Virtual Teams:
an ethnographic study of
teams in action

by

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Abstract

The impact of automation in the utilities sector, with special reference to field engineers, is presented as a case study. The working practices resulting from the implementation of a sophisticated work scheduling application are presented, and the implications for management and instructors of the move to virtual teams are discussed.

Introduction: Virtual Organizational Models

It is 17 years since Strassman presented his view that "Information technology provides a new means for our society to continue its development towards higher levels of prosperity and wealth," and nearly 15 years since Zuboff published her seminal book on the future of work. It sometimes seems that we are still no nearer to working out how to use our "smart machines" to best advantage.

That attention to human factors is a critical success factor in business is a common view amongst business people and academics alike. However, the move to automation in the workplace challenges that view (see for example Collins 2002b). The flexibility required by modern business can be greatly enhanced if the combination of people and technology is properly balanced, but software programs using intelligent software agents (Collins 2000) [brokers] to replace humans is changing the nature of work in many sectors, and in particular the financial sector. Disintermediation [circumventing the middle-man] is commonplace in e-business. Sophisticated routing programs send data and information according to pre-set rules, and route telephone calls to the person with the appropriate skills to deal with the matter under concern. Self-service models are increasingly used, with customers expected to key in information [for example via a web site] to save internal administrative work. Less human intervention is required, and the impact on supervisory and managerial work has yet to be evaluated. Some will no doubt argue that such statements have been made for decades. The difference is that now software applications are being written to deliberately circumvent human intervention in a very much wider range of jobs, particularly in "non-critical" areas such as back office operations. It is a dynamic scenario, constantly changing as the potential of new technological solutions is discovered.

Design strategies for organisations have been evolving for many years. Ford (1926), Pugh (1989), Handy (1990), Morgan (1986; 1993), Jones (1995), Joynson (1995) Gabriel et al (2000), and many others have contributed to this area of study. With the advent of the Internet, communication between separate members of any organisation has been revolutionised. The potential to link distributed or mobile workforces through communications technologies has led to new ideas on managing the virtual team (for example, Oravec 1996; Lipnack & Stamps 2000; Collins 2002a).

The huge scope of virtual organisations is suggested in Figure 1[1]. Conclusions in a previous paper in NTWE (Hughes et al 2001) suggested the following major problems for virtual teams in retail banking:

- Communication
- Scheduling work
- Managerial problems of monitoring and control
- Managing changes in daily work schedules

This paper addresses "B2W" – the distributed workforce. The study demonstrates the use of highly sophisticated software applications to manage the "problems" raised in Hughes' paper.

Background to the study

The author has been studying the impact of automation on working practices for 15 years. Her initial research was sponsored by Digital Equipment UK Ltd, leading to a PhD thesis focused on the problems of managing the future enterprise. The methodology used was a qualitative approach (Gummesson 1991; Strauss & Corbin 1998), based on action research and ethnographic techniques (Boisot 1994; Brewerton & Millward 2001). Having spent the early part of her career in business, including two years as a facilitator, she is used to carrying out in-depth studies of the internal working of organisations.

There are innate problems in the case study approach:

- It is time-consuming
- Regular visits over a long period of time are essential

[1] B2B – Business to business; B2C – Business to Consumer; B2W – Business to worker, described in early literature as the distributed workforce; P2P – Peer to peer. A 1:1 relationship between the technologies in the inner circle and the outer categories is not implied.

- In a dynamic business world, staff leave, policies change and teams at the core of the study may be made redundant
- Introduction of new business models such as e-business dramatically changes the scenario under study
- Building trust takes time
- Each time new staff join the team new variables are introduced

Salkind (2000), whilst agreeing that "there is simply no way to get a richer account of what is occurring than through a case study", also lists the difficulties:

- "what you see is not always what you get"
- the "reality" recorded is only one reality
- they provide in-depth information but may lack breadth
- the approach does not permit analysis of causal relationships
- generalisations are limited

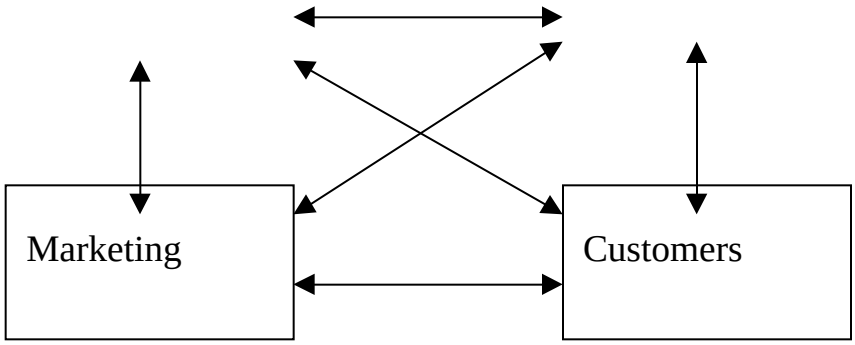
However, business managers appreciate the use of case study material, as it provides material against which to benchmark. In a rapidly changing business world, the value of traditional theoretical models is questionable. The advent of virtual organisations has led to experiments with new forms of working, and until more is understood of the nature of these business models, it is not possible to enhance or revise the theoretical models.

Case Study: BT

Introduction

BT has developed virtual teams as a means to improve customer service and relationships in the provision and repair operations in telecommunications. This virtual team comprises:

- The account/sales team
- The service team
- The engineering/field team
- The marketing team



These teams are geographically distributed and communicate via telephone, email, internal customer service systems, and Internet-based systems via laptops. The account team look after the customers' needs on a strategic basis. The service teams are mainly based in call centres, and need integrated systems so that information is quickly passed on to the appropriate member of staff.

Customers require a seamless operation – whoever they contact, they expect their personal details and case history to be on hand. Too often there are multiple contact points and even the team members can be confused about the correct procedures and responsibilities. To overcome this, a merger of cultures has been a critical success factor. Engineers and sales personnel have totally different perspectives on the problems. The company decided that the engineers, who have most frequent contact with customers, were to become the "face of the company". This need to enhance customer service in the light of increasing competition was the driver behind the technological solutions developed by BT.

Work Manager ™

This section presents a review of:

- the concept of a work allocation system for a distributed [virtual] engineering team. BT has about 20,000 mobile employees who receive work in this way.
- business and cultural factors influencing the design of the system
- reactions from the workforce to the new way of working

Following privatisation in 1984, BT had to adapt quickly to the new environment: demands of shareholders; regulation by Oftel; market forces including globalisation; and increased customer expectations. At the same time, technology was increasing the ***rate*** of change. BT had to develop a new way of working to meet these new

demands. The problem was to provide better levels of customer service, whilst developing a lean administration. Efficient management of the engineering workforce became a critical success factor. It seemed unlikely that reliance on the old manual systems would allow new business targets to be met: manual controls could not cope with the new complexities. New business targets included:

- business repair jobs must be cleared the same day if reported before 4 p.m.
- residential repair jobs must be cleared the same day if reported before 1p.m.
- business repair work clearance within 5 hours of reporting
- residential repair work clearance within 9 hours of reporting
- provision [of new equipment] on demand – 2-hour appointment slots are offered

Operational design in this case involved the specification and delivery of computing function which fully automates the flow of work: from a customer request to receipt by a field engineer and the automation of the closure flow back to originating host systems including time recording and pay systems. Design and build work began in 1989 with the system starting operational trials in December 1991.

The system has continued to evolve with the more recent development of Dynamic Scheduling and Data Visualisation systems which have replaced the real time algorithm, automation of many supporting processes and a completely re-engineered laptop PC field system exploiting the latest Internet and wireless communications technologies [implemented in 2000-2001]. The system not only achieved its original objectives - by 1999 it was delivering an annual operating cost reduction of £100M together with improved customer service. The name given to this system is “Work Manager”.

Work Manager [WM] is an integrated allocation and field despatch software system developed by BT to address their operational problems with improved field and control efficiency, reduced operating costs, improved customer service and reliable management information. Using this system, work is generated and automatically allocated to a field engineer whose skills match the job to be done. The engineer receives the information via a rugged hand-held computer terminal, the Husky or, more recently, a laptop computer. An enhanced allocation system, dynamic scheduling, has dramatically improved the quality of service through greater optimisation and visibility of the allocation process. Figure 2 illustrates the technology used.

It is important to allow sufficient time for different types of job. Every type of work that goes through the system has a time allocated for that type of job. If the job requires knowledge of a new technology, a realistic provision time might be 3-4 hours. The latest software builds a schedule of work for each engineer, up until the day of the job and for the next 7 days. Quite a lot of work will come in advance, so a future schedule can be built for each engineer. Gaps will probably be left for last minute work. That is a static schedule. On the day the work is to be done, it turns into a dynamic schedule: most of the repair work is dealt with on the day it is reported, and is fitted into the static schedule virtually in real time. The system works on the assumption that engineers will complete their work in the allotted time. If a job takes longer, the schedule must be re-calculated. For that reason, the schedules are re-run every 15 minutes, to take account of the changing circumstances: a customer is out; the job is more complex than reported; stores have to be ordered. To achieve optimum scheduling, the algorithms are extremely complex.

Management Issues

For BT, a critical factor is the visibility that the system gives to management throughout the day. Through real-time analysis of the work done and work outstanding, managers can find out where there is insufficient or too much resource; they can compare actual productivity against targets; and measure the levels of customer service. This visibility also aids personnel management. It is easier to find out which people need additional training; to update skill sets; to record training events and starting locations.

Dealing with cultural factors in a constructive way has been a critical success factor in implementing these “virtual teams”. Traditionally, BT was a hierarchical, bureaucratic command and control structure. To change to an outwardly focused, customer-service orientated company was a major pledge. However, with the advent of cheaper computer systems, and the realisation that mundane, repetitive work could be automated, BT moved to a radical re-structuring of operations management.

The first step was to decide which elements of the work could be automated through process automation [such as line testing], and where computing systems were appropriate. The next task was to:

- remove the repetitive tasks of receiving information and decisions concerning allocation of work

- decide how to transfer quality information from the customer service advisors to the engineers
- ensure data integrity

The aim was to get the right person with the right skills to the right place at the right time. Management also needed to know where each person was, and what s/he was doing and what s/he would do next. A system that could generate automatic reports, and thus free the managers from driving from one location to another, constantly checking the team, offered additional productivity and efficiency gains.

Under the manual system, an engineer would get four or five jobs in the morning, and he would choose the order of priority. The new system gives the engineer one job at a time, and s/he must do that job before receiving the next in most circumstances. This change has resulted in a considerable change in working practices. Previously, an engineer could arrange his/her day so that s/he could, for instance, go home at lunch-time and take the dog for a walk. Now the machine regulates their day. Each engineer has a maximum permitted travel distance, and the route is arranged so that s/he basically drives full circle, allocating jobs nearer the base/home point as the day progresses. Whilst the engineer only saw one job at a time, s/he could not arrange the route to suit their own preferences: customer service came first. New features have been provided to allocate and despatch bundles of jobs where they occur at the same customer site or physical location, and the engineers have been given new levels of responsibility. This could only take place once the technology was in place.

Human factors are particularly important, but market pressure often results in a reduction of the planned training time. At first, the machine was regarded as Big Brother, as the introduction of the system so radically changed the lifestyle of the engineers. However, without such a system, reducing costs with increasing volumes of work and service levels could not have been achieved.

The introduction of WM was a massive project: BT had to train up to 20,000 mobile engineers. The initial training was to have been 3 days, but as customer pressure grew, the training began to focus on the technical side of the work. The impact of this implementation has been well-established: the shortcomings of the selection methods and design of work, and the negative impact on perceived levels of job satisfaction are issues raised at every meeting attended by the author. The impossibility of gaining a full picture of operations and the difficulties in obtaining real-time information were highlighted during internal work-study. An important omission was the training of

managers in system skills, so that they could be effective coaches. Poor perceptions of the potential of the new system led to resistance to change and resentment of the new methods of working. The current study has corroborated these views, with an important proviso: the younger, newer members of the teams do not have problems with the new working practices.

During a series of workshops in 1999 [carried out by the author at ten operational sites throughout the UK], every team repeated the same points: the system did not provide the detailed information required by the engineers. The engineers were vociferous on this point. Although the managers can now generate so many different reports that they have information overload, hand-held terminals could provide sufficient *local* operational data for field engineers. Requests included:

- direct access to routing data and records of previous on-site work
- ability to create and access local audit trails; fault history; who had previous responsibility for that job
- revisions of local prints [maps], such as cable prints
- on-line testing
- performance rankings
- route-finder
- drawing editor to assist completion of administrative jobs
- workgroup calendar
- visibility of full day's outstanding work
- on-line stores ordering

Since laptops were introduced for field engineers in 1999-2001, most of these issues have been dealt with.

Multi-skilling

There is much debate on the issue of multi-skilling. Some of the arguments appear to be based on personal [management] preferences and traditional views of working practices. The geographical location does not make a difference to this system, which is standardised throughout the UK. The preferences and skill set of every engineer must be correctly entered on the database, so that work can be matched to the appropriate person. The distance travelled is a key factor. Some managers claim that in rural areas, however, the skill sets become the critical factor. They claim that to avoid unnecessary travelling, multi-skilling is essential in rural areas. In an urban

area, there is almost always sufficient work for an engineer with only a single-skill, without increasing the geographical range of his/her work.

Over the last 5 years, BT has invested heavily in multi-skilling. The view [backed up by a number of simulation models] was, that if 70% of the workforce within a domain [120 engineers] is multi-skilled, the three classes of work – simple repairs, provision and underground work – would be covered. The system would provide an efficient and effective service with that level of training. The system relies on matching skills to the job to be done. If the engineers did not have to refuse jobs because they did not have the skill level, the allocation would be "smooth", and productivity would be high.

The debate about levels of training is an important issue: single-skilling is reminiscent of Taylorism and division into small tasks. The debate about multi-skilling is often linked to discussion of job satisfaction and empowerment. Thus, the arguments over skill levels reflect different management philosophies. This is partly a reflection of the traditional command and control, bureaucratic hierarchical way of managing – not restricted to BT alone. When traditional managers are faced with simulations and models that give a different answer, they may retreat into their comfort zone, and continue in the style to which they are accustomed. Evidence from the engineers gives a different picture. There are still "old hands" who complain bitterly about the new way of working. It is noticeable that new recruits involved in this project find no difficulty in accepting WM.

There are also differences between attitudes to the different types of work. Many engineers will get on with any job provided that they have the right tools. There are some who so dislike working in customer premises that they prefer to do underground work; and vice versa.

Another aspect of the debate is the rapid change in technology. Much of the engineering workforce was trained on simple PSTN – basic telephone equipment. A different workforce is required to cope with BT's change from a telephone company to a communications company (ComCo). The engineers have to switch to Broadband or computer-related work for instance.

<u>Achieving Change</u>

To check the accuracy of the system and to work out achievable targets, BT uses an extremely sophisticated modelling system. Systems engineers and developers are well aware of the potential of the system. Convincing managers to trust the system has proven to be a much longer problem than expected. Staff who work in the control area - the controllers - are not managers.

At managerial level and in the control domain, it is clear that fear of technology and fear of redundancies influences attitudes. This would be true in any company. Attention to the people issues is always critical, but attention at managerial level as well as at field engineer level is required. Various organisational structures have been introduced, to match business needs with operational needs. Customer service teams [CSTs] were set up to introduce the notion of self-managed teams – that name is preferred to "virtual teams". As business pressures have grown, these CSTs have "reverted" to local business units. As WM was developed as a "push" system, it is not compatible with a structure that is trying to encourage self-organisation. Thus the conflicting philosophies are creating tensions during the transition period between the old hierarchical system and the development of an empowered workforce.

In addition, more attention has to be paid to educating the workforce in general business needs. Without a general business understanding, employees cannot comprehend the reasoning behind the business decisions made by the Company. Nor can they answer customer queries convincingly and in a professional manner. Such changes in the organisation require new "soft" skills. Yet market pressure demands that the field engineers spend their time in the field, not in the classroom. There is a constant dissonance between technical needs and personal development. BT is placing increasing emphasis on personal development plans, linking such actions to the Company performance measures and the use of the Balanced Scorecard approach. Much work on developing new competency profiles has been carried out, but it takes time to complete the total change management programme.

Discussion

Efficient resource allocation is a key issue for any company. The BT experience indicates that to maximise a work allocation system for virtual teams it must be integrated with a resource management system: a workforce allocation system. This presumes a technological solution to operational management. However, many customers are not content with a purely automated customer service contact point.

Nor do the majority of employees wish to see their skill set and their job satisfaction reduced.

For a company such as BT to provide the speedy service expected by customers, they have to adopt a more entrepreneurial culture. In the short-term that will be exceedingly difficult, as current operations are controlled by an automated, sophisticated management system. Without WM, the volumes of work and the service targets [required by Oftel as well as driven by competition] could not be achieved. However, as management policies evolve, the focus will be on more customer "self-service" through the Internet and other technologies, leading to yet more emphasis on the mobile field workforce as the "face" of BT. The need is to provide more flexible tools for those engineers, and to devise an appropriate organisational structure that reflects current needs. These issues are under constant review, but future plans cannot be discussed here.

There is no doubt that BT has recognised the obligation to address these "people issues". There is also no doubt that the "24-hour society" is leading to levels of service that can only be provided through higher levels of automation and virtual teams. If more of the routine work can be automated, higher levels of service can be provided through human interfaces. As these interactions will be concerned with the non-routine, difficult issues, the job satisfaction for the employees will be increased, leading to higher motivation.

Conclusions

As all teams differ from each other, there is no prescription for implementation of information technologies. Malcolm Diamond, MD of Trifast plc (2001) suggests that we should take great care:

- IT can provide information overload which then leads to over analysis and over measurement to the extent that managers can lose the plot and become distracted by data so much that they forget the people.

- Electronic communication is so immediate that it can drive managers to constantly change arrangements – leading to more stress, more "butterflying" – less in depth knowledge, understanding and project completion.

- IT has made supplier/customer relationships “antiseptic”. We have to counter “lack of love” feeling by putting people back on a face to face basis (rather than interface).

- Many employees (especially managers) are under pressure to be IT compatible/dependent so as to "prove” their efficiency and modern progressive outlook or culture.

There are several parallels between the scenario described here and previous work in an electricity company by the author (Collins 1999). The change management problems are similar to those catalogued in many textbooks, but with a difference: the sophistication of the technology.

In the utility sector as a whole, the field engineers issued with laptops have strict instructions as to what they can and cannot do and which software applications they may use. In some cases, they are not allowed to load software for personal for fear of corrupting the system; others are encouraged to experiment with the functionality, as it leads to suggestions for improved working.

Since the introduction of laptops, significant changes in the working practices of field engineers have been reinforced [not yet adopted by all the companies]:

- Home starts: the distributed workforce that met at the start of the day at the ‘depot’ to discuss issues and to reinforce the team bonding is replaced by a virtual team that meets when the manager calls a team meeting; peer-to-peer communication is increasingly via wireless technologies; training has to be reinforced by field technicians.
- Automated work scheduling is controlling the movement of engineers, who can no longer plan their whole day. However, as this is so unpopular, BT has introduced new “tour build” schedules that give engineers more than one task at a time so that they can plan some work themselves.
- Replacement of the handheld devices was not successful in all situations: in BT engineers working underground or up a pole could not take a laptop with them – handheld wireless devices are seen as the way forward.
- Engineers have to be recruited as much for their customer relationship skills as for technical skills. They will have to be more pro-active in developing customer relationships. In time, new software applications will enable customers to contact

their local engineers directly – once again cutting out human interfaces [for example, in the call centre].

- Experiments with agent technology [confidential material not yet released] could give virtual teams the ability to self-organise and reduce the managerial contribution required.
- Some field engineers dislike the possibility of managers emailing them at home, and want to maintain the separation of work and home life. The implications of the 24x7 society are not just limited to the engineers.

There is no doubt that management development and manager's use of their time requires significant appraisal when software applications are introduced automate work. Many organisations have been experimenting with self-organisation and self-managed teams. To implement these concepts requires much trust and mutual respect within the teams involved. Such trust is in short supply, but the use of sophisticated software, in particular developments in agent technology, now provide the opportunity to balance self-organisation and control. Teams can arrange their own schedules, but priorities can be set according to a firm's strategy and policies.

The conflict between "push" and "pull" systems will continue to be a considerable constraint in many companies. Many current systems reflect traditional command and control functional hierarchies. Persuading both programmers and senior managers to accept a new philosophy will be as difficult as it was when the notion of "pull" was introduced in manufacturing. The fieldwork for this research demonstrated significant differences between age groups, with younger engineers much more willing to experiment with new ideas, though still concerned about the new responsibilities implied in new job descriptions.

To paraphrase Shakespeare, "Culture makes cowards of us all". The "people" issues remain, but are changing. We have been exhorted to embrace change for decades, and many changes have been implemented despite opposition. Business drivers such as the impact of the Internet have changed the rules, allowing radical experiments in business design. The fact that many "early adopters" failed does not reduce that impact. We need to re-educate our instructors and educators so that they do not continue to pass on old paradigms.

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