sponsors) were able to collaborate despite very different backgrounds and interests Star and Griesemer identified a number of what they called 'boundary objects' – standardised forms and procedures, maps and contracts – around which the stakeholders were able to organise their activities. In the authors' classic definition boundary objects facilitate collaboration because they are '*plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites'*. They are '*weakly structured in common use and become strongly structured in individual site use*' [3, p. 393]. Among the four types of boundary objects they identified were '*ideal types*' – diagrams and models that are abstract and decontextualised but comprehensible enough to act as '"good enough" road map[s] for all parties', and '*repositories*' – 'objects which are indexed in a standardised fashion [so that] people from different worlds can use or borrow from the "pile" for their own purposes without having directly to negotiate differences in purpose' [3, p. 410]. Applying these ideas to health informatics we can view software architectures as 'ideal types' that can accommodate the routines, needs and preferences of diverse groups, thereby facilitating design, while an electronic health record is a 'repository' useful for coordinating care across different specialisations.

The concept of boundary objects has proved very fruitful for exploring the conditions, artifacts and processes that facilitate successful collaboration and the pitfalls that prevent it from occurring. Despite its utility and widespread adoption across many fields of research, including studies of their roles in technological innovation, there are relatively few that investigate how boundary objects are created and used in healthcare and health informatics. Existing work includes Allen's research on the ways in which care pathways in the UK function as boundary objects aligning the interests and activities of clinicians, managers and service users [4]. In health informatics, a study by Bjørn et al. of the introduction of standardised software into adult and pediatric emergency departments traces how some of its elements were transferable and useful across boundaries while others had to be reconfigured in-house to accommodate the contextual contingencies of work in different hospitals [5].

Given the limited research so far there is scope for more extensive investigations of the types of boundary objects and processes that have been developed and used in health ICT and the outcomes they have generated. To this end we draw on research in the broader field of technological innovation that seeks to identify why some projects succeed while others fail. In this context it is important to note that not everything that sits at the intersection of social or occupational groups, or that crosses boundaries, becomes a fully-fledged boundary object [6-8]. Levina and Vaast [8], who based their work on empirical studies of information systems development in an insurance firm and an internet consulting company, make a distinction between 'designated' boundary objects and 'boundary objects-in-use'. Especially during innovation, objects designated or *intended* to facilitate mutual understanding and collaboration may remain obscure, irrelevant or problematic to those whose engagement is sought by project sponsors. Levina and Vaast also found that individuals who act as boundary spanners are crucial for innovation. Again, they distinguish between 'designated' boundary spanners and 'boundary spanners-in-practice'. The latter are able to develop and facilitate 'joint fields of practice' in which, through sustained and productive interaction, interested parties can identify and amend problematic aspects of boundary objects making them mutually comprehensible and beneficial.

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J. Maeder and F. J. Martin-Sanchez, (Eds)
IOS Press, 2012.
pp. 58- 63

Paul Carlile [9,10] added further nuances to the study of boundaries during innovation. Based on ethnographic studies of new product development in the automotive industry, he argued that it is important to pay attention to the relative complexity of the boundaries involved. Three properties that influence complexity are: (1) differences in the degree or types of knowledge across boundaries (e.g. novices and experts, different specialisms); (2) the degree to which groups depend on each other and (3) the novelty of the innovation. Less complex boundaries (similar levels and types of knowledge, independent groups, low novelty) may be spanned by simple transfers of knowledge but more complex boundaries (diverse specialties that depend on each others' expertise, novel technologies) require 'significant practical and political effort' to work across. Trial-and-error problem solving, perhaps using models, pilots or prototypes, will be required.

Drawing on this literature we can conceptualise health informatics projects as particularly challenging, requiring skilled boundary work across diverse specialisations as well as different degrees of information systems knowledge. Success will most likely require several sequential boundary objects and the development of joint fields of practice as projects move from planning to design and implementation. We illustrate and explore these issues below using empirical examples.

3. Method and sources of data

This paper is part of a larger study comparing several attempts to build systems for sharing individual health information in Australia and England. The approach is qualitative, retrospective and comparative, with the broad aim of using the case studies to learn from experiences so far – what seems to work and what pitfalls should we try to avoid in the future? This paper draws on two cases – the building of a regional system connecting local hospitals and GPs in NSW and Australia's first attempt to build a national health information network, Health*Connect* (HC). Although the projects are very different in scale comparing them helps to highlight and explore why (so far) it has been easier to build regional systems than national ones [11].

Chronological accounts of both projects were assembled using public documents and interviews with people who were personally involved, either as project managers or as key players with an 'insider' view of management activities. Twelve people were interviewed. Three were involved only with the regional project, three with both the regional project and national efforts and six with HC only. Interviews were semi-structured and open ended with subjects being asked to identify and discuss their most vivid recollections of the projects, what they perceived as working well and why, the major problems and challenges encountered, and how they think the project(s)could have been managed more effectively. Participants in HC were also asked specific questions about the business architectures developed during the course of the project.

Collection and analysis of data were conducted in parallel with the reading of literature on project management and boundary objects with a view to identifying ideas and concepts that help illuminate the processes required to plan and build health information systems. Emerging accounts and interpretations were discussed and tested for plausibility among members of the research team, itself an interdisciplinary joint field of practice. The accounts below are selective in that they focus on the construction and use of objects and processes that were supposed to facilitate collaboration among different specialisations, particularly information technologists and healthcare

Health Informatics: Building a Healthcare Future Through Trusted Information
J. Maeder and F. J. Martin-Sanchez, (Eds)
IOS Press, 2012.
pp. 58- 63

providers. There are many other ways the stories of these projects could be told. The aim of this paper is not to produce a single definitive 'truth' about them but to offer a theoretically and empirically informed account of some aspects of health informatics projects that have hitherto received little attention.

4. GP Gateway

The GP Gateway project was a joint initiative of the Illawarra Area Health Service (IAHS) and the Illawarra Division of General Practice (IDGP). It began in 2000, funded by the (then) Department of Health and Aged Care through a GP National Innovations Programme administered by the Australian Divisions of General Practice. The primary 'deliverable' – and the (potential) boundary object around which the action revolved - was 'an interface based on web-technology that will enable GPs to access hospital information on patients in their care' [12]. The project required collaboration among diverse groups and positions and committees were established to facilitate this – a steering committee comprising IDGP and IAHS managers, a project coordinator, managers from medical records, IT, administration and nursing services, and a separate GP working group to work on design. The latter produced a 'wish list' of desirable information held in hospital databases and provided feedback on web interface and usability issues prior to the system going live. Engagement was sustained with the GP group meeting five times during the first 12 months of the project.

The project coordinator took on a boundary spanning role liaising with stakeholders and facilitating negotiations around the boundary object at the centre of the action. The following example from an interview with this person illustrates the type of work involved. Hospital clinicians were 'extremely hesitant' at first to make their data electronically available to GPs: 'They considered that their information was their own personal notes, that it was their history. It wasn't really made in a way that was suitable for sharing with others'. The project coordinator facilitated a 'professional to professional' process of negotiation: 'it was building up a repertoire between the GPs and the specialist - and eventually it came to an agreement about what sort of information, so it wasn't the whole kit and caboodle, it was selected information and it was contemporaneous'. The final GP Gateway report [12] estimated that about 70% of the work in the project was devoted to this type of work–'managing and coordinating work practice change' and involving GPs and hospital staff in decision-making. The remaining 30% of the work was technical.

By the time funding for the project ceased in August 2001 the GPs had access to about 30% of the data they had initially requested with more made available in following months and years as systems were updated and connected. There were several contingencies that facilitated and impeded progress. First, engagement was enhanced by the fact that GP Gateway built on several earlier local IT projects so productive collaborative relations between the IDGP and IAHS were already in place. Also, unusually for the time people in the Illawarra already had unique medical record numbers due to a fortuitous decision to introduce them in the 1980s. Healthcare providers did not, however, have unique identifiers and some time was spent addressing this issue. The accessibility of information was hampered by legacy systems that were not compatible with the hospital patient administration system through which information was collected and distributed to GPs. Finally, in an illustration of the way broader political contexts can determine the fate of health informatics projects, the

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pp. 58- 63

system as a whole was lost in 2005, a casualty of the merging of area health services in New South Wales that occurred that year.

5. Health*Connect*

Health*Connect* (HC) was of course much larger, more complex and ambitious than GP Gateway, and this paper can only offer a few brief observations on boundary objects and spanning in this project informed by publicly available documents, interviews with managers and participants and the literature cited above. Like GP Gateway, HC required collaboration among diverse groups for success. Project managers established pilot trials that enabled participants to interact around tangible systems much as they did in GP Gateway. On a national level, however, boundary objects were more abstract, consisting of plans and architectures for future systems. We focus on what could have been a significant boundary object guiding HC's development – the business architecture (BA) which went through three iterations between 2002 and 2004.

A technical manager in the HC programme office drafted the first version of the BA (version 0.7) based on a US method for engineering ICT for governments [13]. It was abstract and decontextualised, 'independent of any system or implementation considerations and organisational constraints' [14, p. 53]. Prior to public release it was refined by a working group of 15 people including clinicians, health informaticians, and representatives from industry, consumer groups and related health bureaucracies [14]. This group could have developed an effective joint field of practice, but its engagement with the BA was not sustained. As a group it was not involved in the assessment of feedback from the wider community or the crafting of later iterations.

The initial BA (version 0.7) and iterations 1.0 and 1.9 were circulated to hundreds of individuals and organisations and considerable feedback was received [15, 16]. Much was positive and informed later versions but some stakeholders found it difficult to relate to the BA's abstract nature, raising contextual issues such as impacts on workloads and how to privately register patients in busy practices, precisely those 'organisational constraints' ruled out by the BA method. By the time BA 1.0 was released some frustration was evident. A report summarising feedback noted that 'Significant groups of stakeholders (particularly nurses and allied health workers) feel disengaged from the consultation process and are seeking much greater consideration of their needs and interests' [17, p. 31].

Architectures are of course important for design and provide potential conduits through which the needs and preferences of diverse users can be accommodated. However, while they remain purely abstract their utility as boundary objects is limited. Returning to Star and Griesmer's definition, boundary objects facilitate collaboration when they are 'weakly structured in common use *and become strongly structured in individual site use'* [3, p. 393, emphasis added]. In HC the BA could not become strongly structured through deployments into individual sites because the necessary technical and governance infrastructures were lacking. The BA remained a somewhat distant 'designated' object rather than an 'object-in-use'. If more attention had been paid to supporting and sustaining joint fields of practice around necessary infrastructure, work may have progressed further. The BA working group could have been used more effectively and the repeated rounds of sporadic consultation with stakeholders fell short of the sustained and ongoing engagement required for effective systems development.

Health Informatics: Building a Healthcare Future Through Trusted Information
J. Maeder and F. J. Martin-Sanchez, (Eds)
IOS Press, 2012.
pp. 58- 63

6. Discussion and conclusion

It is becoming evident that large national health informatics projects have a higher failure rate than smaller regional initiatives [11]. Our comparison of GP Gateway and HC suggests some reasons why this is the case. GP Gateway was conducted in relatively autonomous circumstances by people with appropriate skills, good collaborative relationships and opportunities for on-going face-to-face interactions. The boundary object around which the action was organised was tangible and manipulable, and the results of work done on it were readily available for feedback into later iterations. Interconnectivity, identifiers and consent rules were managed locally without the need to mobilise large bureaucracies. Even in this favorable environment considerable boundary spanning work was needed to build a functioning system.

When projects are scaled up to a national level the complexities of managing collaboration across boundaries escalate markedly. Project managers cannot consult individually with stakeholders and rely more heavily on abstract plans and architectures. However, in HC the degree of boundary spanning work required to progress beyond the stage of BA development was seriously underestimated. Operationalisation of the architectures required the creation of additional boundary objects in the form of reliable, standardised but flexible intrastructural components that could be understood, manipulated and customised in the diverse settings they are designed to reach and connect. In a complex environment like healthcare these can only be created through sustained interaction across the boundaries of the diverse organisations involved.

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