The Evolution of the Customer-Centric Helpdesk: Two Case Studies

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***Abstract* – This article examines how the helpdesk function has changed over the past three decades through examination of two case studies. In 1985, the European shipment of PC workstations overtook shipments of simple terminals (i.e., video display units and keyboards, with very little processing power), instigating a revolution in end-user computing, with computer users taking advantage of new word-processor, spreadsheet, graphics, email and database applications. This article looks at two snapshots of end-user computing and helpdesk operations separated by a 30 year period – one at Glaxo Pharmaceuticals in 1988, and the other at the University of Gloucestershire in 2018. This case study research finds that whilst the range of technologies requiring support has increased markedly, this has been counter-balanced somewhat by the emergence of standards and dominant products in many technology categories. It also finds that the concept of support and the role of the end-user have evolved significantly in a rapidly changing technology landscape.**

Keywords – End-user computing; helpdesk functions; customer-centricity; office systems; personal productivity tools; IT support strategy; Service Desk.

I. INTRODUCTION

The technology environment in major organisations has changed significantly in the past 30 years. In 1988, there was virtually no use of the Internet, portable computers were in their infancy, and there were no mobile phones or tablets. Although the personal computer (PC) had broken through to become the main desktop device in the more advanced organisations, local area networks were just being introduced and MSDOS was the main PC operating system in the pre-Windows age. Many of the mainstream corporate systems were bespoke (often in 3G languages like COBOL), and the main packaged software products like the SAP and Oracle Enterprise Resource Planning (ERP) systems were just starting to be taken up by the bigger corporations.

Technology support is a key issue in nearly all organisations today, and this article examines the origins and evolution of end-user computing and helpdesk support functions over the past three decades. In so doing, the article highlights the key support issues that organisations must address today. It features two case studies. First, Glaxo Pharmaceuticals, which was an advanced technology user and was seen as a leader in its rapid uptake of PC applications in the 1980s [1]. The second case study concerns the University of Gloucestershire (UoG) in 2018. This introductory section is followed in Section 2 by a brief discussion of the background to this research and the case study methodology, and sets two research questions. Sections 3 and 4 focus on the two case studies and section 5 makes some final comparisons and addresses the two research questions.

II. BACKGROUND & RESEARCH METHOD

IT services are key in ensuring the efficiency and agility of business processes [2], and within this context, the importance of a successful helpdesk in supporting corporate performance is generally accepted. Sood [3] recently noted that "the cross-functional nature of its operation means the help desk directly impacts productivity and is an essential part of what enables an agency to meet its stakeholder needs".

As early as 1992, Bridge and Dearden [4] noted "the quality of helpdesk operations can be improved by the provision of knowledge to front line helpdesk operators" and that "this could only be done effectively if AI technology is used". This early study of helpdesk operations proved prophetic as helpdesks have evolved to meet the changing demands of end-users and have used increasingly sophisticated support systems. Existing literature also highlights the increase in the range of technologies that helpdesks have to support. Gonzalez, Giachetti and Ramirez [5], for example, note that the average number of information technologies supported by central support functions has increased from 25 to 2000 in the current millennium.

This article looks at two case studies of helpdesk operations and end-use computing requirements, spanning a 30 year time gap. The case study is a widely used methodology within business research. Bryman and Bell [6] argue that the case study is particularly appropriate to be used in combination with a qualitative research method, allowing detailed and intensive research activity, usually in combination with an inductive approach as regards the relationship between theory and research. Saunders, Lewis and Thornhill [7] argue that case studies are of particular value for explanatory or exploratory investigation.

Data collection to date has been achieved through participant observation and action research. One of the authors worked at the first case study company (Glaxo Pharmaceuticals) as IT Trainer and then End-User Computing manager in the 1984-88 period. Some of the observations included here were discussed in research publications at the time [1] [8], and these have been used as

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secondary sources of material. The other author has worked on the IT Service Desk at the second organization (UoG) and thus has first-hand experience of the technologies deployed and the Service Desk operations. There are thus multiple sources of evidence, which as Yin [9] suggests, is one way of increasing the construct validity of case studies. At UoG, this includes participant observation and a number of internal reports [10].

Within this context, this article addresses two research questions (RQs):

RQ1. How have the support requirements of helpdesks evolved over the past 30 years?

RQ2. How has the helpdesk developed in response to these changes in the technology landscape?

III. CASE STUDY 1: GLAXO PHARMACEUTICALS 1988

Overview: Between 1984 and 1988, Glaxo Pharmaceuticals saw a rapid increase in the use of PCs, which radically changed the nature of computing within the company. In excess of 1300 PCs were installed in the company's four sites at Greenford (London), Barnard Castle (Co Durham), Ware (Hertfordshire) and Speke (near Liverpool). This expansion reflected the dramatic growth and improvement in PC-based office systems during this period, which changed the nature of standard office computing functions in the company. However, in 1984, office systems were clearly a function of the HP3000 mini-computers, there being over a thousand users of these office systems in Glaxo, over 600 of which were electronic mail users. There were just a few PC-based users of spreadsheets in the sales, marketing and market research areas. By 1988, one in four staff had a PC, and of these, six out of ten had a spreadsheet, four out of ten had a graphics package and a word-processor, and three out of ten had a database package. The use of mini-computer graphics modelling and word-processing had virtually disappeared, but electronic mail remained a function of the Hewlett Packard mini-computers, there being over 2,500 users, a fourfold expansion since 1984.

Word-processing and desktop publishing: In the period 1984-88, word-processing experienced several phases of growth. In the two years after 1984, the company standardized on one main word processing system (HPWord), based on an HP mainframe or mini-computer for all secretarial/office staff. Then, in 1987-88 as the PC became the standard desktop machine rather than the terminal, users were transferred to a PC-based version (PCWord) of the mainframe package, thus minimizing the need for retraining. Then in 1988, the company embarked on a further change that would see the introduction of a more sophisticated word-processor as the standard for secretarial use. This was in part driven by the well-publicised benefits of using the so called "desktop publishing" (DTP) packages, which required a skill level normally beyond that of the average secretary, and which also required specialist workstations (an 80386 chip, and a PostScript-compatible printer) if acceptable performance was to be achieved.

This resulted in the introduction of only two desktop publishing workstations (running PageMaker and/or Ventura software packages). However, it was expected at the time that the standard document processing software available to secretaries would come to include some DTP functions such as graphics and scanned image importation, and this is indeed what happened. It was suggested that a move to the type of mid-range product in the word-processing to DTP spectrum, such as the Lotus Manuscript or Advancewrite Plus software packages was likely. The coming of Windows as the standard operating system and the gradual dominance of the Microsoft office products was not envisaged at that time.

Database and spreadsheets: Databases are possibly the most powerful end-user tools of all the functional "off- the-shelf" packages, while spreadsheets are the most commonly used. A PC survey carried out at Glaxo in May 1988 found that for every PC database system written by the company's Information Management Division (IMD), end-users had developed three systems for themselves. The PC systems developed by IMD at the request of end-users is shown in Table I. Authorisation for these systems was done on an *ad hoc* basis, and approval for resource allocation from higher management levels was not required.

A number of different spreadsheet packages had been tried by end-users, but Lotus 1-2-3 was the most commonly used.

TABLE I. END-USER COMPUTING SYSTEMS AT GLAXO 1988

End-user system name	**Software**
Electronic faces folder	DB3+/Tencore
Medical records	DataEase
Unpublished journals	DataEase
Label reconciliation	DataEase
Materials requisition	RBase 5000
Medical terms dictionary	Custom-made with Pascal
Accident records	DataEase
Project engineer management	DataEase
Media scheduling	DataEase
Planning & budgeting	DataEase
Action reporting	DataEase

Graphics packages: Graphics packages were not as common as word-processors, but the two were increasingly

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used in unison as standard secretarial software. They were used mainly for departmental reports and presentations. The data was still input manually for the most part, but electronic transfer into graphics packages was on the increase as integration with mainframe databases and other office systems improved. This was to be a forerunner of the wider integration and consolidation of office productivity tools that occurred in the Microsoft era. By 1988, the main graphics package used was Freelance or Freelance Plus, which was then from the provider of the Lotus 1-2-3 spreadsheet, ensuring ease of data transfer between the two packages.

Electronic presentations systems and presentation design software: This was a significant end-user computing activity. There were a range of software packages available for electronic systems, including PictureIt and Freelance Plus, running on the so-called "IBM compatible" PCs. PictureIt enabled the user to design bar, pie, line, organization and word charts in a range of pre-determined formats. It was extremely easy to use and yet contained sufficient variety to facilitate the design of a reasonable presentation. This was particularly useful for senior management and the sales and marketing functions.

For more specialised needs, Freelance Plus was used. This was a freeform drawing package, with a range of icon libraries that could be combined with PictureIt images. Graphs could also be imported from other software packages (including Lotus 1-2-3 and Lotus Symphony). Standard 80 column/25 line text screens could also be converted to VideoShow format and edited using VIP.

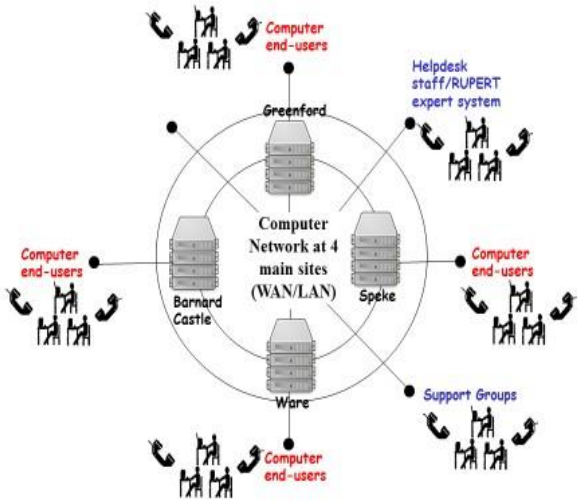

Figure 1. The Rupert helpdesk system: interaction with end-users and support groups.

The VideoShow presentation system was made available to be taken out on loan from the IMD, and each of the four sites had at least one of these machines. Having prepared the presentation with software running on the PC, this was then saved to "floppy disc" and run on the VideoShow presentation system. These presentations could be given to a large audience via a projector (e.g., Barco Data 3 or Electrohome ECP 2000) or a colour monitor for smaller audiences. The wide range of colours available (1,000) as well as the range of formats available made this a convenient way to present material suitable for a 35mm slide presentation. The obvious advantages included the portability of the presentation (one floppy disc could hold as many as 200 images) and the fact that the presentation was always in the correct order, the right way round and there were no focusing problems.

Computer based training (CBT) packages: From 1985 onwards, approximately 30 CBT packages were developed by IMD using the Tencore authoring language [11]. Most of these were for sales and marketing training, and their support and on-going enhancement and update constituted an element of PC systems support at the time.

The helpdesk function: The helpdesk function was centralized at the company's Greenford site, but had links to support staff in the company's three main manufacturing plants at Ware, Barnard Castle and Speke (Figure 1). By 1988, IMD had developed its own in-house fault logging diagnostic system, built using an expert system shell (CASSANDRA). This system was known as "Rupert" (Resolves Users' Problems Expertly).

The helpdesk had hitherto been manned by a senior network analyst who used his expertise to help solve users' problems. Rupert encapsulated some of the experts' knowledge and was able to apply it to users' problems. By asking a series of questions, Rupert could home in on a problem. In some situations it could take action such as aborting a users' session, disconnecting a terminal or asking the user to perform some action such as pressing a key etc. In other cases, where Rupert was unable to provide a full solution, the call was passed on to the support group which, in Rupert's judgement, would be best placed to deal with the problem.

The support groups were still in the main geared to helping users of the company's wide range of bespoke transaction processing and reporting systems for their manufacturing and financial functions. These were mainly written in COBOL or PASCAL, and the analyst-programmers of the day doubled up as support staff to help end-users. Indeed, for the main manufacturing system (known as "MENTOR"), there was a programme of courses run on the four sites on test machines on which the main manufacturing systems could be simulated. There were three main support groups for the main corporate business systems and a fourth for office systems and end-user computing. The main business systems were run on Hewlett Packard mini-computers at the four sites linked by a wide area network, and there were also a number of test and development machines.

In addition to helping to solve problems more quickly, Rupert also produced fault statistics which helped IMD to identify problem areas and thus continue to improve the service given to users.

In the first two months of Rupert's operation, the helpdesk staff:

- handled nearly 2,500 enquiries;
- solved 70 per cent of all queries themselves;

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- found that a number of queries were from users who did not understand the applications (more training courses were arranged);
- discovered that the maintenance support provided by the terminal supplier was unsatisfactory (the company asked its supplier to modify its support system).

The major benefits of Rupert to the company were:

- its role as a training aid for new helpdesk staff;
- the ease with which new knowledge could be added to the system;
- the time taken to resolve user problems was halved;
- the improved image of IMD in the rest of the company;
- the better statistics it provided about user problems.

The last two benefits could probably have been obtained from any helpdesk function and fault reporting software. However, Rupert's excellent user interface made this a very successful application of expert system techniques. It was envisaged that the system would eventually be the focal point of a comprehensive network management system.

IV. CASE STUDY 2: UNIVERSITY OF GLOUCESTERSHIRE 2018

Overview: UoG is located across six sites within Cheltenham and Gloucester with 20 professional departments. The Library, Technology and Information Service (LTI) department provides supports for both staff and students, particularly for teaching and learning, along with the provision of appropriate training and skills development. The University has over 1,500 staff, most of which are computer users, and approximately 10,000 students, who use a range of applications on University equipment in labs and classroom environments. The IT Service Desk is located within LTI and provides full support for staff in University hardware, communications and software solutions. Support for students encompasses Office 365, assignment submission, the Moodle learning management system, and a range of IT guides accessible via MyGlos Help (a web portal guidance page which helps student to search for guidance and information).

Office productivity tools and end-user computing: Microsoft Office 2016, Adobe, SSRS, SPSS, and NVivo are the main packages that are increasingly used as standard on a daily basis. SSRS (SQL reporting) is mainly used for departmental reports, whilst SPSS and NVivo are only used for teaching and research purposes, and PowerPoint (part of Office 2016) is the main package used for presentations. There are many different packages on different machines, depending on department needs. For example, there are 150 graphics package users in the departments of art and design and landscape architecture. The operating system for the PCs is currently Windows 7, although a University-wide upgrade to Windows 10 is currently being rolled out. The University email system is based on Microsoft Office365 and hosted externally. The University supports Office apps such as Skype for business, Outlook, OneDrive, and uses the international roaming service called Eduroam to provide WiFi connectivity. Eduroam allows UoG users to login at any participating institution using their UoG login name and password. Eduroam also allows users from any participating institution to login to UoG using their local login name and password. LTI use Gmetrix to provide Microsoft office training to both staff and students. UoG supports staff and student research efforts with SPSS and Nvivo.

As regards telephony, the internal telephone system (an Avaya IP phone system providing telephony for all the University campuses and the majority of the student halls of residence) is complemented by a number of exchange lines direct from the BT exchange, which are used for alarm lines, swipe machines for debit and credit cards, and payphones around the University and in halls of residence. LTI are responsible for managing mobile phone services, which are coordinated through a centralised agreement with Vodafone. The University will provide support for equipment and software which is procured by the University, but does not support mobile phones, tablets or other equipment purchased by staff or students themselves. Nevertheless, the frontline support teams will endeavour to help students with their own devices if they can (e.g., to reinstall software or attempt data recovery), but they will not attempt to fix any major hardware or mechanical problems.

UoG Main Business Systems: There are about 60 business systems running across the University, including Sunrise, SITS Student Records, Resource link, Agresso Finance and Moodle (Table 2). All of these are now supported by LTI, although some started as departmental end-user systems prior to the centralisation of IT support within the University and the imposition of certain policies and standards. Many of these systems are administered by end-users who undertake data maintenance and general support tasks.

TABLE II: MAIN BUSINESS SYSTEMS SUPPORTED BY UOG LTI

System	Description
Sunrise	IT application to manage enquiries from students and staff
SITS Student Records	SITS is a student records management system used to store, administer and manage all aspects of student information from initial enquiry and application through to degree congregation. A configurable package from software provider Tribal.
ResourceLink	Resourcelink is an integrated HR and Payroll software package.
Agresso Finance (Live)	A global accounting system from software provider Unit4.
Moodle	Moodle is a free and open-source learning management system written in PHP and distributed under the GNU General Public License.

The SITS student records management package is one of the University's core systems, and the system is upgraded

regularly with modifications and new releases from the software supplier (Tribal). These are tested and implemented in the test environment by the SITS users. When the software has been tested thoroughly and approved, a change control is raised which then goes to a change control board, who will approve or reject the change. New developments are driven by the University's business and legal requirements.

The general policy for the procurement of new software applications is that it should be based on web enabling technologies that will assist in the development of a University-wide Managed Learning Environment (MLE). This principle guides procurement when the University has the opportunity to replace systems software through the annual IT capital programme.

UoG IT Service Desk function: Sunrise is the main system used by the LTI staff to manage enquiries from students and staff. In addition, any enquiries received via the MyGlos Help Portal are redirected to the appropriate team. Different versions of Sunrise have been used by the University since the year 2000, but all with the same backend. With the latest version of this system, keywords can be used to select the problem categories and automates the assignation to appropriate support personnel.

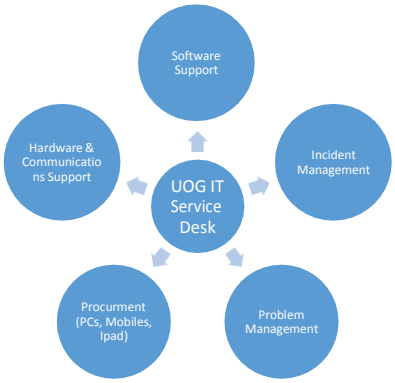

Figure 2. Main Functions of the UoG IT Service Desk 2018.

The IT Service Desk performs a number of functions (Figure 2). It has the responsibility for all user account management as well as giving access to all University business systems such as Agresso and SITS. LTI is responsible for providing the basic "image" (i.e.software footprint) for all staff and student devices. A minimum of between 4-6 weeks is allowed to enable a thorough evaluation and testing of any new software application.

When the IT Service Desk was first established in 2000, one of the front-line technicians would be on Rota to cover the helpdesk shift during the working day. Since June 2017, the IT Service Desk has been run by two officers and one manager from 8am till 5pm during weekdays. An out-of-hours service is provided by IT technicians who share the shifts across the Universitiy's three main campuses on a rota basis.

A Service Desk officer takes a call or email and logs a call. A first fix is applied if possible and remote connections used where appropriate.

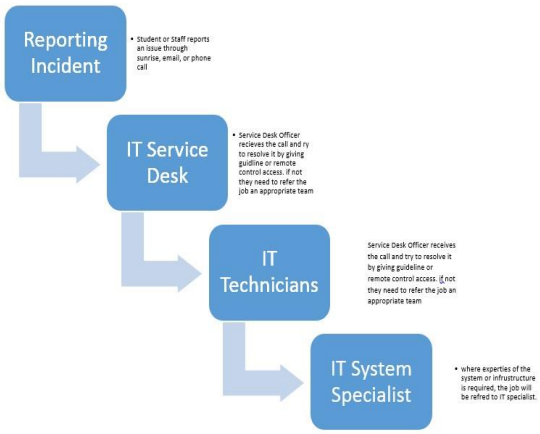

Figure 3. Incident Tracking by UoG IT Sevice Desk 2018

Figure 3 shows the escalation of a call through different levels of service expertise depending on the complexity/specialism of the problem reported. This systematic approach to tackling problems, combined with the application of dedicated human resources to solving Service Desk enquiries, has contributed to a significant improvement in response times and a more efficient IT service for the University's staff and students.

Teams across four sites use IT Service Desk tools and the Sunrise support system. The IT Service Desk tools are an integral part of the Sunrise system, and were developed as a bespoke, standalone system for UoG. Some of its main functions are:

- Password reset
- Unlock accounts
- Create guest login for externals
- Provide access to shared drives
- Deploy software
- Change voicemail passwords

LTI uses the Sunrise system to log calls, update the call, and transfer the call to the appropriate support team. Service Desk officers have access to all communications across the University by searching for the Incident Number, call details, surname, forename, category, hub area, open date, network logon, global summary, priority, escalation level, assigned group, and first time fix. The call needs to be logged under the name of the person that reported the enquiry, which can be logged by network logon (staff number) or forename and surname. The category is selected based on the enquiry; for example, if someone reports an issue with email, Service Desk officers can search for emails and pick the correct category. The use of keywords and categories ensures that an enquiry is managed by the most appropriate team. Once the

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category has been selected, the system will automatically pick the first line team and referral team appropriate to the job.

V. CONCLUSION

This section draws on the case study material discussed above to address the research questions set out in section 2.

RQ1. How have the support requirements of helpdesks evolved over the past 30 years?

Thirty years ago, the needs for IT support in major organisations were somewhat different from those of today. There was no significant use of the internet and very few mobile phones or laptops. There was no Windows - MSDOS was the main operating system for PCs. There was no SKYPE, no viruses and no wifi, but Intel chip-based PCs had established themselves in most organisations and hard-wired LANS linked them to server PCs and mini-computers. Most business systems were bespoked in-house – the age of integrated packaged software was just around the corner.

However, despite the expansion in the range of technologies that helpdesks are now called upon to support, there was arguably more variety in the range of products that needed supporting in each technology category. For example, the Glaxo helpdesk supported 5 different word-processors and several spreadsheets and graphics packages. The market was still evolving with many competing products and no obvious standards. Presentation graphics systems and videoconferencing also needed support, along with bespoked computer-based training packages in the era before on-line help functions for many software products.

There are now a greater range of technologies to support, but there are clearer standards and more obvious choices within each category. It is thus critical that the central support function has clear policies and makes product choices in each technology area. At Glaxo, despite the lack of standards in end-user software, the IMD Director was adamant that only Intel chip based PCs would be permitted in the company, and this has parallels with UoG's non-support of devices not obtained through the University procurement system. In recent years, there has been a clear imposition of standards and product choices at the University as central IT strategy and policies have taken precedence over departmental initiatives.

RQ2. How has the helpdesk developed in response to these changes in the technology landscape?

Over the time duration between the two case studies, the helpdesk function has evolved and adapted to changing requirements and developments in technology. The concept of support has also evolved, with helpdesks increasingly seeing computer users as "customers", but at the same time end-users taking some responsibility for systems ownership, data maintenance and training. The super-user and data maintenance specialists have emerged as key link personnel between the computer user-community and central IT support. The helpdesk is also increasingly seen as part of a broader Service Desk function, with service being defined as "an approach to IT service management that emphasizes the importance of coordination and control across the various functions, processes and systems necessary to manage the full lifecycle of IT services" [12]. This definition is often applied in the context of a third party service provider, but is also relevant to in-house IT service provision. At UoG, the Service Desk is the customer facing front end of all IT services which are measured against stipulated service level targets defined in service level agreements. This aligns with the IT Infrastructure Library (ITIL) concept and definition of the IT Service Desk as the single point of contact between the IT function and users, which manages incidents and service requests, and handles communication with users. There is also a more subtle change in that the service is seen as supporting business processes and people capabilities along with the pure technology elements. The Service Desk now focuses on delivering high quality customer service to end-users, whereas the helpdesk was more concerned with incident management and resolving problems related to IT in the organization [5].

The range of different technologies supported by the Service Desk has seen developments in its own support technology. In addition, the requirements set out in service level agreements have meant that Service Desks need to increase end-user satisfaction levels by responding to the incidents and problems within stipulated response times [13]. To support this increase in customer service levels, support technology has become more sophisticated, involving elements of knowledge management and artificial intelligence. Nevertheless, the basic functions of the RUPERT system established in 1988 at Glaxo remain largely the same. Over and above this, however, as Peppard [14] has noted, the role of people skills and capabilities in delivering a successful Service Desk operation remains critical. Despite advances in technology support systems, a fully automated helpdesk function remains some years away for most organisations, and people skills will remain critical in providing an effective Service Desk operation.

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