Engineer or change manager: dilemmas in the occupational strategy for IT specialists

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Abstract

This paper explores the processes involved in the deployment of technical expertise through a case study of a strategic change programme for a UK bank. It shows how the project emerged in response to past failures in IT decision-making, with the creation of a new Management Services Department combining technical and change management specialists. It explores the relationship between these competing groups, and how they shifted over the life-cycle of the project. A detailed examination is undertaken of the forms of expertise cited by these diverse groups and the networks of organisational contacts involved in carrying out their work. The case reveals some distinctive patterns in terms of the nature and range of skills and networks deployed. These reflect a variety of strategies for the deployment and management of technical expertise. The case study also tells us something about the ways in which groups of IT staff secure their position within the organisational structure (and the internal and external labour market). It highlights, for example, the political and legitimatory processes by which they signal their proximity to those above and below them in the

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hierarchy. Rather than a homogeneous 'software culture', we find a complex fragmented and localised patchwork. This reflects deeper dilemmas in the 'project' of technical expertise: the organisation deploys IT expertise to produce and maintain complex systems, but then faces a problem in controlling the activities of these arcane specialist groups; IT experts face a dilemma between articulating their possession of specialised technical skills or projecting their value to the organisation (in competition with other groups) as a change manager through their combination of technical and business knowledge. This draws attention to some of the problems inherent in establishing a software culture within which the various forms of technical expertise are able to 'mesh' and work effectively together.

Introduction

The bank, the organisation at the centre of our case study, is typical of many large IT users in the finance sector and elsewhere, in having a large and long-established body of in-house expertise responsible for the development of complex software systems: expertise which is housed in its Management Services Division (MSD). The project was unusual insofar as it involved a comprehensive redevelopment of existing software systems to provide an integrated solution to a wide range of information transactions within the bank, particularly in relation to its branch activities. The scale of the project required an elaborate and relatively formalised division of labour in system development. Thus, the study of the staff involved in a single project allows us to build up a detailed picture of the character and orientation of a wide range of expert groups.

We begin by addressing what we mean by 'expertise', followed by brief accounts of both the Management Services Division and the project to provide a context for our analysis of MSD's expert groups. We then consider the detailed division of labour within the project, reviewing the key tasks and skills within its specialist groups, and showing how combinations of expertise varied within and between those groups. Finally, we consider the informational networks which pertained within and between project staff, to illustrate the potential for expert groups to colonise particular frames of reference in pursuit of an optimum 'expert career' strategy.

The Construction of Expertise

Our starting point is that various forms of expertise emerge within the IT-skilled occupations, based on the structural conditions under which that work happens. These conditions include not only the functional problems that systems design addresses, but also their social context. While the latter is shaped by the occupational labour market for IT-skilled workers, our conception of expertise stresses the importance of *local* organisational work structures, knowledges and information networks in understanding how expertise is constituted and managed.

The relationship between IT experts and their host organisation has become of increasing significance as IT systems become more elaborate and take on an increasingly central role in organisational activities. In his authoritative overview of computer systems development, Friedman (1989) suggested that the key bottle-neck in the development of IT applications was no longer the availability of hardware and software but concerned problems of *user relations*. These derive from a lack of understanding by technical specialists of users and their requirements on the one hand, and by users of technical opportunities on the other. Organisations have sought to overcome problems in mutual understanding and communication by various initiatives to break down the traditional barriers between IT and non-IT labour. These include the creation of special groups at the interface between the IT function and the organisation; the creation of individuals with hybrid skills, combining technical and organisational expertise; and diffusing IT skills more widely within the organisation's business divisions. This has implications for the organisation of expert labour; systems analyst and designers are accountable to organisational users as well as their immediate managers in the IT departments -- offsetting tendencies towards direct control and rationalisation of expert labour.

Friedman's analysis thus focuses primarily on the organisational factors shaping the deployment and management of expert labour. However, jobs are rarely simply organisational constructs. The nature of many jobs is heavily shaped by the relative *occupational* power of the worker in the external labour market. To investigate the 'occupational' and 'organisational' components of jobs, we draw upon Winstanley's (1986) useful typology of the power of specialist technical occupations in the internal and external labour markets. As we see in Figure 1, Winstanley distinguishes four main types of technical specialist, in terms of their position in the internal and external labour markets and their relative power in these markets, which is seen as a product of the scarcity and value of the skills they possess. She highlights, on one hand, the differential ability of technical workers to secure their position in the external labour market (ELM) through the possession of *occupationally* validated skills and competencies, and, on the other, the extent to which an internal labour market is developed that protects segments of the technical occupations and encourages a strong *organisational* component to their expertise.

		INTERNAL LABOUR MARKET	
		Undeveloped ILM	Developed ILM
EXTERNAL	positive worker power in ELM	**A. Independent mobile professional**	**B. Company Professional**
LABOUR MARKET	negative worker power in ELM	**C. Insecure Contract Worker**	**D. Dependent Worker (1) Valuable to firm (2) Obsolescent**

Figure 1

This schema is valuable for indicating the diversity of situations in which holders of IT-skilled jobs may find themselves, not only in terms of the level and kind of skills they claim, but also in their ability to translate those skills into particular career opportunities. It thus highlights the very different opportunities and strategies that may be available for members of particular groups to enhance their position in the labour market. For example, it suggests that IT-skilled staff who do not acquire an 'organisational' component to their expertise-base may be vulnerable to the marginalisation of C-type workers, i.e. they may be 'experts' but if their skills are readily available on the ELM they may find themselves peripheral and somewhat dispensable ones. In contrast, those who abandon -- or fail to retain -- an 'occupational' component to their expertise-base may become locked-in to their employer in variations of the D-type model. So long as they continue to be valuable to the firm, their position remains secure. However, their employer's construction of the job may (from the worker's point of view) fatally undermine their status and reputation as distinctly 'expert' staff.

Different strategies are thus available for staff to secure their position within internal and external labour markets. This emphasises that the formation and deployment of expertise is never simply a reflection of management strategy/organisational policies, but also reflects the strategies of individuals, pursuing their interests within or beyond the firm, as they develop their careers. As Heimer (1984) reminds us:

> "No one controls a career as such ... career development depends on a series of factors some of which facilitate individual control and others of which facilitate organisational control ... When we talk about control over a career we are really talking about control over a series of elements that determine whether a person's abilities are developed, whether such development is noted and recorded, and whether the person has access to information about jobs and potential employers have access to information about him or her" (Heimer, 1984).

Heimer offers a useful summary of the key actors in the formation of 'expert' careers:

1. having access to information about *other* relevant jobs. For instance, a job such as software consultancy requires the worker to meet with potential future employers and so is more likely to yield information about employment opportunities elsewhere.
2. being in an organisation which structures jobs into a sequence. The clearer such structuring is, the better, for it allows workers to plan their career in the sense of knowing what experience they lack and need to get, or what activities or skills carry more kudos.
3. occupying jobs which enable them to learn the skills that will lead to promotion. A good 'career' job would be one, which -- even if highly routinised -- is placed in close social proximity to jobs which are more difficult, varied or responsible, and thus the worker has the opportunity to learn new skills on-the-job.
4. being able to negotiate how information about the worker's abilities, training and experience is collected by the organisation and made available to others both upwardly and laterally.

The first two reinforce the importance of the external and internal labour markets to careers, whereas the third and fourth tell us more about the local construction of expertise between management and managed.

Expertise, then, is constructed through the interplay between managerial strategies and occupational structures which, in turn, is enacted through the detailed political economy of expertise within the organisation. Groups attempt to pursue access to resources by means of articulating and legitimating their particular claims to be expert in certain fields, and by negotiating and (sometimes) acknowledging the reciprocal expert claims of other groups. Using this approach, we find that different expert groups are strongly differentiated in terms of how their labour process is organised and controlled; the skills they use; and the way they prioritise and project those skills to others. Thus, in this case study, we are attempting to highlight the structural dynamics which enable different kinds of expertise to be generated and deployed. Our analysis focuses upon three major components in the organisation of expert labour in MSD:

1. how skilled *tasks* are combined -- or segregated -- into distinct jobs through the division of IT labour
2. how those jobs are then linked to each other through more or less formalised *networks* of collaboration and control, through exchange of information with peers and reporting relationships to managers within the bank
3. the *expertise* that these groups articulate, specifically the skills that they claim to deploy in their work. This, in turn, is viewed in terms of their orientation to internal and external labour markets.

These different elements which structure IT-skilled work can be ‘assembled’ in a myriad of ways. The variety of forms we find cannot, however, be reduced to a simple functional account (e.g. mechanistically linking jobs to the expertise claimed by different groups). For instance, when a group is asked to describe its expertise, the skills it chooses to cite may be related to their particular strategies for enhancing their position in the organisation or the labour market, as much as to the tasks it actually does. Some specialist groups may emphasise their possession of organisation-specific skills while others focus on more general technical skills which are primarily valued in terms of the external labour market. Thus, our account demonstrates the interaction between a range of agents and influences in the social construction of the expertise of systems development. For example, we find groups of relatively junior staff who articulate combinations of technical and 'people' skills that give them a similar profile to their senior managers. Elsewhere, we find managers who continue to emphasise their technical skills in a way that partly relates to their responsibilities, but also demonstrates their legitimacy to manage (and remain a member of the tribe of) technical specialists.

Of course, experts’ power to negotiate their expertise is itself crucially shaped by organisational strategies that attempt to reconcile the contradictory requirements of *managing* technical expertise. In particular, managers must seek a balance between generating, intensifying and exploiting the specific competencies of their staff (e.g. particular software design skills, knowledge hardware, knowledge of users’ requirements) and the equally pressing need to *diffuse and re-arrange* the know-how of skilled staff both horizontally (e.g. across teams) and vertically (e.g. between junior and senior staff grades).

Firms do not resolve this tension in a uniform manner. They adopt particular solutions for different parts of the (IT) organisation, and in relation to different elements of the technical system. To manage an elaborate social and technological system, it is broken down into sub-systems in an attempt to place boundaries on the problems that must be resolved by particular groups, and to limit the need for interaction with other groups. In this way, it is possible to segment certain activities or problem areas and thus to standardise (in distinct sub-specialisms) the roles of those responsible for them. We have analysed this process as one of 'black-boxing' different parts of the socio-technical system (Brady et al. 1992). Black-boxing, in this sense, refers to the creation of stabilised sub-specialisms with particular types and combinations of expertise, which may become concretised in departmental domains within the IT department, or in separate ‘pieces’ of the technical infrastructure, or even in particular packages and tools.

However, this segmentation remains partial and is vulnerable to reversal. As problems change, the types and combinations of expertise required for their resolution may change. This shifting background may stimulate the search for new managerial strategies over expert

labour, and new strategies being adopted by expert groups themselves. The outcome is a dynamic stream of shifting knowledges within the IT organisational structure. For IT-skilled staff themselves, the boundaries of their own particular expertise are quite fluid, as they attempt to balance what we call their 'occupational' and 'organisational' knowledges over the course of their careers.

Formation of the Management Services Division

The bank's Management Services Division (MSD) is a fine illustration of the richness and complexity of expert technical labour. MSD was formed when the bank's Board decided to merge the Computer Systems Division (CSD) with the bank's Organisation and Methods (O&M) Department. This move was taken partly in an attempt to resolve the differing views of CSD and O&M about the way forwards for branch automation. The latter had put forward a radical proposal for a customer operated system, whereas (more conventionally) CSD had proposed teller operated terminals. The Board recognised that the two conflicting proposals of CSD and O&M signalled that something was wrong in the way its 'strategic' and 'operational' thinkers were structured into separate divisions. In fact, this was not the first time that this arrangement had been found wanting: several years earlier, the bank had failed to appreciate the strategic significance of ATMs (Scarbrough and Lannon, 1988).

By bringing CSD and O&M together the bank sought to *combine* their respective expertise in systems development and in business analysis. This re-structuring created a powerful alliance and a single centre of IT expertise within the bank which was to become the repository of all strategic and operational thinking about technical change on behalf of the bank.

While MSD was in the process of amalgamation, a working party was established to discuss and resolve what should happen next in relation to customer and/or branch automation. Their deliberations led eventually to the initiation of the CABINET (Customer and Branch Information Network) project. Since the subsequent evolution of CABINET has been so strongly shaped by MSD's emergent ring-master role, it is difficult to discuss one without the other. For clarity, we will first briefly summarise the new structure of MSD, highlighting how its decision-making 'flavour' is more than the sum of its parts. Then, we will describe the project and its evolution.

It is not an easy thing to simply lock two historically distinct parts of an organisation together to work as one. Without the CABINET project acting as the catalyst, we could speculate that the division -- let alone the project -- might have failed to gel. When MSD joined forces, some section divisions could quite easily survive the move without huge functional upheaval. However, the business analysts of O&M and the systems development staff of CSD found themselves involved in a radical re-organisation. These two main groups were united in a

single, large functional division -- Systems Development -- which has two main wings. The biggest is Systems Implementation (SIM) which is centrally concerned with the development of software for new IT systems. Virtually all its staff -- its analysts, programmers and respective managers -- were drawn from CSD. The much smaller wing is Systems Investigation (SIV), which is responsible for initial systems evaluation (based on the traditional accountancy-like criteria of cost-benefit, priority needs, and so on). The SIV staff were drawn mainly from O&M and from a more recent series of promotions of staff from other areas of the bank (e.g. branches, accounting and finance).

Systems Development encapsulates the two historically 'competing' forms of IT expertise within the bank: the technical design and implementation competencies of the SIM developers and the bank-like cost-aware rectitude of the SIV planners. Thus, the first -- and most urgent -- task of the various Chief Managers across Systems Development was to establish some *common* future vision upon which the SIM and SIV wings could meet and strike an alliance. The opportunity for re-designing the technical infrastructure of the branch network provided exactly that 'visionary space'. CABINET could be envisaged according to new rules: MSD did not need to operate within a simple 'technical' paradigm (where 'technical' is defined as the antithesis of being 'business-oriented') nor a simple 'accountancy' paradigm, where the value of IT is measured through cost benefit analysis. Instead, in early MSD discussions about CABINET, we find that strategic awareness of the *market* had been very consciously added to the armoury of Systems Development's amalgamated disciplinary expertise. It is this early 'marketing' line of talk which distinguished both CABINET *and* MSD from any previous precedent in the bank. MSD -- both its SIV and SIM experts -- had found their new joint 'strategic ring master' role, and it was the CABINET project which had given it to them.

Managing CABINET

The goal of CABINET was to convert the branch from a mechanised 'procedures'-dominated office into an automated customer-interactive 'sales' office. It was the largest computer project the bank had ever undertaken, and it became the repository of much of the bank's thinking about future IT strategy and operational improvements. Whereas the bank's existing systems stored data for individual accounts, the project sought to integrate these in a customer-centred database. Branches and HO departments would now have access to all the information relevant to particular customers, via a network linking branch and department systems to the databases held on head-office mainframes. An increasing array of functions would be installed to meet the immediate and strategic needs of the bank, particularly in marketing new services.

A project of this scope and scale raises many difficulties in the management of expertise across a variety of technical and business specialists. Some 30 people were involved in the

original Working Party, chaired by MSD and involving a variety of user departments across the bank. A phased approach was adopted to planning, development and implementation. Three phases were envisaged: Phase 1 involved mounting existing customer databases on the new branch network, and Phase 2 involved the capturing of all micro-fiche and paper-based customer information. Phase 3 addressed the development of new applications.

Problems in managing the project were not slow to surface. It quickly became clear that the difficulties in developing even the basics of the new system had been underestimated. In addition, as the different user departments became more familiar with the project (particularly after the pilot network was installed in branches), users became very enthusiastic in recommending new functions. The project came to be seen by them as a "cure-all". As a result, tighter management of the project was adopted and "ambitions became more realistic". Phase 1 was split into two -- 1A and 1B; the development timetable was lengthened; and the cumbersome Working Party were dispersed into specific sub-committees, leaving only about four to six people making decisions about any one issue.

As the working party dispersed into smaller and more specialist sub-committees, MSD nevertheless retained the function of co-ordinating and controlling the work of each group. At least two MSD managers sat on any given committee (most typically, one of them was a 'bank' manager from SIV, and one a 'technical' manager from SIM) and it was MSD which chaired and minutes meetings. From the outset, MSD had been keen to undertake this role. As one SIM manager remarked:

> "We draw up the minutes, we photocopy the reports, we set the agenda and when you think about it, that gives you a tremendous amount of influence over what happens. It doesn't mean that we ride roughshod over other people, but it does mean that we are able to insist that we get a doable piece of work. It has prevented us all from trying to jump ahead and do something fancy before something else that may be necessary."

The various user representatives on these committees stressed, without exception, that although MSD was indeed 'judge and jury', their soliciting of user input was thorough, consistent and well-organised. But virtually everybody -- including MSD -- was ambivalent about whether the committee mechanism worked as a good decision-making forum. For instance, users remarked that their ability to contribute usefully to the detailed planning on Phase 1A -- a time when very fundamental design decisions were being taken -- was limited by their lack of having anything tangible to respond to. Their silence or uncertainty could be read by the technical designers as agreement, rather than as an understandable 'let's wait and see' tactic. Indeed, it was only after the first CABINET terminals were installed in pilot branches that MSD was deluged with reaction (most of it highly favourable).

For MSD, the working party mechanism was also seen ambivalently. It could "fudge decisions which actually should be made, one way or another". It slowed decision-making down to a crawl, since each sub-committee reported its recommendations back to the Core Committee (again, co-ordinated by MSD) which, in turn, reported to the Policy Group of senior management from each relevant division. In part, the difficulty was that the sub-committees acted as a forum both for representing and incorporating users' views (i.e. a democratic device) and, at the same time, as a means to ensure that the technical staff properly understood the terrain they were building on (i.e. a policing device).

It seems clear, however, that MSD thrived on this ambivalence. In the first place, they alone possessed the expertise to accept or reject a proposal as being technically feasible or not at any given time. In the second place, they were singularly successful in grasping that the working parties were a political tool. It was explicitly understood by MSD managers that the value of encouraging close user involvement is as much to enrol the user's *commitment* to the decisions made, as it is to solicit and incorporate their detailed local knowledge. As one SIV manager put it:

> "If they (the users) haven't been involved in the process, the chances are they will just sit and nit-pick. They'll disagree the whole way. We've got to make sure that we've got them in before we get to the Big Report stage. We need to have commitment. Because without that commitment, it will become (an MSD) project which nobody else actually believes in, or is interested in. It could become 'our fault' if things go wrong. I feel strongly that we need to take them along with us, so that when the crunch moments come and we need support from them, it will be there. Without that support, the whole thing will just flounder along. Part of that process is getting their input to the thing, without letting that necessarily dominate everything. Our responsibility is to keep the thing coherent. To make sure that it's actually implementable."

As we have seen, CABINET was unique amongst MSD projects in that it was initiated without any detailed cost justification. However, cost justification was still an intrinsic part of project management. For example, for proposed maintenance or enhancement work on CABINET, an initial costing estimate was required. In this case, SIV decided on whether the 'maintenance' was really new development work, which properly should belong to a future phase (i.e. be given a lower priority number). And in this way, SIV succeeded in establishing itself as an obligatory point of passage for proposals about technological change within the bank (Law and Canon, 1992).

The fact that many issues only surfaced fully for users *after* Phase 1 was installed, points to why the *implementation* process is such an important period of organisational learning, and of consequent re-negotiation of the 'meaning' of the technical change. The response of MSD to such problems revealed a quite fundamental divergence of concepts of technical expertise between SIV and SIM. Within SIV, such problems were accepted as inevitable in the

context of an innovative project, and they saw part of their expertise as being to create a project environment in which its inherent uncertainties could be managed. One business analyst reflected that

> "If there's no business process there at the moment, then it's not just a matter of going in and analysing what somebody's doing in an office and writing that down in some formal or informal way ... The most problematic areas for us are the areas where we don't do anything at the moment ... because the user doesn't have an existing system ... they haven't got anything to get to grips with. These are the most painful bits of systems analysis ... with the best will in the world, and the best business analysis in the world, what you have come up with is a product which needs to be tuned again and again ... gradually people would get a clearer idea of what was required to be done ... Systems evolve, so the direction you push them in has to be the right evolutionary direction."

In contrast, uncertainty was viewed within SIM as a sign of lack of competence. A member of SIM emphasised that a good systems analyst was

> "... someone who defines the thing properly and gets the specification correct the first time and does not have to make ... lots of changes, someone who actually thinks ahead of anything that is going to impact on it".

These conflicting expertise claims do not, in themselves, mean that members of SIV and SIM must inevitably be at loggerheads: groups can and do acknowledge the expert claims of others. However, there was evidence of tension between the two groups which pointed to the failure of their respective forms of expertise to 'mesh', as the following comment illustrates:

> "... a lot of SIV reports come to us in draft form. Some get hammered because they haven't asked the right questions. They don't know what the right questions are. So ... we're not a fan of SIV, I suppose."

SIV staff members saw it as part of their role to act as a buffer between SIM and users and, if necessary, defend the latter's interests:

> "We are the in-betweenies, we have to fight for the users' requirements against what systems really think is best from a technical viewpoint ... I think some of the [SIM] analysts feel 'why do we need these people, they are superfluous, why can't we just get on with the job'. I disagree with that. If we ever have any difficulties liaising with programming teams ... it would be tenfold if the user had to liaise directly ... We are there to create the interface between the two."

Though this role was contested, SIV had succeeded in establishing themselves as a mediator, controlling the relationship between the business users and the technical specialists in MSD. Critical to this was their ability to negotiate between different groups, to redefine problems and solutions by deploying diverse and changing criteria (e.g. of strategic imperative or of

financial control) in different situations and at different stages of the programme. These acts of translation seem to constitute a classic example of the heterogeneous engineering involved in building socio-technical systems (Bijker and Law 1992). Their SIM counterparts, in contrast, remained rooted in a software engineering culture which sought certainty in system specification -- they after all had to write the software to meet such specification -- and were less prepared to deal with the ambiguities and uncertainties inherent in such a central role as change manager for the organisation.

The Detailed Division of Labour in CABINET

For CABINET to succeed, MSD had to manage a wide array of technical, managerial and business specialisms both within MSD and across the user departments of the bank. The scale and diversity of the project was reflected in the number, type and composition of teams within the project (each of which was geared to address particular technical and/or organisational objectives) and by the complexity of the managerial structures and information networks within and between project teams.

Each of the functional groups pointed to distinctive types and combinations of expertise in the doing project work. Taken in sum, we find both technical knowledge (e.g. of the bank's IT systems, and more generally, of languages, tools and techniques) and organisational and managerial knowledge (e.g. of banking operations within the bank, together with general evaluation, communication and decision-making skills). In addition, we find distinct patterns in the range of people these groups refer to, across different locations in the organisation. We now describe the tasks undertaken by specialist groups, and observe how each group defined its own skills in that context.

We have already seen the main structural outlines of the new MSD. Roughly speaking, SIV receive and prioritise requests from users for facilities, and then produce initial Investigation Reports and, later, Business Specifications. Within SIV, CABINET was the responsibility of one of the four SIV business analysis teams. SIM are the technical designers who specify and build the applications. Within SIM, there were three CABINET programming teams, each with about five staff reporting directly to their Project Managers, and two analysis teams. Each programming team specialised in developing different parts of the software infrastructure, with some occasional over-lapping between them.

SIM: Programmer team 1 -- P9000 development group

This group comprise five programmer/analysts who, together with three staff seconded from Philips, are responsible for the design, coding, testing and maintenance of application programs for the branch P9000 systems. This is the most technically insular of SIM's CABINET teams in that their members are more likely to celebrate their 'purely' technical skills; they tend to be recruited directly from the external labour market *as* (junior)

programmers; since some programmers do not want to become “ghettoised” in this area, and they work very closely with Philips software staff seconded to work on-site in the bank for the critical years of CABINET’s development.

These programmers identify the skills used in their job in technical terms, e.g. being competent in particular languages (Cobol and C), and in using IBM's proprietary IMS system. This group's claim to expertise is not only highly technical, but also relates to the sorts of skills which find direct value on the external IT labour market. Their project manager is exceptional in that he is the only MSD project manager surveyed who does not mention managerial skills in his job, citing instead, technical knowledge of software. The programmers report solely upwards to their project manager and manager, though the P9000 project manager refers to the other SIM CABINET project manager.

SIM: Programmer Team 2 -- Batch Mainframe Processing (BMP) Systems
This group of three programmer/analysts and an analyst use database design techniques to reconfigured the logical relationships of the bank's large and complex batch processing systems -- not least, the branches IBM back office waste system. Their skills are primarily ones which can only be acquired gradually and in-house, since they need extensive knowledge of pre-CABINET branch and head office systems, and of how proposed CABINET developments might affect them. It is striking that these staff do not articulate their expertise in terms of their possession of specific languages and techniques. Instead, they cite knowledge of the project; of the bank's working practices; and of unspecified development methods and tools. They are seen as highly skilled within MSD and perhaps do not need to base their expertise claims upon ‘universal’ IT skills.

Two of the programmer/analysts are concerned with the effect of the project on changes in other systems. Thus, they refer to the other project managers within the project, as well as other SIM analyst/programmers. Their project manager cites his programming competencies; his general knowledge of the project and other bank systems; and administrative and personnel skills. He refers in his work to MSD project managers and their staff outwith, as well as within, the project.

SIM: Programmer Team 3 -- Corporate Database Access (CDA)
This group of five programmer/analysts access information for the CABINET systems from the corporate databases, using a number of different languages and tools. Their senior manager described it as a “hybrid group”, with the lowest level of technical specialism, deploying a wide *range* of technical skills, each to a limited depth.

As the work is concerned with information transfer within and between the bank’s main databases, it involves interacting with many of SIM’s development teams, rather than MSD

or the bank in general. For example, one member (an analyst/programmer) deals extensively with SIM's systems analysts and the P9000 team, and collaboration and co-ordination become especially important in the testing and implementation of changes.

SIM: Systems Analysts

The four systems analysts and their project manager each deal with a separate application area: access control, on-line updating, managerial facilities, plastic card on-line updating, and account/service requests. The group deals with a range of user and MSD departments including Database Administration, systems testing and Network Support. In addition, it is involved in the preparation of training materials and house-style standards manuals.

One systems analyst cites verbal and written communication as the first skill used; knowledge of existing computer systems and business practices; and an ability to think clearly, viewing problems from different perspectives. He refers to numerous other analysts, programmers, project managers and a variety of people in other departments. The project manager's role is to co-ordinate the implementation of Phase 2. She supervises other analysts, attends review and design meetings which involve other departments, and delegates out work to SIM staff.

Technical competence is required in the work of SIM systems analysts. However, it occupies a relatively minor role in the expertise claimed by this group, being overshadowed by their emphasis on communication and planning skills. Unlike the programming teams, these analysts also provide the organisational link between SIM and those other MSD sections responsible for bank training courses; the production of user manuals; the evolution of house-style standards; and so on. So, not only do the SIM systems analysts point to different skills from the SIM programmers we have met, they also refer to a much wider range of people in MSD and the rest of the bank. Their role and expertise claims are similar to the SIV business analysts (see below).

SIM: Computer Systems Assurance Unit (CSAU)

This group comprise a systems analyst, an analyst/programmer and a support analyst, reporting directly to a manager. Its staff are involved in the planning and co-ordination of integrated system testing for Phase 2, and draw heavily on their experience of the bank's systems. In this work they refer to each other and to the project managers of SIM's three CABINET programming teams. CSAU's manager is directly involved in CABINET assurance testing. He reports to his senior manager and interacts chiefly with his own three junior staff.

The systems analyst's role and expertise are very different from the SIM system analysis team described above. He refers primarily to the programming project managers, and

highlights his own technical knowledge. Similarly the CSAU manager emphasises technical expertise in the conduct of his work.

This group differs quite markedly from the SIM groups we have described: middle and senior managers continue to emphasise their technical rather than their managerial skills. In some respects they may represent a narrower form of technical specialisation than some of the SIM programmers, who are ultimately concerned with the development of application software for the purpose of achieving organisational change.

Systems Investigation (SIV)

The SIV team involved in the analysis of proposed Phase 3 CABINET applications comprise four business analysts and a project manager, reporting via a manager to a senior manager. Their role includes investigating business requirements; undertaking cost/benefit analysis of new CABINET facilities; and developing strategy for customer information and marketing. In their work, the SIV business analysts refer to their project manager, their senior manager, to many user managers outwith MSD, and to SIM managers on the CABINET teams.

The SIV business analysts -- perhaps even more than the SIM systems analysts -- refer to a very broad, diverse and loosely structured network of players, largely outside their department. They, and the SIM analysts, identify collaborators only in general terms. This stands in contrast to the network of *specific* contacts identified by the SIM programmers, who interact with particular people in their own and adjacent teams. In addition, while SIM programmers refer to those immediately related to them in the managerial hierarchy (mainly their project managers), the system and business analysts relate to a range of levels in the organisation. The SIV business analysts not only highlight their special access to management, but also claim the same types of expertise as them, e.g. interviewing, analysis, report writing.

The SIV project manager in charge of the Phase 3 Business Requirements Investigation refers to managers in (some) branches and HO departments, and managers and staff in SIV and SIM. The skills deployed are primarily project and personnel management, interviewing, conducting meetings, together with being aware of the bank's business objectives. Thus, the distinction between programmers and business/systems analysts *also* holds true for their project managers. Project managers of programming teams give more weight to their technical than their managerial skills; and their networks are more tightly focused around adjacent staff in the hierarchy.

The Generation of Experts in CABINET Work

The previous section describes how the various groups of specialist CABINET staff deploy distinctive combinations of expertise. Here, we conceptualise those combinations in terms of

workers' 'occupational' orientation to their jobs (i.e. possessing skills which are non-firm-specific, and which are readily tradable on the external labour market) and their 'organisational' orientation (i.e. possessing skills which enhance their immediate value to the firm, in the context of its internal labour market).

As Winstanley's schema suggests, the trick for the most successful members within the IT-skilled occupations is to attempt to optimise their possession of both 'occupational' and 'organisational' bases to their expertise. Let us examine how CABINET programming staff relate their key skills to the jobs they hold, and where, in Winstanley's matrix, our disparate MSD expert groups are located.

We find fairly clear differences between the three groups of SIM programmers. P9000 -- the most technically-oriented and perhaps the most 'ghettoised' group within MSD's internal labour market -- identify their skills as ones which have been obtained externally, and whose expertise claims revolve around this general marketability. In this sense, we might see them as potentially A-type experts, i.e. 'Independent Mobile Professionals' -- whose skills are closely related to programming languages and technologies that are widely available on the external market. In contrast, the BMP group emphasise their experience with the bank's software systems and working practices. Although their managers identify them as having the highest level of programming skill, their claim to expertise is based on an *internal* reputation: it is expertise developed and deployed in terms of the bank's internal labour market, rather than being formalised around externally marketable skills. They would appear to identify themselves as B-type ('Company Professionals') experts.

The third group of programmers -- in CDA -- point to their familiarity with a wide range of languages and tools, without possessing in-depth knowledge of any. Their D-type expert jobs rest on the need to interface between systems, requiring a hybrid -- albeit firm-specific -- combination of technical knowledges. The analyst in CSAU highlights a combination of formal knowledge of software tools and experience of the bank's IT systems -- a B-type classification.

We can categorise the diversity of skills these different groups of SIM programmers presented in terms of whether they are universal or particular (see Figure 2). Universal technical skills tend to take the form of formalised technical knowledges which can be obtained, and their value negotiated, on the external labour market. Particular technical skills tend to be experience-based, and are gained within the organisation through its internal labour market.

		RANGE OF SKILLS	
		Narrow range of skills	Broader range of skills
FORM OF EXPERTISE	Formal knowledge	P9000	
			CDA
			CSAU
	Experience-based	BMP	

Figure 2

The dichotomy between the BMP and the P9000 groups highlights two alternative strategies for the development of claims to be expert. At one extreme, BMP's claim is based on internal reputations of expertise acquired through experience. At the other extreme (P9000), expertise is based upon possession of formal knowledge as an identifiable skill, the value of which can be validated on the external labour market. These are two models of intensive specialisation of skills, one (BMP) oriented towards the organisation's specific technical systems (B-type) and the other oriented towards a particular occupational specialism (A-type) within the 'IT discipline'.[2] In contrast, staff from CDA and CSAU are not seen as having high-level specialist skills, but articulate a wide range of technical competencies, combining both formalised techniques and knowledge of the bank's specific technical practices and systems. They are able to compensate for their lack of specialism by offering a combination of technical skills that match the bank's requirements. Thus, they retain their value to the organisation, and may also keep open their potential to trade on the external labour market, at least within the banking sector of that market.

While the programming staff articulate different types of technical knowledge, the SIM systems analysts and SIV business analysts highlight a range of organisational knowledges: both universal (communication and evaluation) and particular (knowledge of Bank of Scotland's methods of operation, and its principles of systems development). The analysts thus claim not only a much broader range of skills than the programming staff, but also ones that can be more generally applied in the analysis, evaluation and management of (technical) change. These groups thus fall solidly within Winstanley's B-type 'Company Professional'.

Moreover, the type and range of expertise articulated by these groups is very similar to that projected by MSD *managers*. By emphasising this view, the analysts are, it seems, enhancing their position 'ideologically', by stressing their proximity to senior managers; their familiarity with, and involvement in, the bank's strategic concerns; and (as we shall see later)

[2] The comments of the programmers' Senior Manager suggest that within SIM formal and universal technical skills are *less* highly valued, than experience of the bank's particular computer systems. The corollary of this, of course, is that bank staff generally tend to stay within their organisation, and pursue career advancement through its extensive internal labour market.

their close working relationships with senior managers within MSD and elsewhere. At the same time they are also indicating their preparedness and ability to move into more general managerial positions.

Knowledge Networks and Expertise

One way of measuring how existing competencies are intensified and consolidated is to look at the networks that pertain between job-holders. Within CABINET, the patterns of networking are complex and vary between and -- to a lesser extent -- within the main groups. Clear differences can be found in the range of contacts and types of interaction between the business and systems analysts, the programmers, and the technical interface staff.[3]

We have seen that the analysts refer in their work to a wide range of people in MSD and beyond. Their collaborative networks are fluid, loosely specified and proved difficult for them to define. They exercise considerable autonomy in their work, and their jobs are highly individualised. The technical interface staff, by virtue of their jobs, also report an extensive range of contacts with other *technical* staff. Their interactions are in relation to highly specialised functions and their roles are tightly defined. We find differences between these staff and the analysts, in that the latter's dealings with other groups range from peers up to senior managers. In contrast, it is largely the *managers* of the technical interface groups who engage in lateral discussions at the senior management level.

The programmers report very different patterns of networking. Their work is collective, and is quite tightly focused upon a narrow network of people in similar roles. We also find smaller, but notable, differences *between* the three groups of SIM programmers. The highly technically-oriented P9000 group have relatively weak links with the rest of the organisation: most of their interactions are vertical and happen within their own team or with the external supplier, Philips. The BMP and CDA programmers do liaise with people outside their team -- although these interactions tend to be more localised than the technical interface staff. This is particularly the case for the CDA team that, as we saw, has a tightly-specified technical role.

Whether a job-holder's role is highly specialised or not, is not simply a consequence of whether a group interacts with a narrow or broad network of other actors. It also reflects whether the responsibilities the group undertakes are complex and poorly-bounded. In addition, it refers to the *character* of the interactions with others (i.e. the extent to which the knowledge network is specialist or diffuse). These two features are closely related. We can thus differentiate the different groups of MSD staff involved in CABINET along two dimensions (see Figure 3):

[3] In MSD such technical interface staff include those working on the maintenance of software standards, database administration and the provision of hardware, networks and software support.

the *breadth* of the network (between extensive and narrow networks), and
the *nature* of the responsibilities and interactions (between well-specified and poorly bounded)

The analysis jobs -- those at the interface between the technical system and/or bank users -- involve extensive, fluid, diffuse networks, coupled with loosely specified roles. These jobs have a low level of specialisation and can be contrasted with the technical interface staff and the programmers. The technical interface staff enjoy *extensive* specialisation, i.e. they undertake tightly-specified roles, while relating to wide networks of technical specialists. The programmers exemplify *intensive* specialisation, i.e. they undertake a broad range of tasks, and relate to a small range of actors associated with a particular part of the IT system.

	tightly-bounded networks/specialist interactions	diffuse network/less specialist interactions
extensive network	'technical interface staff' *(extensive specialisation)*	Business Analysts
	Systems Analysts	
	CDA programmers	
	BMP programmers	
narrow network	P9000 programmers *(intensive specialisation)*	

Figure 3

We now turn to look at the orientation and expertise claims of MSD managers by noting their network relationships with the groups they manage. Project managers constitute an important intermediary position here. They are recruited from amongst the analysts and programmers they are responsible for. Not surprisingly therefore, they tended to show a similar orientation and skill profile to their respective expert groups. Thus, given the *organisational* knowledge networks of systems and business analysts, the analysts' project managers saw their job as primarily involving managerial and people skills. Programmers' project managers, in contrast, emphasise their technical ability and experience. Indeed, the P9000 project manager does not claim any managerial expertise in his job.

However, it should not be presumed that programming jobs and knowledge networks prevent these staff from acquiring managerial skills. In contrast to the individualised work of the

systems and business analysts, programming is a highly *collective* activity. Within the programming teams, the division of labour between different grades is relatively informal. Staff undertake a mixture of tasks -- those with greater experience tend to be allocated more investigative tasks and take on more project management responsibilities -- in preparation for the promotional shift to project manager. Skills are developed through *experience*, more or less in the 'master-apprentice' style of on-the-job learning. After a relatively brief training period, new staff are introduced to various departments to gain experience. There is a 'buddy system' whereby junior programmers are paired with more experienced staff who have a responsibility for their development over the first 6-12 months. More senior programmers are responsible for allocating work to junior colleagues, and are involved in staff appraisal. As a result, senior programmers will have extensive experience in managing teams of workers. It is significant, though, that the programmers' project managers do not *articulate* their claims to expertise on the basis of these skills. Rather, they legitimate their 'right to manage' in terms of their possession of the same technical skills as their staff. In addition, these managers retain a hands-on involvement in programming as part of their work. In other words, they show that they are still 'part of the tribe' of expert technical specialists.

The managers to whom project managers themselves report in both SIV and SIM see themselves as having a *general* management role, i.e. in resource allocation; in managing and deploying labour; in interfacing with other groups within MSD and the rest of the organisation. The skills these more senior managers report reflect this general role: personnel management; problem solving; communications; planning and scheduling of activities.[4] These managers on the whole seem to be broadly homogeneous. This is not surprising, both because of their generalist role within MSD and also because managers at this level are likely to have worked in various other MSD departments. In contrast, the more senior grades of manager in the technical interface groups emphasise their *direct* involvement in the technical problems of their area. They claim a range of technical skills, and their interactions with others are most frequently reported as being highly specialist in content.

We thus find a dichotomy in managerial knowledge networks between Systems Development (SIM and SIV) in which job-holders in the managerial grades claim and exercise a generalist role, and the technical interface managers, whose networks reflect their specialised functions in maintaining the IT infrastructure. This dichotomy reflects alternative *methods* for deploying expertise, as well as differences between the various cultures of MSD departments: some managerial staff prioritise their technical over their managerial skills as a consequence of the knowledge networks their roles involve them in. As a result, the

[4] Though the senior manager for the SIM teams of programmers and analysts also cites his possession of technical skills, this perhaps reflects a need to demonstrate his competence and 'membership of the club' in his dealings with both SIM/SIV staff and Philips. Though his work no longer involves any direct technical contribution, he still needs to assess the demands coming from his own staff and from Philips, which requires a general knowledge of the area, as well as an ability to appear technically qualified in these dealings.

borderline between specialist roles and general managerial roles takes place at *higher levels* of the grading structure amongst the specialised groups, than it does in the SIV/SIM groups involved in the specification and design of new systems.

These patterns partly reflect MSD's elaborate strategy for technical and management skill development. Promotion through the programming grades is typically vertical, within their specialist departments, enabling MSD to intensify and exploit its programming expertise. Above the level of project manager, promotions more often involved horizontal and diagonal moves between departments. This was geared towards the bank's goal of creating a general cadre of technical management with a broad expertise base and a shared common approach.[5]

Conclusions

In this paper we have examined the formation and deployment of technical expertise in detail in the case of a large scale, organisationally strategic computerisation project. Our analysis has highlighted the political and legitimatory processes by which groups of staff secure their position within the organisational structure -- in particular by articulating claims about the value of their diverse sorts of expertise. Here IT specialists face a dilemma between, on the one hand, signalling their value to organisational users and their proximity to the business users (and senior decision-makers) who comprise their market and, on the other, demonstrating the depth of their arcane technical expertise. The former potentially brings them into sharp conflict with other organisational specialists; the latter represents perhaps a safer strategy for technical specialists, but limits their 'occupational project', and involves choices about which kinds and combinations of expertise are most relevant on internal and external labour markets. These dilemmas may be resolved in quite different ways by particular groups depending upon their organisational location and local culture. The managers of these specialist groups find themselves in an ambiguous position, between signalling their proximity to higher echelons and their membership of the 'tribe'. The relationship between managers and managed involves 'two-way' processes of legitimation and accommodation.

Our study shows that 'technical work' is itself highly differentiated. We find variety both in the range and types of skill covered by this term. This work, on the one hand, ranges from ‘narrow but deep’ to ‘diverse but shallow’ technical competence, and, on the other hand, encompasses 'universal' and 'organisation-specific' technical know-how. We also find that the array of tasks a group engages in may change, and there are many opportunities for staff to *redefine* the way these tasks are parcelled up into jobs, and linked through the broader division of labour.

[5]There was also some indication of an attempt to generalise particular approaches -- with managers from the technical support functions being routed through SIV and SIM which had a stronger orientation towards business goals.

As an outcome of the division of expert labour in MSD, these diverse facets of 'technical work' shape the networks of collaboration and information exchange between expert groups, and govern whether those transactions are loosely or tightly defined. For example, we found programming teams whose jobs (and, by corollary, social networks) involved *intensive* specialisation and, as Friedman predicted, user-relations staff deploying a wider range of technical and organisational skills and a more diverse and less well-prescribed range of contacts. We also found a pattern, which does not seem to have been noted in the literature of *extensive* specialisation amongst technical interface staff, responsible for maintaining a particular aspect of a variety of IT systems. Such staff are likely to be increasingly important in maintaining systems reliability and standards as the IT infrastructure becomes more extensive and complex. It indeed reflects broader strategies for the management of complexity in a highly dynamic and elaborate technical infrastructure through the segmentation of artefacts and the compartmentalisation of the knowledges needed to manipulate them.

Our analysis suggests that two sets of factors may have particular importance in shaping the style of expertise claimed by different specialist groups. On the one hand, there is the interaction between 'organisational' and 'occupational' bases to the experts' understanding of themselves as experts. On the other hand, there is the effect of management control strategies on those particular specialist groups. Taken together, these factors shape the strategies by which experts seek to maximise their claim to expertise in the internal and external labour markets. In the bank, with its strong internal labour market, the *organisational* opportunities for 'creating' experts are exceptionally well developed. However, some job-holders within the CABINET project also possess a particularly strong occupational component to their expertise base resulting from their retention of those technical competencies which can be easily validated on the external labour market, in the course of their necessary interactions with suppliers, coupled with their relative isolation within MSD's internal labour market. Following Winstanley, we have shown how this particular group *can* pursue an A-type 'Independent Mobile Professional' strategy. Meanwhile, a sister programming team within SIM are more likely to be able to consolidate their power as experts by pursuing a D-type 'Valued Dependent Worker' strategy, by capitalising on their *bank-specific technical know-how*. Likewise, we show that intermediate groups of programmers together with the technical interface specialists, come closer to the B-type 'Company Professional' model, as an outcome of how their jobs and social networks are structured. Their value to the bank rests on their local knowledge (of the bank's technological and business context) and their possession of particular *combinations of skills* which match the firms requirements.

However, to understand how these different ‘expert strategies’ operate it is necessary to go beyond a snapshot of labour market power. In this paper, we have addressed how staff acquire new skills and competencies (or consolidate older ones) over time, by means of analysing the career as a powerful, negotiable, organisational resource.

Particular claims to expertise over the course of a career are not shaped by management alone, but are subject to different forms of accommodation between managers and their expert staff. Thus, at one extreme, business and systems analysts announce their proximity to *management* in their skills, working methods, perspectives and organisational networks. At the other, the managers of some of the technical specialist functions emphasise their proximity to *staff*, by highlighting their technical competence even at senior managerial levels. It should not, however, be presumed that analysts necessarily have a privileged position in relation to promotion, though their skill profile perhaps gives them greater room to manoeuvre. Rather, each expert specialism has its own mechanisms for the acquisition of those managerial skills which are most likely to prove legitimate *within* each separate expert culture.

These findings call into question the idea of a 'software culture'. Instead we find a complex set of patterns within MSD in terms of the division of labour and knowledge and in the collaborative networks involved in different kinds of technically-specialised work. These reflect the particular history of the organisation (in its broader technological and labour market setting), and the interactions between managerial strategies and the individual and collective occupational strategies of technical staff themselves. More profoundly they reflect contradictions at the heart of the technology 'project' itself. For example, the resort to technical and other bodies of expertise by organisations to deal with perceived problems and uncertainties inevitably opens up further difficulties for management in maintaining accountability and control over arcane technical fields -- the exercise of scrutiny requires a level of technical competence by management. Conversely, as IT becomes ever-more intimately an 'organisational technology', it leaves technical specialists with a dilemma between the security of presenting themselves as 'technical specialists', and the bigger opportunities and risks of taking on board the broader role as change managers for the organisation.

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