INDUSTRIAL NEW PRODUCT PLANNING

A study of the sources of new product ideas
and the development of new product proposals
in the UK Computer Industry.

Volume 1 of 2

Submitted by Peter Rawlinson
for the degree of Doctor of Philosophy
The University of Aston in Birmingham.

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SUMMARY:

This thesis presents a study of the sources of new product ideas and the development of new product proposals in an organisation in the UK Computer Industry.

The thesis extends the work of von Hippel by showing how the phenomenon which he describes as "the Customer Active Paradigm for new product idea generation" can be observed to operate in this industry. Furthermore, this thesis contrasts his Customer Active Paradigm with the more usually encountered Manufacturer Active Paradigm.

In a second area, the thesis draws a number of conclusions relating to methods of market research, confirming existing observations and demonstrating the suitability of flexible interview strategies in certain circumstances.

The thesis goes on to demonstrate the importance of free information flow within the organisation, making it more likely that sought and unsought opportunities can be exploited. It is shown that formal information flows and documents are a necessary but not sufficient means of influencing the formation of the organisation's dominant ideas on new product areas.

The findings also link the work of Tushman and Katz on the role of "Gatekeepers" with the work of von Hippel by showing that the role of gatekeeper is particularly appropriate and useful to an organisation changing from Customer Active to Manufacturer Active methods of idea generation.

Finally, the thesis provides conclusions relating to the exploitation of specific new product opportunities facing the sponsoring organisation.

KEYWORDS:
Product Idea Generation
Industrial Market Research
Industrial New Product Planning
Office Computing Technology

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Finally, my thanks go to my wife for not only making the original challenge, but also for not flinching when the going got tough.

Poynton, Cheshire

September 1982.

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CHAPTER ONE

INTRODUCTION

1.1 THE SCOPE OF THE PROJECT.

1.2 THE ORGANISATION OF THE THESIS.

This thesis describes the work done as part of a project organised by the Interdisciplinary Higher Degrees Scheme of the University of Aston in Birmingham, in conjunction with the Wythenshawe Division of Ferranti Computer Systems Ltd., and is submitted for assessment for the award of the degree of Doctor of Philosophy.

1.1 THE SCOPE OF THE PROJECT.

The project originated from a brief prepared by the Wythenshawe Division of Ferranti Computer Systems Ltd., (Appendix A) describing the need for a feasibility study to identify the market requirements for the next generation of a computer terminal product manufactured by them. This project was considered suitable to be run under the Interdisciplinary Higher Degrees Scheme of the University of Aston in Birmingham.

This thesis describes the work done and the proposal submitted as part of this feasibility study. A requirement of the Interdisciplinary Higher Degrees Scheme (as the name implies) is that work for submission under its auspices should cover a number of academic disciplines. The work to prepare the feasibility study comprised the elements of Electronic Engineering, Computer Software, and Ergonomics, and hence can be seen to cover a range of disciplines. However, the opportunity was taken to broaden the scope of the thesis even further to encompass other elements of product planning and its practice in an organisation manufacturing

and supplying a range of computer systems.

Thus, apart from the technical elements of the Product Feasibility Study proper, this thesis has been broadened to cover a number of other academically interesting areas in that it describes how the numerous conflicting commercial and technical pressures were resolved in this particular situation, and also presents "contributions to knowledge" in the areas of:

the sources of ideas for industrial products (chapter 3);

the choice of methods for market research (chapter 4);

the submission of new product proposals (chapter 4);

the interplay of development strategies for the various product lines (chapters 4,5,6,7).

1.2 THE ORGANISATION OF THE THESIS

The thesis comprises a number of chapters and related appendices. Each chapter deals with a different aspect of the interdisciplinary nature of the project. Because the thesis covers a number of different academic areas, it has not been possible to concentrate the literature review in one chapter. A more appropriate philosophy has been adopted of dispersing the literature review throughout the thesis, and referring to appropriate references as and when necessary to reinforce the narrative. By this method of associating the references closely with the text, it is hoped that the resulting chapters are more complete in themselves and more readable than they would be with an alternative, centralised literature review.

This **first chapter** of the thesis provides a brief introduction describing the origins of the project, its interdisciplinary nature and how the thesis is organised. **Chapter Two** provides background information necessary for the understanding of the subsequent chapters, commencing with a description of the sponsoring organisation and its position within the parent company. The chapter continues with a description of the business pursued by the organisation, showing its origins and continuing large commitment to the production of computer systems "tailored" to customer specifications in areas such as industrial process control, urban traffic

control, and electricity generation control. The organisation's diversification into the manufacture of standard products is then described, showing the increasing importance of this type of business. The chapter concludes with a description of the product PT7 with which this project was principally concerned, showing its origins and history and describing the organisation's view that the life of the current generation of the product was limited, and that a study (this project) was necessary to identify the market requirements of the next generation of the product.

Chapter Three extends the work of von Hippel concerning the origins of ideas for industrial products, shows that his "Customer Active Paradigm" of idea generation can be extensively observed here, discusses why this should be so, and shows the attractions of such a method.

Chapter Four resumes the description of the project proper, starting from the premise that the Customer Active Paradigm, as described in Chapter Three, is not wholly appropriate to the needs of an exercise such as this where opportunities require to be identified before a deadline. It describes the method adopted, relating this to the existing literature, where possible, and showing how the method was modified as a result of experience, and as a result of changing project requirements. The chapter concludes with a summary of

the lessons learnt from the project. In particular, it contrasts the Customer Active and Manufacturer Active methods of idea generation; describes the suitability of various information gathering methods; records the lessons learnt concerning the submission of formal project documents; and identifies the requirement to remain alert to the changing project environment so as to react appropriately to changing circumstances and to be able to take advantage of opportunities which arise unexpectedly from time to time as they did in this project.

Chapter Five describes the "Office Product Proposal" which was the outcome of the main activities of the project described in this thesis. It describes how the main emphasis of the project changed from its initial conception of seeking out requirements for the next generation of computer terminal products. By the end of the exercise, the proposal recommended not only terminal requirements but also application requirements which went beyond the previous product concept of an application-independent terminal system. This change in emphasis arose because of the development of opportunities related to the earlier computer terminal markets, the new opportunities being referred to as "Office Products" or "Information Technology". The chapter extends the description of the project method given in the previous chapter, by describing what role the Information Gathering Exercises described in Chapter

Four played in the preparation of the product proposal. Chapter Five then continues by describing some alternative strategies which were considered and then rejected before submission. Finally it describes the various elements of the strategy which was proposed to (and accepted by) the organisation's New Product Committee.

Chapter Six describes a second product proposal which arose out of this project as a result of the neccessary widening of the project boundaries to satisfy the primary project requirements (chapters four and five) and also as a result of external catalytic events which resulted in the exploitation of a product opportunity. This chapter reinforces the lessons learnt (as described in Chapter Four) with regard to the requirement to remain alert to changing circumstances.

The chapter starts by considering the origin of the idea for the second product in the terminal systems exercise, and notes that, whilst the opportunity could be seen to exist, it was not initially pursued since it was beyond the scope of this project and (more importantly) could not be exploited by the organisation without a substantial change of business direction. The chapter then describes an external catalytic event which caused the product idea to be taken up again when another subsidiary company within the Ferranti group entered into a joint venture in the business direction referred to above. (This event was totally unconnected to the

opportunities identified by this project.) The chapter goes on to describe the development of the second product feasibility proposal, giving the product's function, attraction and justification, showing how market responsiveness was judged, what the proposed product features were to be and what the resulting product competitiveness and identity would be. The chapter then describes the technical aspects of the product which remained to be resolved by the design team, and closes with a description of why the product was attractive to the organisation.

Chapter Seven further illustrates that projects such as this cannot be isolated within the sponsoring organisation. It describes how the findings of this project influenced other projects and products which were current at that time. The chapter describes how the new, broader definition of the term "user friendliness" developed as part of this project influenced the presentation of other products; it describes the information fed into a design study set up to recommend which strategy should be adopted by the organisation with regard to Local Area Networks; it also describes how market sizing data gathered as part of this project was used in the consideration of a Teletex product development and illustrates the interactive nature of product design as a result of the interaction between technical and marketing elements.

Chapter Eight concludes the thesis by summarising and reiterating the main findings and contributions to knowledge.

A number of **Appendices** then follow the concluding chapter. The underlying philosophy has been to include as appendices the important documents presented to the sponsoring organisation as part of the project (where confidentiality considerations permit) and to use the thesis chapters to provide narrative to link these documents, explaining the broader issues which emerge and summarising the contributions to knowledge which can be made. It is felt that by incorporating such documents exactly as submitted within the sponsoring organisation, useful insights can be made into the practice of product planning. This occasionally introduces aspects of layout, style, vocabulary and presentation into the Appendices which are at variance with those in the body of the thesis. It is strongly felt however, that to alter the Appendices to harmonise with the body of the thesis would reduce the utility of these documents.

Finally, it remains to be said that the computer business and its technologies move exceedingly fast, and that what is a novel thought or insight one day soon becomes common knowledge, and that what is a product distinction one day, soon becomes almost a product prerequisite for competing products. Hence the contents

of the technical chapters of this thesis should be read with regard to the state of the development at the time the events took place, not necessarily at the time the thesis is read. Indication of the timing of events is given, where appropriate.

CHAPTER TWO

THE BACKGROUND TO THE PROJECT

2.1 THE ORGANISATION

- 2.1.1 Ferranti PLC
- 2.1.2 Ferranti Computer Systems Ltd.
- 2.1.3 Wythenshawe Division

2.2 THE BUSINESS

- 2.2.1 The Systems Business
- 2.2.2 The Desire for Growth
- 2.2.3 Standard Products

2.3 THE PROJECT

- 2.3.1 The PT7 Product
  - 2.3.1.1 Its Origins
  - 2.3.1.2 Its History
  - 2.3.1.3 Its Life Expectancy
- 2.3.2 The Telex Manager Product

2.4 CHAPTER SUMMARY

This chapter provides background information regarding the sponsoring organisation, its business, and the principal products which influenced this project. This information provides a reference for the understanding of subsequent chapters.

2.1 THE ORGANISATION

The work described here was performed under the auspices of the Wythenshawe Division of Ferranti Computer Systems Limited, referred to subsequently as "the organisation". Ferranti Computer Systems Limited is a wholly-owned subsidiary of Ferranti PLC, which is also the parent company of a number of other subsidiaries which operate in various areas in the field of Electronic and Electrical Engineering. This section describes the structure of the Ferranti company and the position of the organisation within this structure.

2.1.1 Ferranti PLC

Ferranti PLC is a publicly quoted engineering company with a 1981/82 turnover of £271.5 million, based mainly in the UK and employing over 18,000 people. Ferranti PLC is the holding company for a number of wholly owned subsidiaries operating autonomously in a number of different market areas. The parent and main subsidiary companies are shown on Figure 2.1.

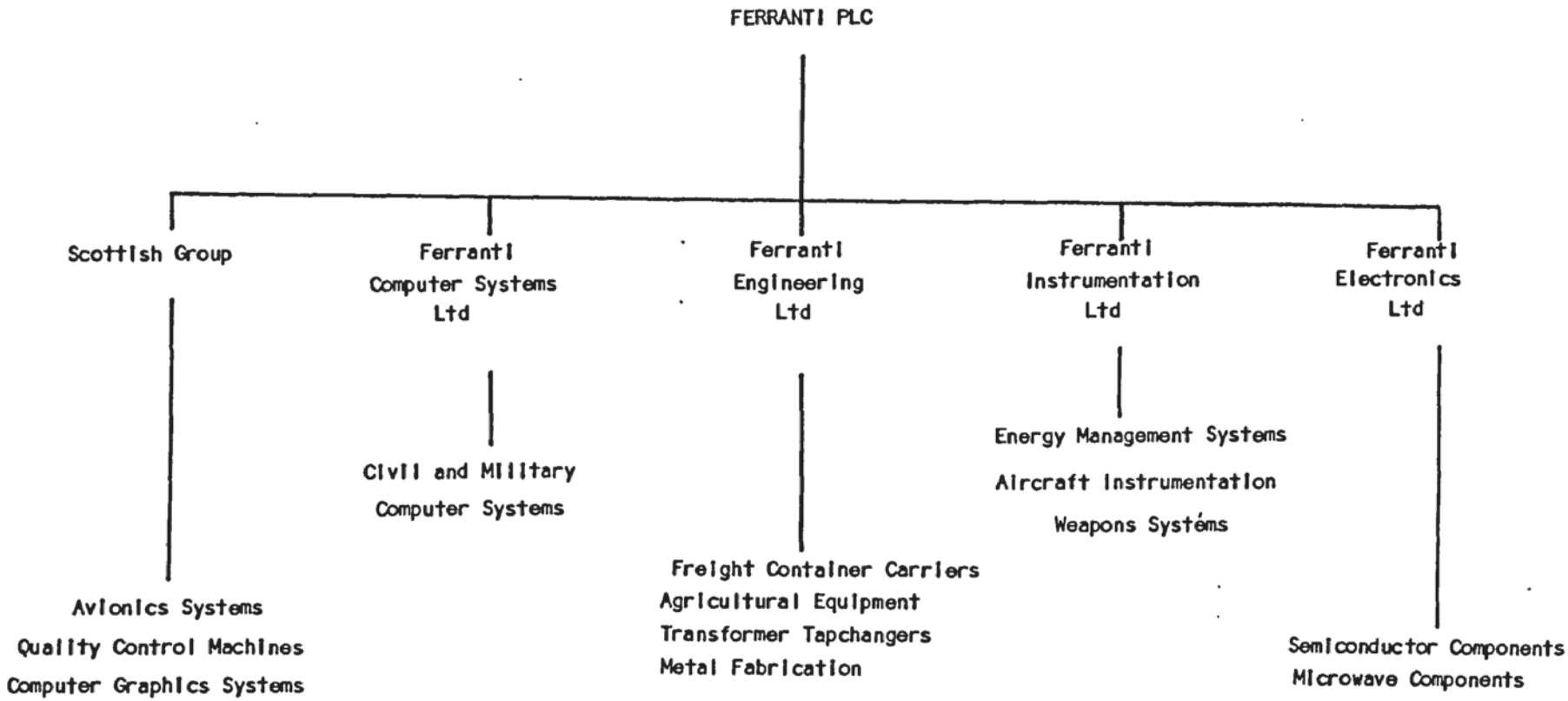

FIGURE 2.1 Ferranti PLC and Subsidiary Companies

2.1.2 Ferranti Computer Systems Limited

The history of the subsidiary company now known as Ferranti Computer Systems Limited can be traced back to 1948 when the Manchester based Ferranti Limited manufactured one of the world's first computers, in collaboration with research workers at the University of Manchester. In the following years, the Ferranti interest ranged over most aspects of computing.

In 1963 the company's commercial computing interests were transferred to International Computers Limited (ICL) and since then, the company's emphasis has been on real-time, on-line computer systems for civil and defence applications. The 1981/82 turnover of Ferranti Computer Systems Limited was over £100 million, and the company employed more than 5,000 people.

The Company is organised into three largely independent operating divisions as shown in Figure 2.2. Bracknell Division concentrates wholly on military computer applications for the navy and airforce. Cheadle Heath Division produces computer systems for fire service and police applications, sonar data handling and anti-submarine warfare trainers. Wythenshawe Division represents the civil interests of the company and is the organisation within which the work reported here was undertaken. The Division and its business are described more fully later.

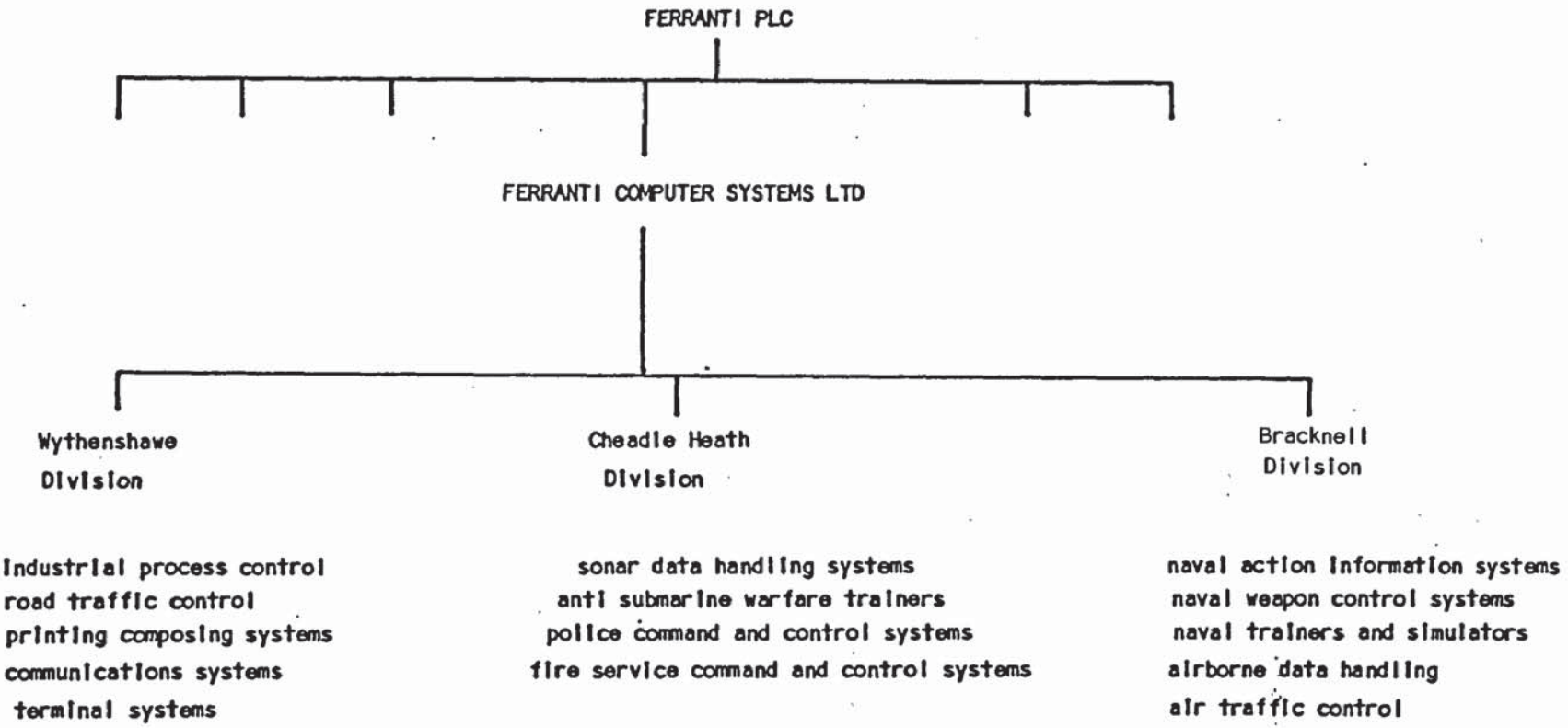

FIGURE 2.2 The Structure of Ferranti Computer Systems Ltd

The operating areas of the three divisions can be seen to be largely independent, although the companies are linked by their common use of the Argus range of computers manufactured by Wythenshawe Division. Thus, within the disciplines of the FCSL board of directors, the divisions seek out and exploit their own markets.

2.1.3 Wythenshawe Division

Wythenshawe Division, representing the civil application interests of Ferranti Computer Systems Limited, is based in South Manchester, employs over 1,700 people and had a 1981/82 turnover in excess of £26 million. As mentioned above, it manufactures the Argus range of computer systems for its own use and that of the other two divisions, and finds application for them in the areas of:

industrial process control;
road traffic control;
printing composing systems;
communication systems;
and computer terminal systems.

Further details of this business are described in the next section.

The division is organised as shown in Figure 2.3, with eight operating departments reporting to the Divisional Manager. The work described here was performed under the auspices of the Market Planning Group which reports to the Marketing Manager, and whose

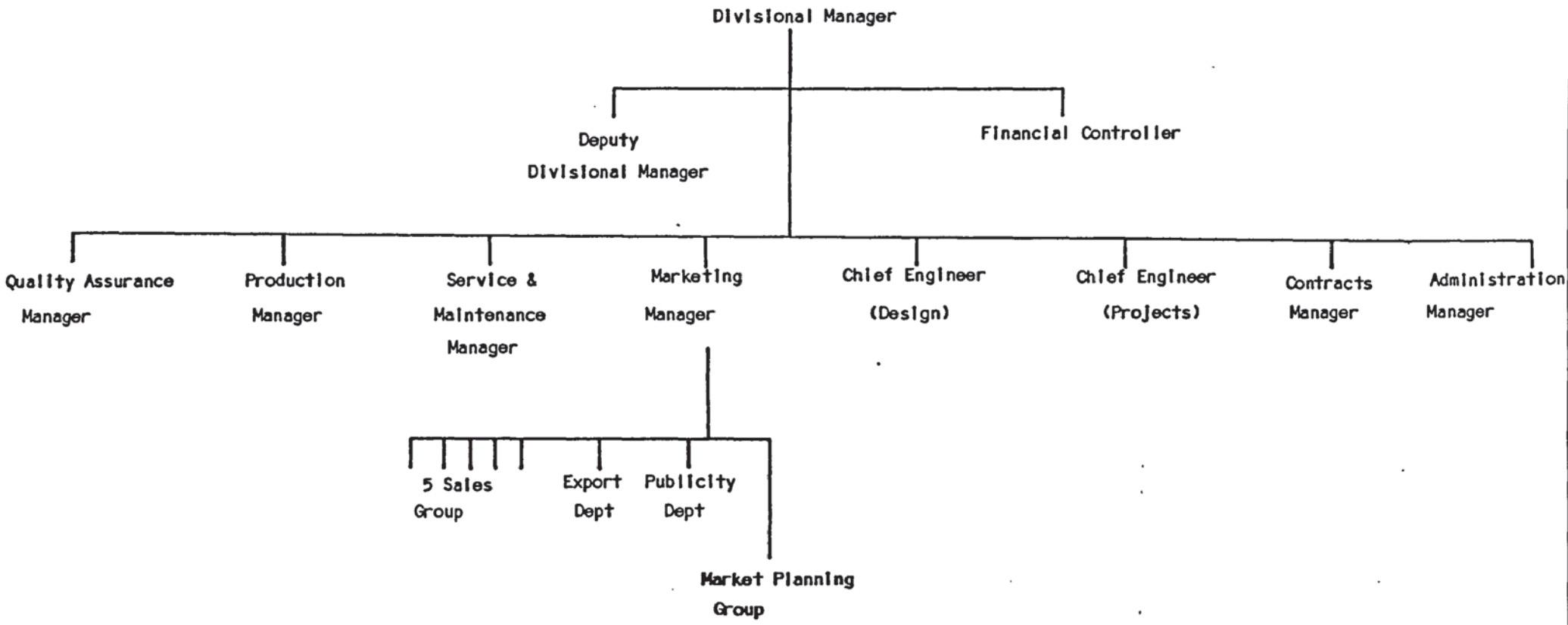

FIGURE 2.3 The Structure of Wythenshawe Division

responsibilities include the search for new product areas and assessing the marketing aspects of the continuation of existing product areas. This work involves close liaison with all departments, but particularly with the Sales and Design Groups.

2.2 THE BUSINESS

As noted above, in the years preceeding this study, a substantial part of the turnover of the organisation was accounted for by the Automation Systems Department or "Systems Business" as it was and is known.

2.2.1 The Systems Business

The two main elements of the Systems Business are:

(i) the design and manufacture of standard minicomputer hardware and software, comprising processors, stores, peripheral equipment, digital and analogue input/output systems, operating systems, language compilers and program development software;

(ii) the provision of hardware and software skills and effort to configure the hardware, and write special software to customer specification so as to "tailor" the standard products for individual customer applications, e.g. power station control and supervision, or urban traffic control.

These two main elements were accompanied by customer support, service and maintenance, and customer training functions, all of which produced revenue in their own right, but were ancillary to the two main elements described above.

Furthermore, whilst the standard hardware and software of (i) above were sold to other organisations inside or outside the Ferranti group (these organisations operating as OEMs -see glossary) the major part of the organisation's income was represented by the customer specific "tailoring" or "project work" described in (ii)- Figure 2.4 shows the relative importance of these revenue components in a typical year.

Thus it can be seen that with the Systems Business as the most important of its revenue earning activities, the organisation existed to sell its specialist skills in computer hardware and software to other organisations who could identify a need within their own establishments and for which they could produce a specification, but not a solution, from their own resources. This is not a business organised around standard products designed and supplied to perform specific functions for a large number of customers, but one which concentrates on a highly visible set of technologies and skills aimed at providing individual solutions to unique problems where no mass solution existed. The advertising to support this business did, and still does, emphasise the technology and skills of the company.

The organisation developed skills in certain specialist application areas such as industrial process control, urban traffic control, electricity generation control and airline booking systems. In addition, being

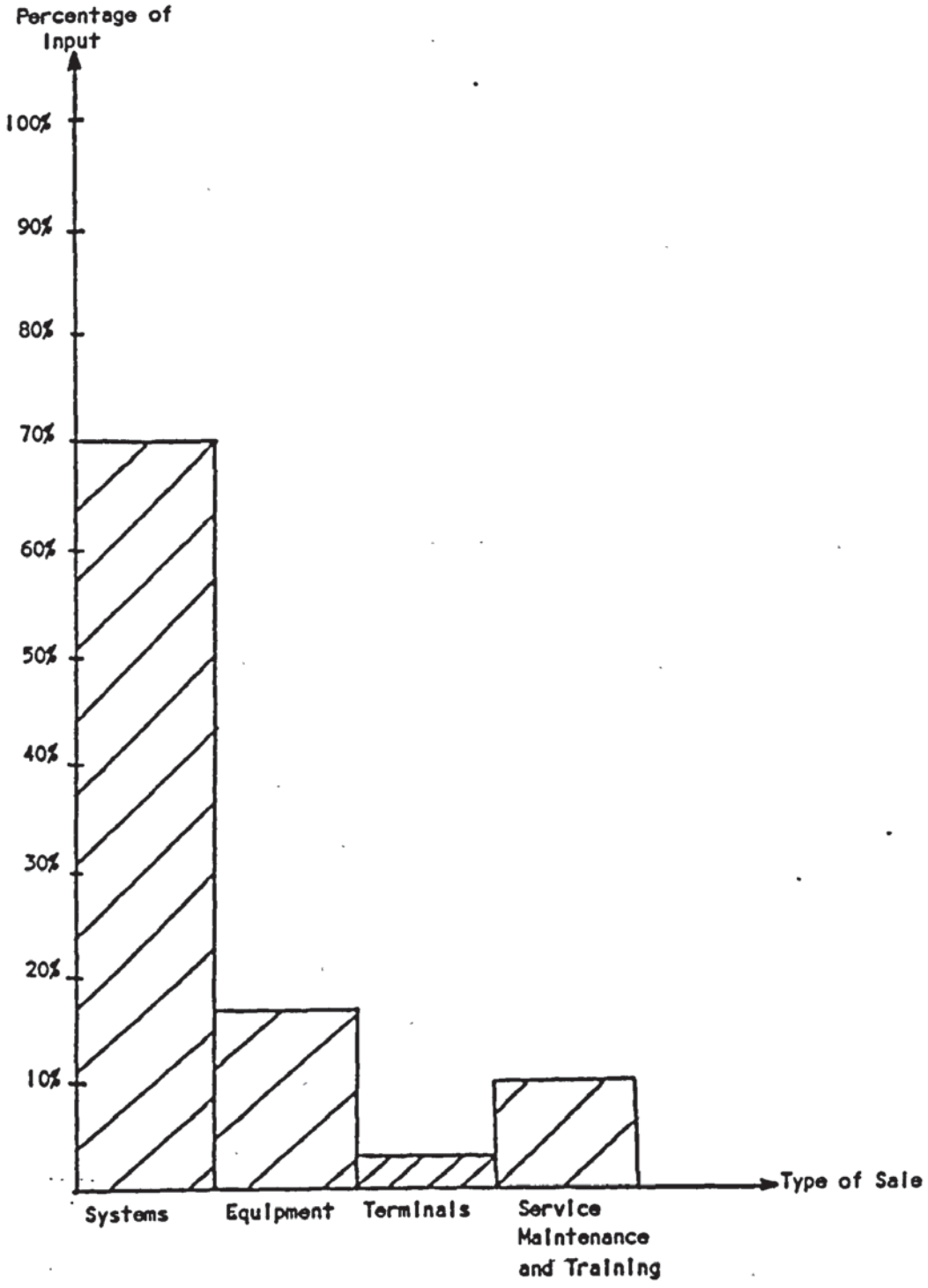

FIGURE 2.4 Sources of Revenue 1975/76

a native UK supplier, it nurtured close associations with central and local government authorities and nationalised industries, so as to be well placed to receive business in new areas.

The modus operandi of the Systems Business is summarised in Figure 2.5 in an idealised form - there will obviously be deviations from this sequence to accommodate the requirements of individual customers and projects. However, in general, it can be said that following the issue of the invitation to tender, an iterative process can be observed involving a Sales Engineer as principal customer contact, but also Project Management, Hardware and Software Design personnel, Contracts and Manufacturing personnel. They refine the customer's specification (which would be expressed in terms of his needs - eg. the control of an oil platform or a gas pipline) into a form identifiable with the hardware and software products of the organisation or (in the case where such hardware and software did not exist) to produce a specification for special-to-project items which could be costed for the tender and manufactured, should the tender be accepted.

On acceptance of the tender, the project then proceeds in two parallel forms

(i) the manufacture of the standard hardware (along with the design and manufacture of any special-to-project hardware) and

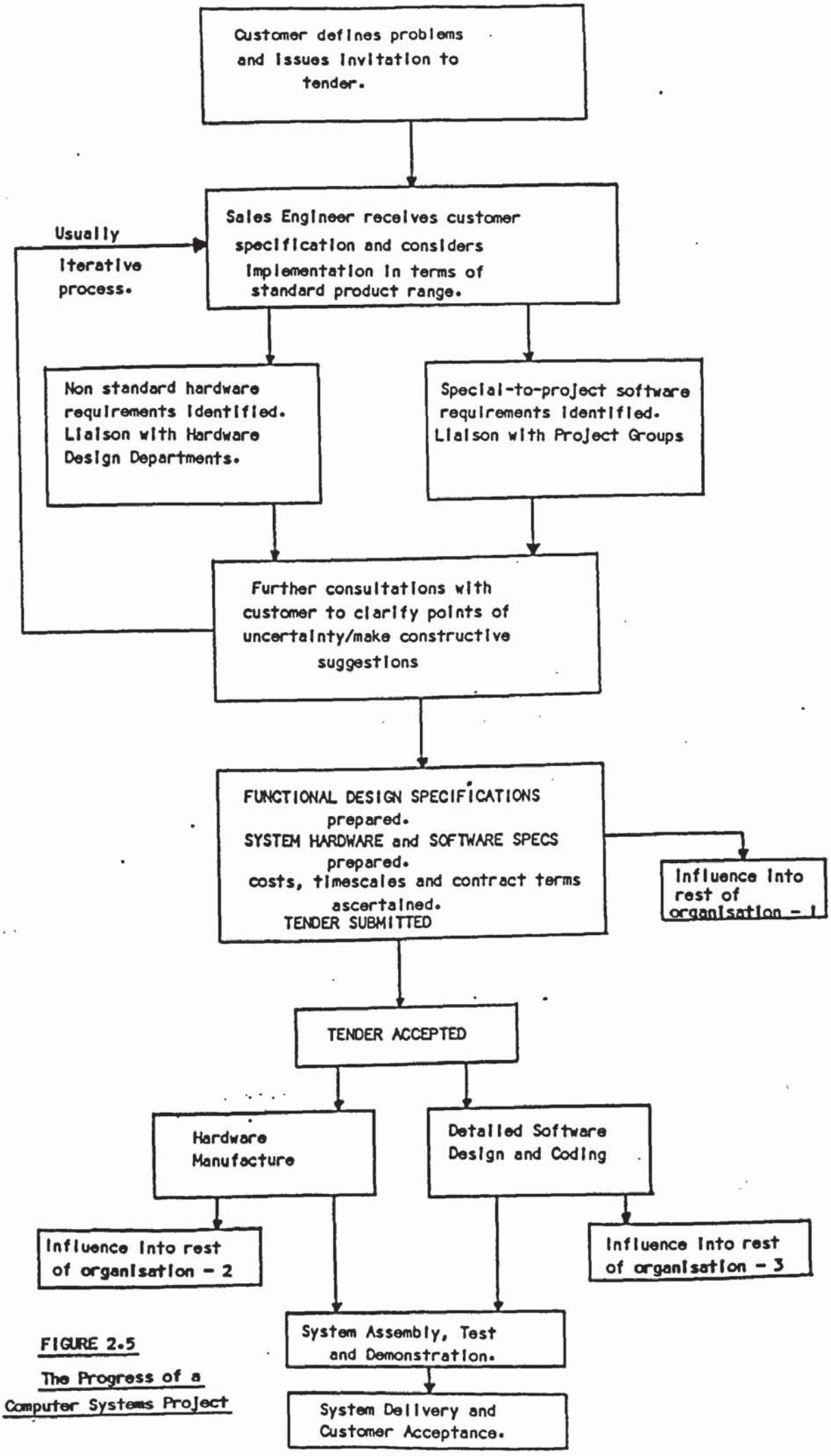

FIGURE 2.5

The Progress of a Computer Systems Project

(ii) the design and coding of the application software around a nucleus of standard operating system software and using the tools of the program development software.

At the stages of preparation of the Functional Design Specification, and Hardware and Software Design, the requirements of the customer organisation have maximum influence on the rest of the organisation. The customer's requirements are considered in the light of the organisation's existing product range, or new components are designed with a view to maximum reusability in other projects and incorporation into the catalogue. This goes some way towards explaining the high number of new product suggestions which were sponsored by both Sales and Design departments (see section 3.3.2). After assembly and testing of the project hardware and software, the system could then be demonstrated to the customer and subsequently delivered to site, recommissioned, tested and handed over to the final users.

2.2.2 The Desire for Growth

In the latter years of the 1970s the organisation sought to expand its business along with the general expansion of the computer industry. For many reasons, however, the Systems Business was not able to satisfy this expansion:

- nationally, there was a shortage of skilled programming staff;
- programming costs increased (partially as a result of this shortage), thus increasing the cost of tailored application systems;
- the organisation's principal customers in the public sector had to cut back on expenditure owing to national revenue constraints;
- more competitors entered the market, operating as "software houses", not owning manufacturing facilities, but buying in computer hardware principally from foreign manufacturers.

Thus the organisation sought to expand by attempting to develop "packaged products" - application-based computer systems differing from the Systems Business in that both hardware and software configurations were largely standarised so as to be able to be resold in a number of applications, thus,

- reducing delivery times;
- reducing development requirements;
- containing manufacturing costs (particularly software);
- producing repeated revenue from one software development.

This diversification is shown in Figure 2.6, in which the decreasing proportion of Systems Business input is represented. It should however be emphasised that this was a process of expansion. Whilst the proportion

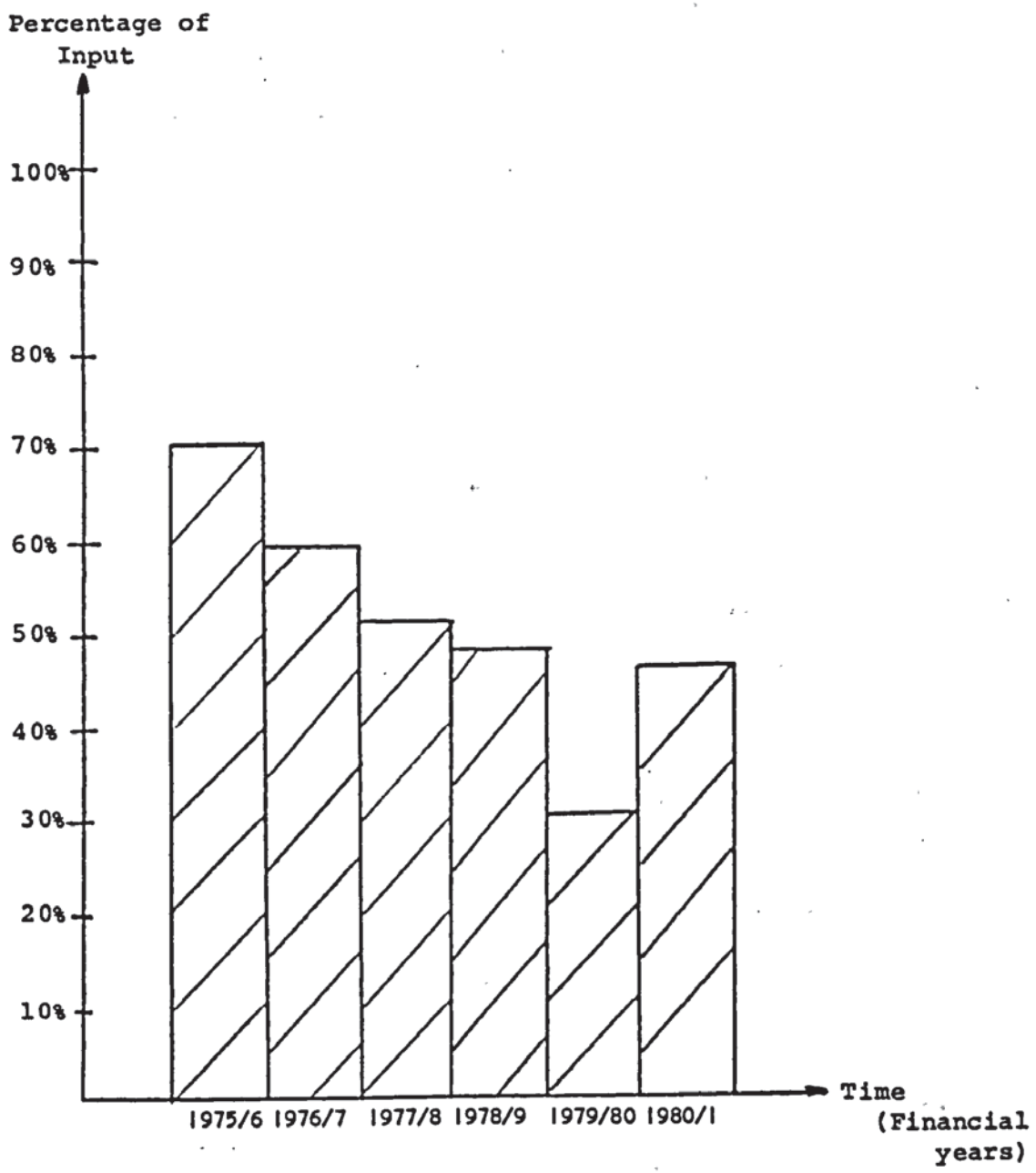

FIGURE 2.6 Decline of the Systems Business as a Proportion of Input

represented by the Systems Business decreased, the overall absolute value of the Systems Business taken on by the organisation, in fact, increased.

The very low figure of 1979/80 was somewhat of an abberration in that a very low level of Systems Business was secured in this year. However the general, less dramatic downward trend can be seen to continue in the figure for 1980/81.

2.2.3 Standard Products

The diversification into standard "packaged" products was born of a desire to expand the business in line with the general development of the computer industry. The Systems Business on its own was not able to support this expansion, in addition to which, increases in the cost of the labour-intensive process of computer programming led to an increasing dissatisfaction with the long delivery times and high cost of the individually "tailored" system type of solution to customer problems.

It was attractive to both supplier and customer that products should be developed which were able to frequently reuse the software and special-to-project hardware.

The following standard products were developed by the organisation, all based on standard Argus hardware and (more importantly) reusable software:

PT7 - a range of clustered, programmable computer terminals which could be used as input and output devices to IBM and ICL mainframe computers.

CS7 - a computerised composing system facilitating the preparation of text for input to a phototypesetter used by newspapers and general printers.

The Delphi Phoenix Laboratory Record and Analysis System which facilitates the automation of the recording and analysis of data in a pathology laboratory.

The organisation also began to distribute Videodata - a cabling system sold under license from an American company; the system employs wide bandwidth coaxial cable and associated modems using frequency or time division multiplexing techniques to provide a more cost effective method of signal distribution when compared to conventional multicore cabling.

Furthermore, the organisation developed PMS (Process Management System) a suite of configurable software designed to reduce substantially the time taken to prepare the special-to-project software used in the process control element of the Systems Business.

Figure 2.7 shows the growth of the above mentioned standard products, and the way in which the proportion of the organisation's turnover represented by these products increased (PMS is excluded from this analysis since it is not principally sold as a product, but is a tool to assist the Systems Business shown in Figure 2.6).

It can be seen from Figure 2.7 that these standard products grew from an aggregate of 2% in 1974/5 (when PT7 was the sole product) to an aggregate of 23% in 1980/81 following the introduction of the other products at various times over the intervening period. During this period, the organisation's turnover was more than doubled, demonstrating the success of the policy of expansion by diversification into new and repetitive business areas.

During the course of the current study, this process was continued and the author participated in the process, both in refining and extending existing product lines (particularly PT7) and also in the identification of new product areas.

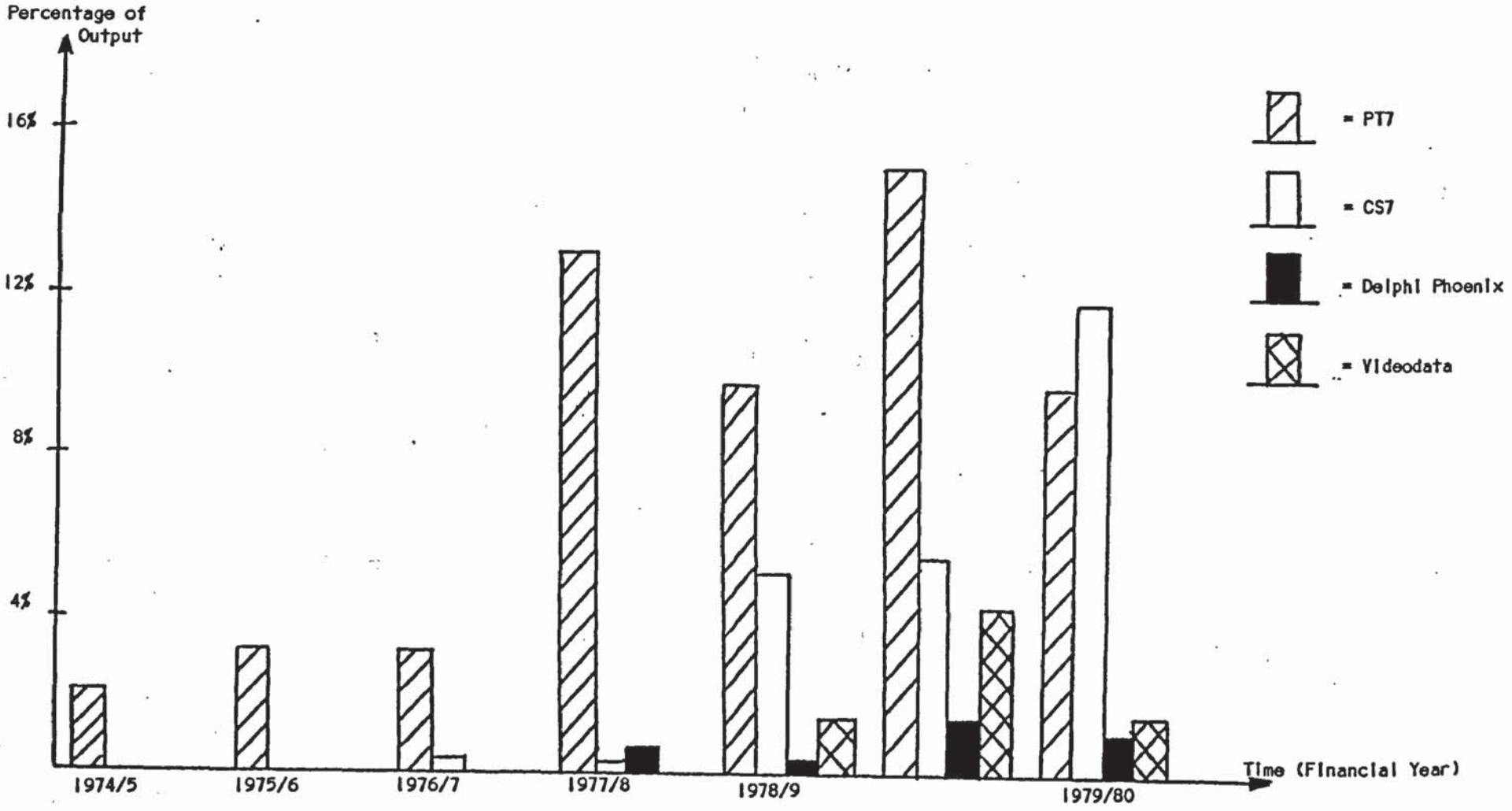

FIGURE 2.7 Growth of Standard Products as A Proportion of Output

2.3 THE PROJECT

The project brief which was presented to the author at the outset of the project is contained as Appendix A. The organisation had recognised that one of its major standard products, PT7, was nearing the end of the life expectancy of its current design and that a study was required to define the requirements of the next-generation design which would continue the product name and business sector into the future. This study is the basis of the work reported here, and this thesis presents the lessons learnt by the researcher as a result of pursuing the study. In addition to the specifics of this particular product study, the project also presented the opportunity to study in depth the process of industrial product planning, and in particular the sources of ideas for new industrial products and the applicability of market research methods. The findings of this study are presented in Chapters 3 and 4.

The two subsequent sections of the present chapter provide background information on the product "PT7", describing its development up to the beginning of the project, and also the product "Telex Manager" which was in development at the start of the project, but which was launched onto the market during the final stages. Although the project was initially intended to investigate a replacement for the single product PT7, it will be seen that the findings of the study indicated the

requirement to broaden the scope of the product to become a component of a wider range of Office Products (Chapter 5). The Telex Manager product would become another component of this range, and references are made to it at various points in the narrative. The opportunity is taken here to describe briefly the function of the Telex Manager product as background for the subsequent references.

2.3.1 The PT7 Product

The PT7 product, as it was at the beginning of the project, is described in detail in Appendix B. In summary, it is a clustered computer terminal system for connection to ICL and IBM mainframe computers and is sold as an alternative to the terminal systems provided by the mainframe suppliers. The product is sold in a range of configurations, starting with a direct, plug compatible (PCM-see glossary) equivalent to the mainframe supplier's terminals (known as the emulator-level product) and extending to models comprising improved features when compared to the competition (features such as support of a larger number of terminals in any one cluster, provision of more local disc storage, or local programmability).

2.3.1.1 Its Origins.

The history of PT7 can be traced back to the late 1960s and the organisation's early business in producing single visual display unit terminals. The organisation was awarded a contract by a major airline company to develop a clustered terminal system for use with that airline's computerised seat reservation system. Thus the origins of what became the organisation's first standard packaged product can be seen in its Systems Business, and its association with advanced computer users whose requirements could not be met by other products available at that time. This theme is pursued more deeply in Chapter 3.

2.3.1.2 Its History

The major events in the product history are summarised in Figure 2.8. In the late 1960's, the organisation was established as a supplier of stand-alone VDU products. As a result of this business and its computer expertise, it was approached to supply clustered VDU terminals for the Airline Company, as mentioned above. Having supplied terminals to this contract for a number of years, the organisation decided, in mid 1973, to expand its market and to sell clustered terminals as "plug compatible" competitors to ICL and IBM products, the market leaders in the UK. This resulted in

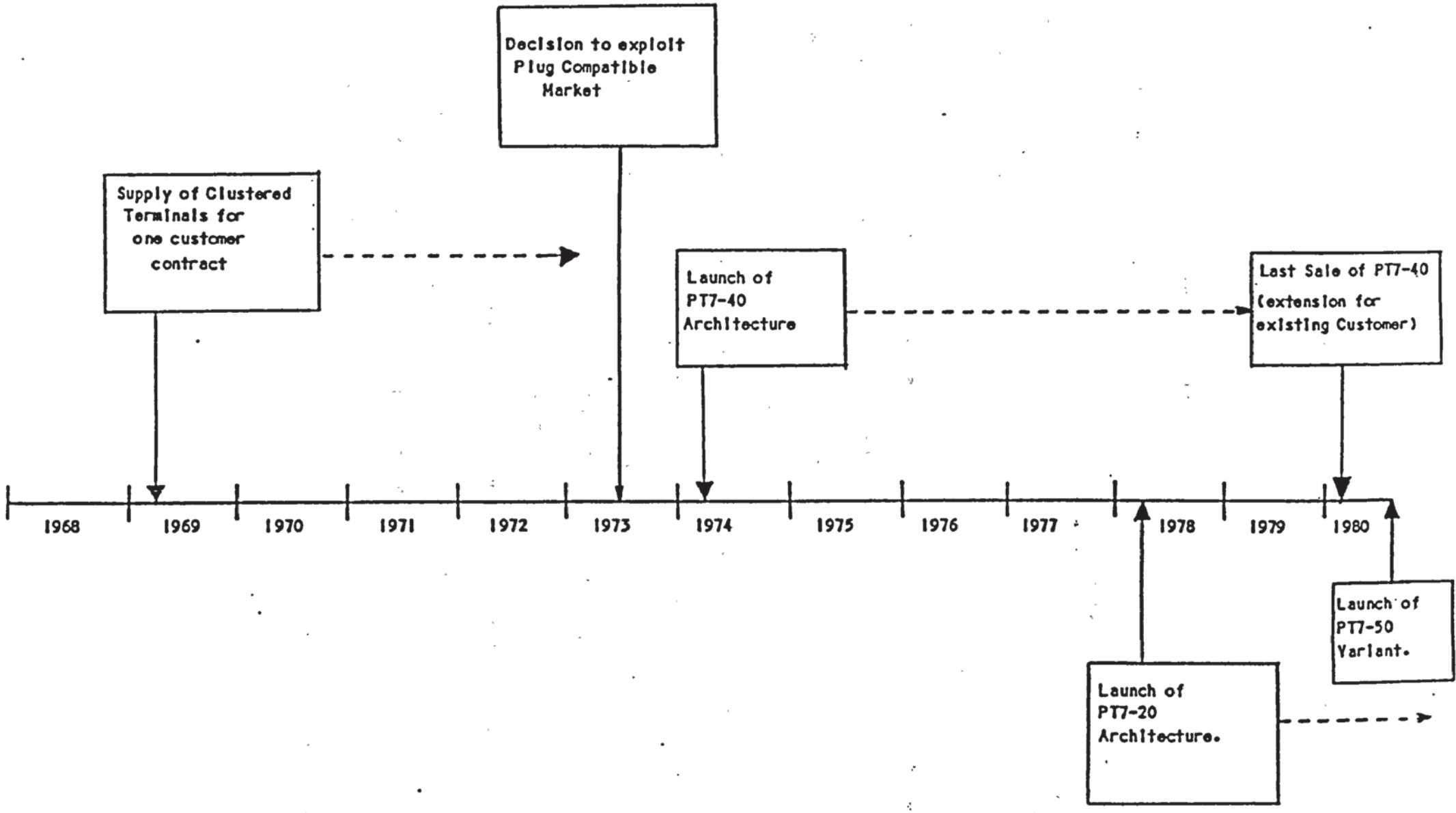

FIGURE 2.8 The History of the PT7 Product

the launch of the PT7-40 range of products in 1974, based on new designs which took advantage of newly available hardware.

The PT7-40 range was sold for a number of years with the final delivery being in early 1980. The later deliveries of these products, however, were restricted to extensions to earlier contracts from existing PT7-40 users, since technical advances and competitor action had resulted in the launch of a new range of PT7 products known as the PT7-20 range. This was a product redesign based on newly available hardware, designed to restore the (by then) flagging financial performance of the elderly PT7-40 architecture. The PT7-20 range was the product which was being actively marketed at the outset of this project in September 1979, although a version to be known as the PT7-50 series was in development and due for launch in mid 1980. The PT7-50 series, however, was not a major redesign, it was a range extension based on the same architecture and similar hardware and was intended to increase the number of terminals able to be clustered onto any one controller, and to increase the amount of storage available to any one cluster. The product philosophy and hardware and software architecture would, however, remain unaffected.

2.3.1.3 Its Life Expectancy

At the outset of this project, in September 1979, the PT7 product was established as a worthwhile business area for the organisation and was expected to have long term potential, but would require periodic redesign of the hardware and software. Thus it was obvious to the organisation that it should look ahead to the requirements of the next generation of the product.

The previous history of the product's relaunches in 1974 and 1978 suggested that each product generation appeared to have a life expectancy of four to five years, and that if this were so for the PT7-20 range, then the next generation would be due around 1983. This timescale matched well with the Interdisciplinary Higher Degree Scheme, and the project described in this thesis was commissioned.

It is interesting that a new generation of competing product was launched in mid 1982, at the same time as this project was drawing to a close and Office Products Proposal was being submitted (Chapter 5), thus emphasising the four to five year life expectancy of each product generation.

2.3.2 The Telex Manager Product

The Telex Manager Product was designed for organisations using three or more telex lines. It was intended to reduce the number of telex lines required to support a given level of telex traffic by separating the processes of telex preparation and telex despatch, which were closely linked on conventional telex terminals.

The process of telex despatch was improved by eliminating the need for noisy and messy paper tape punching and substituting neat and quiet VDU terminals which provided text editing facilities to improve further the preparation of correct telex messages.

Up to ten VDU terminals were clustered onto one microprocessor-based controller which provided the interface to the telex network. Once a telex message had been prepared at a VDU terminal, the controller took over responsibility for the despatch of the message, freeing the operator to continue preparation of the next message. The controller automatically dealt with the processes of establishing the telex connection, retry if line busy, telex despatch, despatch at specified time, and priority messages. The controller also automated the process of receipt of telex messages, accepting telexes from the network and storing them until retrieved by the operator.

The product was launched in September 1981 as a precursor to the organisation's range of "Cost Justified Office Products", part of its publicity material explaining how the product could pay for itself in one year in organisations with an annual telex bill of over £15,000.

2.4 CHAPTER SUMMARY

This chapter contains background information useful to the understanding of subsequent chapters. It describes the sponsoring organisation and the position within this organisation from which this work was performed. It describes the nature of the business of the sponsoring organisation, its historical emphasis on "tailored" computer systems to the specification of individual customers, and its more recent moves to diversify into standard packaged products.

One such product was PT7 which formed the major concern of the project described here - the pursuit of a feasibility study to identify the requirements of a new generation product design. The function, origin, history and life expectancy of this product are described. The chapter ends with a brief description of the Telex Manager product which was in development at the start of this project and launched towards the end. Although it was originally envisaged as a separate business area, it became apparent as the project progressed that the development of PT7 and Telex Manager would converge into one range of Office Products. Background information on the Telex Manager product is presented to support references made at various points in subsequent chapters.

CHAPTER THREE

THE IDEAS FOR EXISTING PROJECTS

3.1 THE LITERATURE

3.2 DATA

3.3 ANALYSIS

- 3.3.1 Analysis of New Product Suggestions by Reason.
- 3.3.2 Analysis of New Product Suggestions by Sponsoring Department.
- 3.3.3 Analysis of the Origins of Independent Business Segments.

3.4 DISCUSSION

- 3.4.1 The Nature of the Technology.
- 3.4.2 The History of the Organisation.
- 3.4.3 The Requirement for Skills Not Available to the Originating Organisation.
- 3.4.4 Reduction of Development Costs and Lessening of Risks.
- 3.4.5 The Reference Installation.
- 3.4.6 Results of this Mode of Operation.
- 3.4.7 The Nurturing of this Idea Source.

3.5 CHAPTER SUMMARY.

This chapter analyses the origins of the ideas for the organisation's existing products. In contrast with most of the rest of the literature, von Hippel has shown the existence of a Customer Active Paradigm for new product idea generation. The analysis presented here shows that such methods can also be observed in this case.

The chapter goes on to describe why the CAP is suited to the cases described, and presents some results of this mode of operation.

3.1 THE LITERATURE

The literature of new product planning emphasises the responsibility of the manufacturer to control the processes by which new product ideas are generated (see, for example, Kotler 1976, chapter 10; Pessemier 1977, chapter 4; Carson and Richards 1979). Broadly, ideas are described as originating from the spontaneous creative or R & D flair of the members of the organisation, or by deliberate and often systematic search exercises involving employees or existing and potential customers. Many techniques have been developed to assist in this process. Sands (1977) lists such methods as brainstorming, synectics, attribute listing, transfer analysis, morphological analysis, benefit structure analysis and cojoint analysis.

These techniques generally found first application in consumer markets and are associated with the "marketing concept" which is defined by Kotler (1976) as:-

"a management orientation that holds that the key task of the organisation is to determine the needs, wants and values of a target market and to adapt the organisation to delivering the desired satisfaction more effectively and efficiently than its competitors".

Proposals to apply them to industrial marketing are generally supported by such studies as Project SAPPHO (Achilladelis, 1972; Rothwell, 1974) and Project NEWPROD (Cooper 1979). These studies investigated the correlation between a number of factors and the success or failure of new product ventures. They found that following factors were highly correlated with success:

"a fuller and more imaginative understanding of user needs";

"product met customer needs best";

"supplier knew customer needs, wants and specification".

The implication is that any organisation seeking new product opportunities must take control of the process by use of the techniques mentioned above. Whilst some techniques such as brainstorming, technology forecasting and Delphi panels (all of which, it should be noted, can be used internally to the organisation) have been widely used in industrial product planning, many of the more

involved techniques involving customer participation have remained largely within the consumer sphere as witnessed by the examples used to illustrate such techniques (eg Doyle 1972, Green 1975, Myers 1976, Wind 1973).

In intriguing contrast, however, to this "conventional wisdom", there is a body of knowledge (von Hippel 1976, 1977, 1982, Utterback 1971) which demonstrates that in certain markets, it is the customers, not the manufacturer who is active in defining new product need, and, more importantly, specification. Von Hippel has shown that the specialised needs of advanced technical organisations using Semiconductor Process machinery, Electronic Subassembly Manufacturing Equipment and Scientific Instruments have resulted in user organisations specifying (and sometimes building) prototype equipment to satisfy their needs, before approaching manufacturers to build these products to production standard - the manufacturers then going on to adapt these devices for a wider market. He has further shown, from examining published literature, that evidence exists to support the existence of similar practices in the chemical and process plant manufacturing industries.

Recently (1982) he has also shown that it is possible for suppliers in the bakery and packaged software industries to nurture users as a source of new product ideas either by organising a national ideas competition

(confectionery) or coordinating the marketing of externally developed programs (software).

It will be seen that this "Customer Active Paradigm" (von Hippel 1978) of new product idea generation does not necessarily conflict with the result of projects SAPPHO and NEWPROD referred to above, and arguably provides a new insight into how such "Customer need information" can be obtained as an attempt to assist in the sucess of the new product. Furthermore, additonal analysis of the results of project NEWPROD shows that whilst the factor

"Product met customer needs best" is highly correlated with product success, the factors

"Detailed Market Study or Market Research" and "Preliminary Market Assessment" are somewhat less well correlated. In other words, whilst it would appear that it is very necessary for a product to meet user needs in order to succeed, it is less necessary for a supplier to actively canvass user opinion. It would, of course, be a very wasteful hit-and-miss process to launch a new product with no guide to user needs. Von Hippel's work shows that other methods exist to obtain such guidance without embarking upon detailed market studies at the instigation of the manufacturing organisation. Furthermore, his work shows that customers can be more than just a source of new product ideas (as is mentioned in other literature, eg Kotler 1976), in that they can also be observed to provide quite detailed specifications, and sometimes even prototypes.

The rest of this chapter will be devoted to a demonstration that the "Customer Active Paradigm" of new product idea generation can be observed to have operated extensively in the organisation in the period up to thisstudy. A discussion will also be presented of why this should be so and what are the benefits and attractions of this mode of operation. In the next chapter, the limitations of the method will be explored, and the Customer Active Paradigm will be contrasted with "Manufacturer Active" methods in terms of applicability in different circumstances.

3.2 DATA

Since 1973, FCSL had operated a New Products Committee (comprising senior Divisional and Departmental Management) which formally assessed New Product Suggestions in order to assign funds and resources to those ideas which showed most promise. The formal submission documents have changed in format a number of times over the years but sufficient information has always been present to establish (in retrospect) the basis of the idea, its sponsor(s), the department in which it originated, and the reasons why it was proposed.

Furthermore the minutes of the New Products Committee Meetings were available to examine the support given to these suggestions from other departments; it was possible to speak to many of the people involved (most of whom were still employed in the organisation) to clarify areas of doubt; and finally, the author's participation in some of the supporting activities in the latter years gave further insight.

The combination of information from all the above sources permitted the following analysis to be made. Similarly the discussion following the analysis is founded on the experience of the participants along with the author's own insights.

3.3 ANALYSIS

The New Product Suggestions studied varied considerably. They requested large and small amounts of money and resources, suggested new component modules and high level application areas, and requested both actual developments and feasibility studies. However each NPS represents an idea, formalised to a high degree, and if all such NPS (approximately 250) submitted between 1973 and the end of 1981 are considered, then it is possible to analyse the reasons behind the submissions according to the nine categories in Figure 3.1. The titles of these categories are the author's summaries of the reasons cited by the supporters of the New Product Suggestions.

Some NPS, were submitted for more than one reason, in which case those NPS are counted under each appropriate reason - thus the tabulation is of "the percentage of NPS submitted with this reason" rather than "the percentage of NPS submitted with this as principal reason".

Finally, it should be said that the NPS categorised below cover both product "increments" and completely new products. NPS resulting in totally new business areas are analysed further in section 3.3.3.

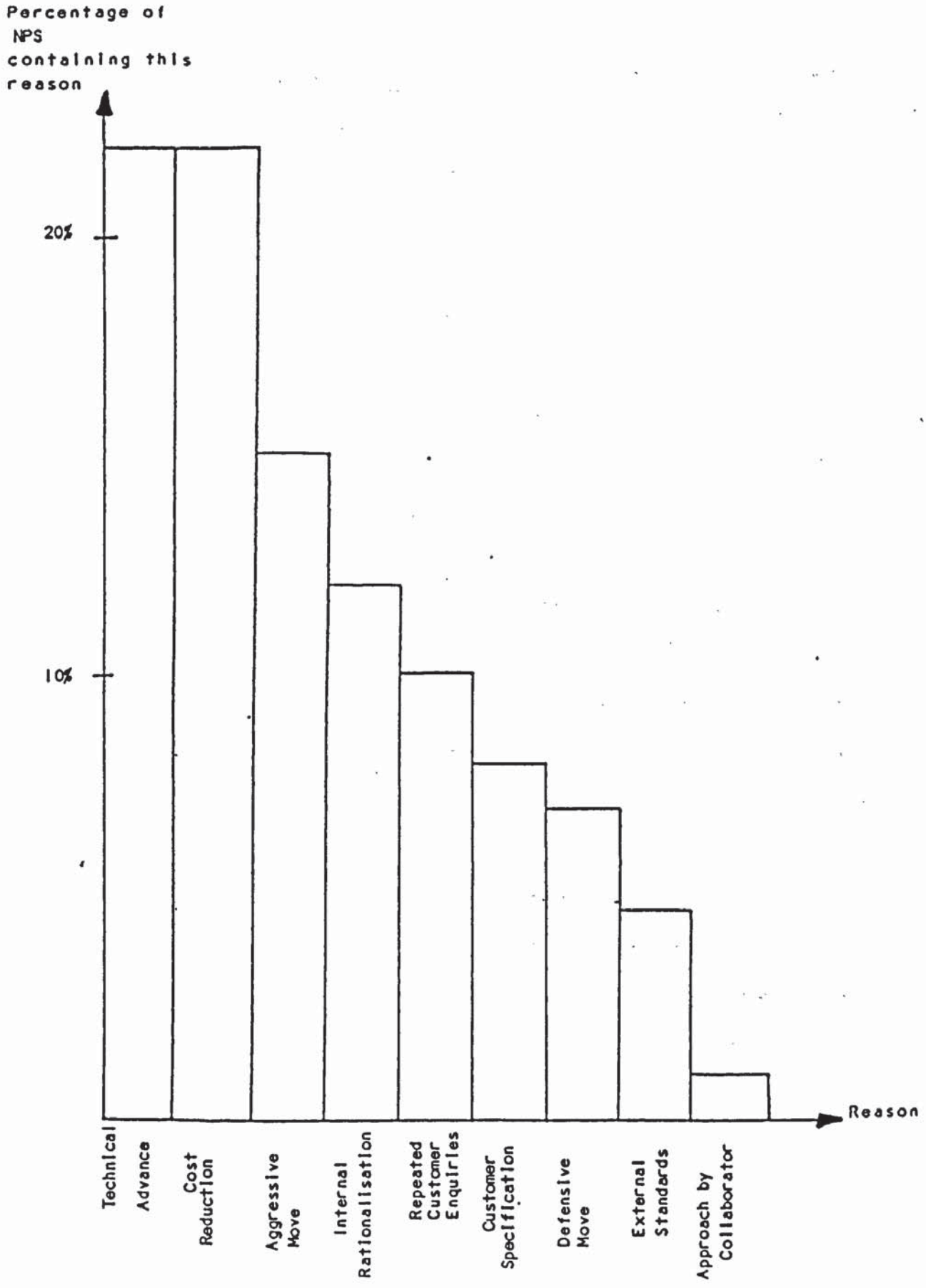

FIGURE 3.1 Reasons for Submission of NPS 1973-1981

3.3.1. Analysis of New Product Suggestions by Reason

A more detailed definition of the categories is given below.

3.3.1.1 Technical Advance: The NPS was submitted because an advance had been made either externally (eg bought-in components) or internally (eg better design) allowing a product or module to be bigger / smaller / faster etc where this could not previously be done economically. Also included are remedies to shortcomings of previous products or modules, and suggestions to improve safety.

3.3.1.2 Cost Reduction: The NPS was submitted because it was now possible to reduce the manufacturing cost of an item which already existed in the organisation's catalogue, because of the identification of cheaper components, better manufacturing techniques or similar factors. This type of suggestion did not necessarily alter the performance specification of the product concerned - it results in the existing performance being achieved at a lesser cost.

3.3.1.3 Aggressive Market Move: The NPS was submitted in order to provide features /

facilities which were in advance of competitive products, or at a lower price than competitors. Also included are suggestions to fill product line gaps, extend a product range up or down, moves into new product areas, or responses to competitive moves. The distinction between this category and a Defensive Market Move (3.3.1.7) is that these suggestions involve alterations to a product specification which result in the product being in advance of the competition.

3.3.1.4 Internal Rationalisation or Standardisation:

The NPS was submitted in order to adhere to a newly introduced organisational standard, or to cut down the number of items manufactured (rationalisation). Also included are the formalisation of items previously treated as special-to-project. The principal objective of this type of suggestion was to reduce the total number of items in the organisation's catalogue.

3.3.1.5 Response to Repeated Customer Enquiries:

The NPS was submitted because a number of customer enquiries had been recently received to which the sales force had been unable to respond.

3.3.1.6 Customer Request Containing Specification: A customer specification had been received for a custom project, the result of which appeared to have wider market potential.

3.3.1.7 Defensive Market Move: The NPS was submitted to respond to competitor moves which had reduced the organisation's market share. The NPS sought to restore that share but not necessarily provide features in advance of the competition (that would be an Aggressive Market Move, see 3.3.1.3).

3.3.1.8 Response to External Standards: The NPS was submitted either because a large existing customer had decided to standardise in some way on one type of product, or because national/international standards had been established which affect existing products.

3.3.1.9 Approach by Potential Collaborator: A small number of approaches were received from organisations seeking to collaborate in the manufacture of a new product.

There is obviously a degree of overlap between some of the above categories and where this occurs, the definitions seek to point it out and to explain the basis of assignment to one category or the other.

3.3.2 Analysis of New Product Suggestions by Sponsoring Department.

The New Product Suggestions can also be analysed as in Figure 3.2, according to the department(s) sponsoring the submission. In many cases it was possible to assign the idea to one department alone. However, just over one third of submissions were made as a result of co-ordination between the Sales and Design departments, either by a salesman seeking a technical assessment of his suggestion before submission or by a design engineer seeking advice on the sales potential of his suggestion before submission. The Sales and Design departments are brought into close association during the tendering phases of a systems project, and this would increase the likelihood of joint submissions arising out of the requirements of specific projects (see section 2.2.1 and Figure 2.5). It should also be noted that one of the functions of the Market Planning Group was to formalise this liaison and hence many of the submissions from this source could also fall into the above mentioned category, but it was not really possible to do this reliably, and hence all submissions from Market Planning Group have been grouped together.

3.3.3 Analysis of the Origins of Independent Business Segments.

There is one more interesting analysis which can be performed on the new product suggestion process, and it is

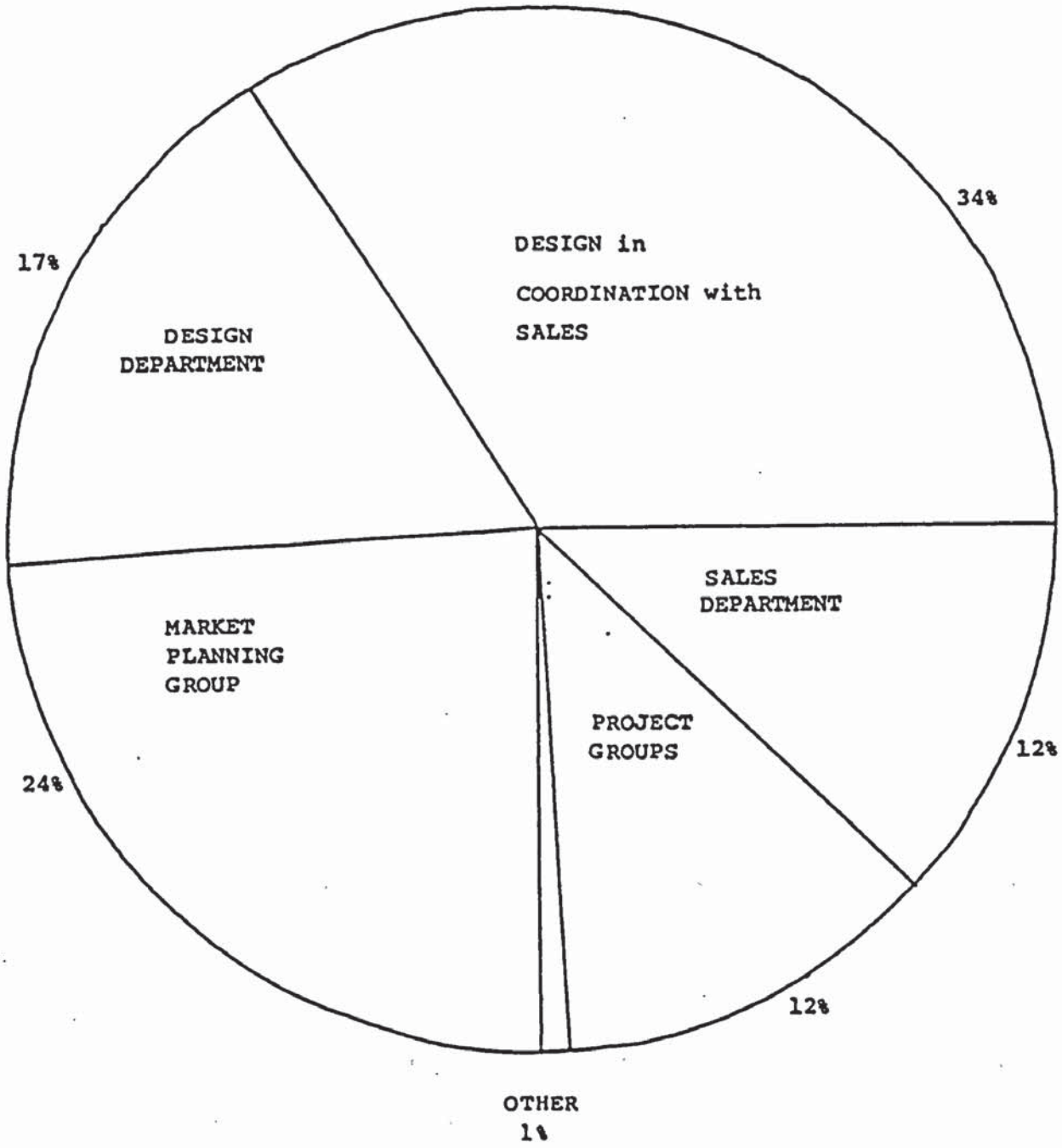

FIGURE 3.2 Sponsorship of NPS 1973-1981

this which is most telling. The NPS as analysed above contain ideas both large and small, ideas accepted and rejected and represent a mixture of competitive moves within existing market areas, new revenue opportunities, range extensions etc. It is possible to eliminate all ideas except those which resulted in new, independent product lines being offered to market. To define such new, independent product lines it is possible to use a definition of a business segment which derives from the analysis of the Boston Consultancy Group. The Group use the definition to separate the constituent business segments of an organisation, in order to analyse the strengths and weaknesses of that organisation's business portfolio.

We can define product lines as being independent "if it is possible to establish and defend a competitive advantage for that product alone without needing to participate in other related product areas".(Goold 1981 B)

Hence whilst the products PT7, CS7, Delphi Phoenix etc are all based on Argus Equipment, they are independent in the sense that it is possible to establish the PT7 product area without having to participate in the CS7, Delphi Phoenix, Videodata or (strictly speaking) Systems Business areas. Whereas it is not possible to define the product variants PT7-20 and PT7-50 as independent. (see Appendix B for an explanation of PT7-20 and PT7-50).

We can therefore define seven separate business areas at the time of the analysis, the five mentioned above in Chapter Two (Systems, PT7, CS7, Videodata and Delphi Phoenix) plus one product almost at the point of launch (Telex Manager) and one product in development (product A)

The Systems Business is the long established activity of the organisation and as described above, a desire to diversify from this base arose in the period preceding this project. It was possible to trace the development of such new "product orientated" business areas back to the original in-house event or "idea" which ultimately led to the development of an identifiably separate business segment. Whilst some of the longer established business segments have been subjected to changes of emphasis and direction, and also technical updating since their inception, the underlying product identity can be traced back to the events described below.

3.3.3.1 PT7 can be traced back as far as a contract to manufacture such a system at the instigation of, and to the specification of, a large national airline. (The airline approached the organisation because of its skills in VDU manufacture). Since then, the business has been extended to support mainframe protocols other than that used by the original airline, and the product features have been extended for sale to

other industries. However it should be noted that the initial approach and specification came from a customer.

3.3.3.2 CS7, an automated composing system for newspaper and general printers can be traced back to an invitation to tender sent out by a major regional newspaper containing a specification for such a system. This was a hardware and software specification and was treated as a systems project. As with PT7, the product has been modified and extended in succeeding years, and a jointly owned software company has been set up to handle software development. However, once again the original specification was developed by the initial user, who sought a suitable manufacturer for the required equipment.

3.3.3.3 Videodata, a single (coaxial) cable, multi channel data transmission system was originally developed by an American company, but was introduced to the U.K. market by FCSL under licence from the originators. However, the organisation was introduced to the originators by a third party - a large, U.K. manufacturing company who had discovered the device in America as

an answer to the rising cost and inflexibility of the conventional cabling systems required by their automation programme. The U.K. manufacturing company, however, were unable to handle the support and maintenance of their required system, and approached FCSL (because of the organisation's expertise in electronic engineering and widespread maintenance capability) to ascertain whether it would be interested in importing the system. From the beginning, Videodata was developed into an independent product line for a wider market.

3.3.3.4 Delphi Phoenix is a computer based data handling system designed specifically for use in pathology laboratories. The suite of application programs was designed and developed at the Hammersmith Hospital, London, and aroused widespread interest in hospitals and pathology laboratories throughout the U.K. The software was written in the language CORAL but was not originally implemented on Argus hardware. However, one potential user saw benefit in converting the programs to run on a second manufacturer's hardware. He approached FCSL because of its known capability in the

support of the CORAL language and assisted in the conversion of the software. In the short time since then, the Argus based system has been sold to a number of other hospitals. The basis of this product can be seen to have been developed (rather than just specified) by an external organisation.

3.3.3.5 Telex Manager, a small telex store and forward switching system can be traced back to a contact given by the national telecommunications authority to FCSL in conjunction with a software house, to provide equipment and software to control the International Leased Telegraph Message Switching Service. As a result of this contract the organisation held joint rights to the software and sought other applications for it. The result of this search was a substantial redesign exercise to produce a smaller product aimed at organisations who were substantial users of the telex service, and who, typically, had three telex lines at one location. Unlike the other products described above above, this product cannot claim to derive its specifications from its first customer, but certainly can be seen to be inspired by an external organisation.

3.3.3.6 Product A, a product which arose from the creative flair of an employee. He devised a novel method to overcome a barrier in the application of popular efficiency-increasing techniques to a new market.

Thus the result of this analysis can be seen to show that four out of the six independent product areas either active or under development within the organisation at the commencement of this study were originated by specifications or developments from outside the organisation. This supports von Hippel's findings concerning the importance of this mechanism in industrial new product development.

Examination and reinterpretation of existing literature shows that such active customer involvement in the development of products in this industry can be traced to the very early days when the J.Lyons Catering Company took a very active and participatory interest in the research work at Cambridge University in the late 1940s and early 1950s (Evans 1979).

The following discussion will seek to demonstrate why the CAP should be so important in the case under consideration.

3.4 DISCUSSION.

Considering the data presented above, one point is immediately obvious from Figure 3.1.

The two categories of

(i) Technical Advance (3.3.1.1)

and (ii) Cost Reduction (3.3.1.2)

account between them for 42% of the NPS submitted. This is a high proportion to be accounted for by just two out of nine categories. However, it should be realised that the vast majority of NPS submitted contained suggestions for new component modules, or for functional extension of existing modules or products. Numerically very few NPS contained suggestions for new, independent business segments. The phenomenally rapid advance of computer related techniques (Moralee 1981, Gabet 1979, Theis 1978) has resulted in consistently falling component costs, and consistently rising component complexity. In order to remain competitive, the organisation had to frequently introduce new components into its products, resulting in the domination of its NPS procedures by the above two reasons.

Looking at the other categories in Figure 3.1 it should be pointed out that NPS submitted as a result of a specific customer request containing a specification which appeared to have a wider market potential, accounted for 8% by number of all suggestions. Furthermore, customer or market related suggestions

accounted for fully 40% by number of all suggestions (Aggressive and Defensive Market Moves + Customer Specification + Repeated Customer Enquiries).

This is a high proportion of market-orientated suggestions. Furthermore Figure 3.2 shows that 34% of submissions were made as a result of Design / Sales Department co-ordination and 12% by the Sales Department alone. In addition to this, submissions sponsored by the Market Planning Group (parts of whose function were to co-ordinate Design / Sales liaison and to seek out new markets for the organisations technology and skills) accounted for 24%; and finally Project Groups (whose work in the Systems Business was very closely aligned to customer requirements) accounted for a further 12%.

All in all the organisation can be seen to have a very high market-led drive and to operate very much in accord with modern thinking on the need for a substantial Marketing input to the innovation process (Rothwell 1973).

Figure 3.1 shows that 8% of all New Product Suggestions were submitted as a result of the receipt of customer specification. However, 67% by number (Section 3.3.3) and 25% by value (Figure 2.7) of the organisation's Independent Business Segments can be traced back to such customer specifications, and in certain cases, developments undertaken or solutions identified by original customers. These customers did

much of the original work of product identification and development before seeking a supplier capable of providing a production-standard implementation of their development, backed up by adequate maintenance and support skills.

These figures extend the previous work of von Hippel (1978) in identifying the importance of this "Customer Active Paradigm" in some industrial product areas by showing that it can also be observed in this business sector.

But what are the reasons why it should be important in this case? and what are its limitations?. The observation of the phenomenon can be extended to the organisation studied. The identification of the reasons for its existence and limitations on its performance (given below and in Chapter Four) will assist in its extension to other organisations and industries.

3.4.1 The Nature of the Technology

Computer related technology is, by its very nature, highly adaptable. Its programmability in software and firmware ensures this, and microprocessors and larger computers can be found in a wide range of applications across an extensive range of otherwise unrelated areas (from coffee vending machines to national taxation organisations). Provided suitable interface devices are

available to control external devices, silicon or other programmable logic can, in theory, be used to replace both men and machinery wherever a repetitive but logical and deterministic sequence of events is required.

Defined as above, there is clearly a wide market for the electronic and computer based skills of the organisation, application ideas being limited virtually only by the imagination of users and suppliers. Whilst appreciation of the software aspects of computer technology can be seen to be spreading throughout many industries, the complementary skills of software and hardware support tend to be restricted more to the specialist concerns in the computer industry, and hardware design skills are now tending to become more specialised.

Hence we observe the twin driving forces of:

(i) a spreading appreciation of the benefits which this intentionally adaptable technology can bring to the spectrum of user industries and organisations;

(ii) on the whole, the inappropriateness of these user organisations developing the specialist and support skills necessary to back up the application of this technology to their specific requirements.

Under these circumstances, then it should not be surprising that we observe a high degree of customer activity in identifying areas where computer technology could be of assistance, possibly going as far as to specify the necessary system and even write the necessary software to provide a solution to their problem, and then looking outside for hardware and support assistance.

3.4.2 The History of the Organisation

The organisation has a history as a supplier of skills as well as products. This can be traced back to the earliest days of computing when in 1948 Ferranti was awarded a Government contract which ran for five years to make a production version of the Manchester University Mark 1 computer (Lavington 1978).

In later years, as has been described, the organisation had derived its main income from the Systems Business in which it devoted the majority of its hardware skills to the production of standard hardware (although it did produce special-to-project hardware where necessary) and sold software and project management effort to produce computer systems to the specification of its customers. By the nature of this operation, the organisation was constantly in touch with unmet needs and had developed a good reputation in certain areas for quality of product and support.

It is not surprising then, that operating as above, the organisation attracted approaches from innovative users of the adaptable technology (Section 3.4.1) who could identify the requirements for their own needs but could not provide the necessary design skills (as in the case of the airline and PT7), software effort (as in the case of the newspaper and CS7), or hardware and maintenance support (as in the case of Videodata and Delphi Phoenix).

Furthermore it is not surprising that some of these innovative users should be early representatives of a wider market for the system they had specified.

Thus the history of the organisation in the Systems Business can be seen to have placed the organisation in an enviable position to receive fruitful customer ideas, and to be subject to von Hippel's Customer Active Paradigm.

3.4.3 The Requirement for Skills Not Available to the Originating Organisation

Whilst it is one thing for customers to identify solutions to their own problems and maybe to realise that they are harbingers of a wider market, it is quite another thing for that customer to be able to provide the necessary organisation and support to exploit the opportunity.

Ferranti Computer Systems Ltd, by virtue of its participation in the Systems Business possessed the full complement of skills necessary firstly to provide and support the products when used by the customer organisation, and secondly to exploit the wider opportunity facing the product in a general market.

Thus it is unreasonable to expect product ideas to be passed on in this way by organisations whose skills and business interests would allow them to exploit ideas themselves. The operation of the Customer Active Paradigm would be largely restricted to organisations in complementary industries.

3.4.4 Reduction of Development Costs and Lessening of Risks

The organisation, of course, was happy to produce its desired expansion and diversification into standard products in this way. The production of a first system as special-to-project meant that much of the development cost of the ultimate product (particularly software development) could be recouped from the original customer, thus providing an effective subsidy to development. The only costs required to be supported by the organisation alone were those to broaden the development to a product with wider potential. If, as was sometimes possible, stage payments could also be negotiated over the life of the project, then commercial risk would be further reduced.

Hence, having this method of exploiting new product opportunities, it is hardly surprising that this or any other organisation would use it.

3.4.5 The Reference Installation

An important phenomenon in the sales of computer (and other) products is the "Reference Installation" - an existing user of the product to whom a potential user can be referred to allow him to see the system in operation, and with whom he can confidentially discuss the supplier's performance in delivery, maintenance etc.

Where these reference installations are also known innovators or opinion leaders in their repective segments, then they can also act like innovators or early adoptors in Kotler's analysis of the diffusion process of new products (1976 p 225).

The development of products from customer contracts in the Systems Business provides such products with ready made reference installations.

3.4.6 Results of this Mode of Operation

One of the major outcomes of using this source of ideas for new products is that customer contact is dispersed throughout the organisation, since during the negotiation stage before the signing of the contract, a

wide degree of customer contact takes place ranging from sales (as the primary point of contact) through contracts, project management, design, quality assurance, maintenance and, exceptionally, manufacturing.

However, this contact is confined to one customer, and whilst customer contact is desirable and results in some broadening of the experience of the organisation it is likely that its perspective would be closely linked to the needs of the original customer rather than the wider market (it would obviously be undesirable to dissipate the time of the personnel by using them to contact wider potential users). Unless otherwise compensated, this might result in the product design being too closely aligned to the original customer, at the expense of the wider market.

Furthermore, this mode of operation with the customer having responsibility for the preparation of the specification would, of itself, result in the manufacturing organisation developing a balance of skills closer to the technology than is optimum. In recent years this growing realisation within the organisation resulted in the appointment of Product Managers responsible for the general direction of each product, backed up in some cases by specialist design teams who could build up experience in the product's applications, and hopefully attract into these design teams individuals with application experience.

Nevertheless, despite these actions, the potential dangers of developing a balance of skills too close to the technology can be judged from the fact that, of the necessary changes (major and minor) which were required to be incorporated into one of the products mentioned above after initial trials, a high proportion (41%) came from early users/potential customers.

One would expect a healthy flow of new ideas following the launch of the product but 41% is a high proportion in view of the need to market immediately acceptable products.

3.4.7 The Nurturing of this Idea Source

Once the customer base has been identified as a fruitful source of product ideas, then it is obviously in the interest of the manufacturer to nurture it. Some measures taken by the organisation to achieve this were as follows:-

(i) The development of good relationships with identified opinion leaders and advanced users in the customer base, particularly airlines, nationalised industry, printing research, pathology and other important business areas. This could be achieved by close and frequent contact, special attention and advice with problems, the occasional "good turn" etc.

(ii) Good performance in existing contracts. This is obviously the target of all business organisations, but is given particular emphasis when the customer is known to be a good source of ideas.

(iii) The use of a technically skilled sales force able and willing to get to the heart of a customer problem and understand the nature of his particular requirements rather than attempt to fit the problem to the available solution. This was the essence of the Systems sales force which was the source of such a range of new opportunities (many of the Systems sales force had spent the early part of their careers within the organisation's own technical or project groups). It was only in recent years in the new business areas that the organisation was able to move to a more product orientated sales force in certain areas, basing their operation on shorter customer contact than was normal in Systems areas.

(iv) The promotion of the total range of skills possessed by the organisation at all appropriate opportunities (the current theme of group advertising at the time of the study was "Ferranti - Selling Technology") and emphasis of the wide range of skills present in the group and related companies. As in the case of the

Videodata product, it could occur that this wide range of ablility could attract a new product opportunity to the organisation.

3.5 CHAPTER SUMMARY

This chapter presents an examination of the sources of new product ideas in the organisation, and in particular the origin of the independent business segments. It shows that a high proportion (approximately two thirds) originated with the initial user of the product, and that furthermore it was this initial user who took the initiative in developing the specification and in some cases identifying the solution or writing the software. The observation extends to a new industry area von Hippel's work on the identification of a Customer Active Paradigm of New Product Development.

A discussion of this type of idea source shows that it is suitable because of the highly adaptable nature of the technology, and the organisation's business background. The benefits to the manufacturer are demonstrated in that it provides a subsidy to development, lessens commercial risk and provides a valuable reference installation for new customers to observe. The results and a potential pitfall of this operation are pointed out, and finally actions which can be taken to nurture this idea source are described.

CHAPTER FOUR.

THE PROJECT METHOD

This chapter describes the method employed to produce the product proposals contained in Chapters 5,6 and 7. It also presents the lessons learnt by the author as a result of pursuing this method.

The preceding chapter describes how the organisation's existing product lines had originated in ways which are in accordance with von Hippel's Customer Active Paradigm. It was unreasonable, however, to expect similar mechanisms to apply in the case of the project described here: the Customer Active Paradigm tends to result in the opportunistic exploitation of product developments which was clearly not suitable in this case where an existing business area had to be preserved against competitor, technological and user advances. The specific requirements of this project in terms of timescales and business areas meant that a more "Manufacturer Active " strategy had to be pursued.

It was realised that information would be required relating to the forces of Market Pull and Technology Push, and these would have to be weighed against the benefits which any development would bring to the company. It was further realised that much information could be obtained from published literature, conferences, seminars and the like, but that this would only provide a background to the market requirements. It would be necessary to obtain more detailed information from users and potential users of the products by specific market research.

This work was organised in two stages, the first stage (scheduled for completion by December 1980) was to comprise the monitoring of literature, conferences, seminars etc along with a first User Information Gathering Exercise and was to produce a document which would identify the various concepts which were possible for the next generation product.

Having thus reduced the number of options down to a manageable level, the second stage of the project (scheduled for completion by September 1981) would further investigate the technical and marketing requirements of these alternative Product Concepts, to enable the production of the Product Strategy Proposal which was the required outcome of the project, as stated in Appendix A.

The Product Strategy Proposal would define the broad marketing requirements of the next generation product, to the point which would form the basis on which the Design Department could consider specific hardware and software proposals addressing the issues identified.

4.1 THE FIRST INFORMATION GATHERING EXERCISE

It was initially envisaged that the first part of the project would comprise the investigation of three important influences:

user requirements;

competitor moves;

technical advances.

The latter two could be monitored by professional and trade literature, attendance at exhibitions and conferences and close liaison with the organisation's design personnel. However, investigation of user requirements was a more involved process and required much thought and effort resulting in the first User Information Gathering Exercise of the project which comprised a survey of Data Processing Managers. At the time it was envisaged that this would contribute to the information required to produce the Product Concept Proposal, which would then be developed as described above by further technical and business analysis into the Product Strategy Proposal. A further survey would be made towards the end of the project after the submission of the strategy proposal so as to track any changes in user attitudes which might affect product development, and would also permit further investigation of any points left unresolved by the first exercise.

4.1.1 The Postal Questionnaire.

This Information Gathering Exercise was intended to gather information relating to a number of topics:

(i) Details of existing data processing system: indicating degree of sophistication of existing system, usage, manufacturer and technical factors, and system history (indicating buying patterns, amounts spent, reasons for buying);

(ii) Benefits sought and justifications used: allowing an understanding of justification methods, development motivation and degree of satisfaction with existing systems;

(iii) System implementation: indicating whether the system was bought, leased or rented, whether the respondent obtained terminals from the same supplier as his mainframe or whether he would contemplate independent suppliers, software development strategy and indication of any problem areas encountered;

(iv) Future developments: indicating existing development plans, changes in implementation philosophy, current frustrated developments, likely in-house development standards, changes in benefits/justifications sought, likely data/personnel/departmental changes.

The exercise was intended to be wide ranging in its assessement of customer requirements, market sizes and

segmentations and the evidence contained in the literature (eg Rawnsley 1978) indicated that a postal questionnaire survey would be the cheapest, quickest, widest, most consistent method of obtaining the information and might lead to more considered answers. Certain drawbacks were indicated, however, such as lack of personal contact, low response rate and lack of opportunity to probe interesting or confusing answers. Nevertheless, provided the questionnaire was correctly constructed and piloted (Oppenheim 1966) it was felt that a postal questionnaire would give a wide coverage by contacting a large number of respondent organisations.

Following the recommendations in the literature it was decided to try out the questionnaire in a small number of face-to-face interviews with Data Processing Managers in order to give a general guide to its suitability and terminology and to point out any ambiguities.

An extensive survey would then follow. A questionnaire covering the points of interest was prepared (which was similar to the later version shown in Appendix C) and a structured sample of two hundred and seventy computer users was compiled from a combination of the information in two industry reference sources: the KOMPASS trade directory and the United Trade Press Annual Computer Survey.

This sample was composed with the dimensions of size of firm (by number of employees and turnover), UK geographical areas, activity (by Standard Industrial Classification) public or private sector, type of computer (broad range of manufacturers, but with a deliberate bias towards ICL and IBM) and computer applications (spanning the range of classifications shown in the Computer Survey).

The questionnaire was piloted with a small number of face-to-face interviews and this led to some modifications in terminology and content to remove ambiguity and misunderstanding. Apart from these modifications which were to be expected, difficulties did arise in the use of the questionnaire which suggested that a postal survey would not be suitable for this exercise. Difficulties encountered were as follows:

(a) The questionnaire was too unwieldy - the questions had become too long in order to specify on paper exactly what was required. Long questions are unlikely to be answered;

(b) The survey had become too large and contained too many questions in order to cover the required areas;

(c) The wording of postal questionnaires is fixed once they have been sent out and thus in some instances avoids bias and variations in questioning. However in this case this

inflexibility proved to be a drawback owing to the widespread user belief that his installation was in some way unique and that the questions as worded were in some way not directly applicable to him. This variation can be seen to result from the technological adaptability described in 3.4.1;

(d) Respondents tended to concentrate on their existing system rather than the future developments which were the primary concern of the exercise. The identification of future requirements was more important than the market quantification which the questions about existing installations were partially designed to provide.

These drawbacks can be seen to be a re-expression of the potential drawbacks identified by the literature and described above. In some instances these drawbacks are not important. In this case, however, they forced the abandonment of the idea of a postal questionnaire, the reason being that this exercise is primarily concerned with the identification of future needs. The establishment of these needs and dissatisfactions with existing products requires a more flexible interview strategy, permitting the probing of opinions and a two way exchange between interviewer and respondent to explore the reasons behind the respondent's statements.

The evidence of the pilot survey (in which the questions were asked face-to-face but without probing) indicated that the postal questionnaire could have satisfactorily established (assuming an acceptable response rate) facts and figures concerning current user installations and intentions regarding currently available products, but since the exercise was required to establish information about products which did not yet exist, then this method was not appropriate.

4.1.2 Telephone Interviews

Following the abandonment of plans for a postal questionnaire, attention was turned to a strategy of telephone interviewing using a similar questionnaire. The literature (Rawnsley 1978) stated that whilst this method was more expensive than a postal questionnaire, it still permitted a large number of contacts whilst allowing the question wording to be varied according to the varying circumstances of the respondent and also allowing the reinforcement and probing of answers on the important areas of future needs and future system philosophy.

Experience in the first ten telephone interviews however, indicated that the length of time telephone respondents were willing to give (varying between five and thirty minutes and being typically twenty minutes) was not sufficient to cover the relevant points contained

in the questionnaire. It should have been possible to contact a respondent with a view to making an appointment to phone back at some mutually convenient time for an extended (one hour) telephone interview, but this idea was abandoned. Comparison of experiences with telephone interviewing as against the face-to-face interviewing done earlier in the original pilot exercise showed that actually being present in the same office as the recipient permitted a far better rapport to be established between the interviewer and responding Data Processing Manager. Also, visiting the respondent's premises allowed many more subsidiary and informative pieces of information to be gleaned, such as how much attention the respondent paid, what the computer installation looked like, whether computer terminals were widespread throughout the organisation, etc. Finally, being there permitted back-up information (in the form of diagrams, brochures and demonstrations) to be readily exchanged.

4.1.3 Personal Interviews

The adoption of a personal interview strategy meant that all ideas of broad coverage had to be abandoned since it would not be possible to visit as many respondents as it would be to make telephone calls or to send out postal questionnaires. This meant that one of the emphases of the Information Gathering Exercise had to be dropped.

It would no longer be possible to use the exercise in itself to generate information which could be directly interpreted in terms of market size. This would have to be obtained indirectly by the use of commercially available or published data, or inferred from knowledge of the cost justification aspects of any proposed products.

It was decided to continue the strategy of approaching Data Processing Managers as they were the individuals likely to be in possession of the required information, although in certain cases it was agreed to interview deputies nominated by the initial contact. The questionnaire contained as Appendix C was used, which was very similar to that used in previous stages, although modified as follows according to the experiences in those earlier stages. By now, terminology had been refined to remove ambiguity and misunderstanding; the emphasis had been changed from a questionnaire to be filled in by the repondent to one filled in by the interviewer, although the initial question wording was fixed so as to reduce bias; answers could now be classified in certain categories by ticking boxes, so as to reduce note taking and maintain the flow of the interview; the order of the questions had been altered so as to ensure sufficient time was spent on the important issues of development expectations, with the later questions being able to be omitted if time was short. It was envisaged that each interview should last about one hour, and this was generally achieved.

The questionnaire was intended to ensure that the interview covered as many relevant topics as possible, but the most important lesson learnt from the preceding experiences was that it was highly likely that side issues would arise which should be pursued - the objective of the exercise was now changed from one of generating statistics to one of understanding and interpreting the preoccupations of Data Processing Managers in planning their computer developments, and in particular their VDU terminal strategies.

The sample philosopy was significantly rethought at this stage. It was realised that only a relatively small number of users could be approached since all interviewing would have to be done by one person. To make this more effective, the original sample of two hundred and seventy computer users was re-analysed to indentify those users (forty two as it turned out) who appeared from their entries in the Computer Survey to be users of "intelligent terminals", "terminal networks" or other such expressions which appeared to align with the PT7 philosophy. This was a list closely related to likely users of the new product, since the new product would have to be presented as a development from the old. It was decided to eliminate from the sample any existing customers of the organisation's products since it was felt that channels already existed between these

and the organisation via the sales force and that to approach such users would be an inefficient use of the limited time available.

Eventually fourteen geographically accessible repondents (corresponding to the criteria described above) agreed to be interviewed. It was necessary also to consider computer users who did not at present correspond to users of PT7-like equipment, since the possibility of extending the available market had to be considered. In order to do this, the interviews were arranged with the fourteen repondents described above, and then in each case, organisations in the same geographical area were approached with a view to making two or if possible three interviews in the same area in the same day and to extend the coverage of the survey. This was partially successful in that the eventual total number of interviews was extended to twenty two. This was by no means as large a number as originally envisaged for the postal or telephone interviewing strategy, but, ultimately, still demanding in time and stamina since they were spread throughout the country. These interviews were used to pursue the deeper implications of issues raised in the literature and in commercially available surveys, and hence contrary to the original expectation, the small number was not a restriction on the usefulness of the exercise.

The outcome of this first Information Gathering Exercise was reported in the document contained as Appendix D.

From the experience of this exercise, it was concluded that the fixed questionnaire method was not suited to this type of Information Gathering Exercise in which one interviewer was to explore the preoccupations of the market place with a view to understanding its driving forces.

A much more "organic" or semi-structured interviewing strategy was required. It had to be able to be developed over the time of the exercise and has to allow the information obtained from earlier respondents to influence (deliberately) that sought from later recipients. The emphasis was on the interviewer understanding the preoccupations of his respondents rather than logging them numerically. In order to aid this understanding, the questionnaire came to be used less and less as an end in itself, and more as a guide to ensure adequate coverage of topics, but with detailed discussion on each topic being free-ranging and benefitting from the expertise and experience of respondents in their own specialist areas.

4.2 THE RESULTS OF THE FIRST INFORMATION GATHERING EXERCISE

A report on the first Information Gathering Exercise is contained as Appendix D and gives an analysis of the responses to the interviews.

Appendix E demonstrates how the results of the Information Gathering Exercise came together with the other activities of the monitoring of competitive moves and the investigation of other information sources to begin to identify the appropriate product concept.

In brief, this document identified some of the organisational goals against which product performance was measured, and demonstrated that because this product area represented a major area of revenue for the organisation, the only feasible alternative was to continue the development of the product, recommending

"Development of additional features, inclusion of any new or improved communications protocols released by the mainframe suppliers and exploitation of advances in hardware technology"

To emphasise this point, if the PT7 product is plotted on the Boston Consultancy Group's Portfolio Matrix Analysis (Goold 1981 A) then it can be classified as a star (a star has the characteristics of a good

competitive position in a high growth market). Commercially available figures (Quantum Science Corporation) show a 17% growth in the computer terminal market between 1978 and 1979 (a high growth). In the same period, PT7 sales increased by 21.2%, thus increasing its competitive position and demonstrating that it should be classed as a star product.

The analysis of this Portfolio Matrix suggests that investment should be made in such star products to defend and possibly improve their competitive position in order to convert them into "cash cows" when the market matures and growth slows. This analysis confirms the more pragmatic recommendations given in Appendix E.

Appendix E goes on to identify the development opportunities open to the product. It shows that the most attractive opportunity to realise the organisation's objectives of selling standard products with high profit margins, high contribution and high resource ratios was in the rapidly expanding area of "office technology" of which data entry (as performed by existing PT7 devices) would be a subset. Such a new product would have to be "user friendly" since it was likely to be used increasingly by personnel who would not wish to understand the intricate technical details in order to operate the system. Furthermore, data processing "application packaged" systems provided an opportunity which the organisation was not able to exploit in its

present form, although later technical developments in "transportable software" were to redress this balance. Finally, alternative data entry methods were also identified as an opportunity, but were not investigated as part of this project - later developments were to prove this decision to be correct, since although alternative forms of data entry were better suited to certain applications (and indeed were investigated by other members of the organisation) the flexibility of the VDU/keyboard combination is such as to fit it to a wide range of new applications in office technology.

Thus the project had resulted in the redefinition of the product development. It was now necessary to investigate the development opportunities for PT7 (and in effect another new and related product, Telex Manager) in the growing office technology market. It was at this time that the Product Concept Proposal document had been expected to be produced. However, it was discovered that whilst being necessary, formal documents are not always the most effective method of imparting information to the organisation at large.

At the same time that the project called for the preparation of the Product Concept Proposal document, other agencies in the organisation began to realise the opportunities presented by the emerging office automation market and a meeting was convened at which interested groups (Market Planning Group amongst them) were invited

to table papers suggesting how the organisation's strategy might develop in this area. The papers appended here (particularly Appendices D and E) had already been discussed within Market Planning Group, and were seen to be pointing in this direction. Thus the author's work towards a Product Concept Proposal became part of a wider Market Planning Group effort to prepare a document for submission to this "Office Products Discussion Meeting" to take place in January 1981. The document contained as Appendix F is part of that submission and shows how the project's work on identifying opportunities in office technology had progressed to the point of having identified the requirements for products in this area, and had also begun to identify the suitable product marketing strategy by an examination of the organisation's current markets - it was seen as most important that any future product should be seen as an extension to current product areas, so as to allow the organisation to capitalise on its existing customers, and also to allow those customers to develop easily from their current products to the new generation. The paper also shows how the work on the organisation's financial requirements had progressed to the realisation of the implications of specific financial targets (Appendix F, 4.1.5).

The document begins to draw out the themes of "flexibility" and "friendliness" which were seen as important to the organisation's product strategy. "Friendliness" was emphasised because users wanted it

(see above), but the concept had been developed beyond the normally conceived confines of "ease of operation" to a more generalised idea of easing the task of each participant along the development / sales / customer purchase/installation/use/maintenance continuum, with the hoped-for effect that product sales would be improved.

It was begining to be realised that any product would still have to coexist with other manufacturers' products (Appendix F) and that communications features and an adherence to agreed or "ad-hoc" (market driven) standards would be important. The requirement for product(s) which were easily understood by customers and whose advantages and benefits could be clearly perceived, was first stated here (Appendix F). Underlying the whole document was the concept that, despite the widespread popularity of the concept of "office automation" or "Information Technology" and despite the fact that research was advancing in order to be able to provide aspects of the required technology (Chambers 1980, Coulouris 1979, de Souza 1981, Dordick 1979, Ellis and Nutt 1980, Healey and Woodward 1979, Page and Walsby 1979, Warter and Mules 1979), users of such technology would more than likely require evolutionary rather than revolutionary progress from their existing systems. Finally, the document shows the progress of the project in assessing the capability of the organisation to address the opportunities available, by the presentation (section 7) of an assessment of the strengths and weaknesses of the organisation.

4.3 THE SECOND INFORMATION GATHERING EXERCISE

The first Information Gathering Exercise and subsequent work had, by January 1981, resulted in significant changes to the character of the project. Such changes required amendments to the original project plan. It was decided that the expectation to produce a Product Feasibility Proposal by September 1981 would be retained, but that the new direction of the project dictated that a second Information Gathering Exercise was required to investigate users' attitudes to new "office technology" products. This took place between March and May 1981.

The lessons of the previous Information Gathering Exercise were applied to this exercise in that from the outset it was envisaged as consisting of personal, face-to-face interviews with Data Processing Managers, or their delegates. The objective was to obtain further detailed information on the issues identified in the Product Concept Proposal (Appendix F) by interviewing a sample of computer users who were known to be active in this area, again with an emphasis on understanding rather than statistics.

The computer trade press and other sources were searched for mention of organisations recently buying or installing specific office automation products. In addition to this, reference sources such as the Computer

Users Yearbook were searched for users of other equipment provided by suppliers of office automation equipment, on the assumption that although the yearbook entry might be out of date, these users would be the first to know of new office products, and hence to consider or even to use them.

The intention was to find out about their objectives, strategies and experiences and, learning from the first exercise of 12 months previously, it was realised that a strict questionnaire would be totally unsuitable. Interviewees were likely to have only limited experience in isolated areas of office automation, because everyone was at such an early stage. Thus it would be necessary to allow the user to talk about his own experiences in his own way and a fixed interview strategy would not be suitable for this.

A flexible strategy was devised, based on a questionnaire (Appendix G) which would remind the interviewer of points needing to be covered, but which would not obstruct the interviewee in the development of his response. Questions fell into three sections and the overall interview was paced to cover about one hour:

- First part (5 mins) - Organisational Characteristics; to elicit the nature of the business the technology was intended to serve, plus some measures of employment, turnover and

dispersion allowing comparison with other interviewees.

- Second part (5-10 mins) - Computer System, Present Applications, Planned Developments: allowing build up of rapport and also allowing the interviewer an insight into the starting point for office automation.

- Third part (remaining time) - Office Automation: comprising a thumb-indexed section of the elements of office technology. The areas of interest were listed to the interviewee to delineate the discussion, but then the interviewee was left to his own way of describing his system and plans. This involved the interviewer in much flicking through the thumb index to make notes as the discussion developed, but overall this proved to be most successful in avoiding the imposition of preconceived ideas and structures on the respondent.

A report detailing the findings of this second Information Gathering Exercise is given as Appendix H, which also contains detailed reports on the individual interviews and installations. In all, twenty three organisations were contacted including, as previously, some organisations not known to be advanced users, but which served to expand the base of the exercise allowing

two or perhaps three organisations to be approached in one area on the same day, and also providing insights into the expectations of less advanced users. All contacts were chosen so as to conform to the target markets described in the Product Concept Proposal (Appendix F), existing customers of the organisation being once again excluded. However, it is interesting to note that a number of respondents were (unknown to the author) also in contact with the organisation's sales representatives at the time of interview, reinforcing the claim that respondents were potential customers for the organisation.

The findings of the exercise in each area addressed by the Product Concept Proposal are described in detail in Appendix H; however findings of particular interest which are worthy of separate mention here are in the following areas:-

(i) User development strategy: a strong feeling was observed for evolutionary rather than revolutionary development strategies. Respondents were looking for products applicable to well defined applications and offering quantifiable benefits and paybacks. This confirmed similar statements in the Concept Proposal.

(ii) Justification of new products: a degree of confusion was observed in user's justification of new products since many introduced "soft" or unquantifiable benefits such as "better" information, "swifter" decisions or "easier" access to information. There was a general feeling that these were beneficial to the organisation but that they were difficult subjects to balance financially against the cost of the products. In a number of instances, this led to a strategy of "marginal" costing and evolution whereby products which could be easily justified against quantifiable benefits (eg PABX, Word Processing, personal computers in certain applications) were introduced and justified on the basis of those benefits, and then more sophisticated, "softer" applications such as electronic messaging were introduced at marginal cost on the basis of these devices.

4.4 OTHER INFORMATION SOURCES

As mentioned at various points in this chapter, the two Information Gathering Exercises were not the only sources of information which provided input to the project. Many other sources of written and verbal information were consulted as indicated below:

technical and professional literature

commercial surveys and reports

advertising

trade union publications

universities and research organisations

government report and statistics

conferences and proceedings

user groups

exhibitions

information from the organisation's sales personnel

invitations to tender

organisation's internal policy documents

other individuals within the organisation, each with their own set of infomation sources.

4.5 BEYOND THE INFORMATION GATHERING EXERCISE

After the completion of the second Information Gathering Exercise in June 1981, the intention was to prepare a Product Strategy Proposal for formal submission in or around September 1981, the other sources of information mentioned in 4.4 being continually monitored for their influence on the Proposal. However, the impact of the findings to date had proven to be so wide that the exercise could no longer be considered in isolation as a development of the organisation's strategy for terminal systems.

4.5.1 The Role of Gatekeeper

The requirements of product entry to the office technology market had implications beyond terminal products into standard hardware and software strategy and also into other product areas being considered by other parts of the organisation as alternative entry points into the office automation market. An information flow had been established into the organisation via the author and this information had now to be channelled to those parts of the organisation to which it would be of use. Textual information flow in the form of reports and memos was not entirely appropriate since the synergy of personal contact would be important in developing the ideas.

The role of the author had developed to encompass half of the function of a "gatekeeper" (Tushman and Katz, 1980) defined as an "individual both strongly connected to internal colleagues and strongly linked to external domains"...and performing a two stage process...."to gather and understand external information and subsequently.....to translate this information into terms that are meaningful and useful to his more locally oriented colleagues."

Tushman and Katz point out that the role of a gatekeeper is most important in development projects whose tasks are locally defined, yet where the technology employed is changing, and that whilst the role cannot be imposed by management, it can be facilitated.

In this case, there were a number of different development areas which were affected by moves to office automation, and both the technology and user perceptions of their requirements were changing rapidly. The author had access to information and information sources able to track these changes and it was realised that these were important areas of input to development projects. However it would be necessary to develop the internal links required to complete the structure required to support the role of gatekeeper. This would facilitate rather than guarantee the performance of the role since to perform the role would also require the development teams to respect and value the information and

contribution of the would-be gatekeeper - this could not be guaranteed.

However steps were taken to establish the internal contacts and channels for information dissemination; examples are:

contacts were increased with the existing PT7 development organisation by more frequent discussions with the Product Manager on development issues; a development team was convened to investigate local communications developments in response to the release of Local Area Network products (see chapter 7, section 2, which shows how the author worked in liaison with this development); the author contributed to the development of the Telex Manager product on the subject of its ergonomics (see chapter 7, section 1); the author contributed to the Teletex development (see chapter 7 section 3).

These and other measures were taken to increase contact with other parts of the organisation. Once this contact had been made, then social and personal factors could be exploited to increase the information flow and usefulness of such contacts.

It is interesting to reflect at this point that, as pointed out in section 3.6, the Customer Active Paradigm observed in earlier product developments is likely to result in the manufacturer concentrating on skills close

to the technology rather than the application. In such cases, a mismatch between the vocabularies and coding schemes of internal and external organisations (Tushman and Katz 1980) is likely to arise, requiring the assistance of the translational function of a gatekeeper when a development is pursued which is not to an individual customer specification.

4.5.2 PABX-Related Opportunities

During the course of the project, the potential of the PABX in office automation development had come through very strongly from the Information Gathering Exercises (Appendices F and H). Since PABX's were not within the organisation's business area and were certainly beyond the scope of this project, the observations were noted in the above-mentioned reports, but no further action was taken. However during summer 1981, it became known within the organisation that one of the other Ferranti subsidiary companies had entered into negotiations to set up a joint venture company with an American firm to manufacture PABXs in this country. This presented great opportunities to be exploited. It affected both the development of the terminal and communications strategies, and also led to the proposal of a PABX-related office product which was not related to any of the organisation's business areas. These moves are described in detail in later chapters.

The project moved into its final phase during 1981. As envisaged, work continued on the preparation of the strategy proposal for the Terminal Systems/Office Products business (chapter 5), but work was now also required on the PABX-related office product proposal (Chapter 6), and the other internal developments mentioned above. This widening of the influence of the project resulted in the Office Products Proposal being prepared somewhat later than planned, but the preparation of a number of internal reports, and participation in the developments listed, led to further modifications in the outcome of the project.

4.5.3 Presentation of the New Ideas

It was originally thought that the project would proceed to the preparation of the Strategy Proposal which would then be formally submitted for assesssment by the New Products Committee for the decision to commit funds and resources. Normann (1977) describes the strategy of a business organisation as being determined by the "dominating ideas" which are the result of interactions between the "significant actors" which comprise the organisation's "core group". This emphasis of an organisation being comprised of individuals led to a modification of the presentation strategy to one whereby elements of the product proposal were fed into the decision-making forums via such significant actors as were accessible and amenable. This occurred principally

through the author's superior in Market Planning Group, however in the case of the Voice Messaging System and other development projects, horizontal links to the Design Department established a parallel information flow into the core group. Normann points out that the core group generally meet regularly and frequently, both formally and informally, to discuss a variety of matters and a free flow of information amongst the significant actors (in order to adapt the dominating ideas to the changing requirements of the current situation) is highly desirable. The project proposals appeared likely to affect many areas of the operation of the organisation. The intention of setting up an early flow of information into the decision forums has two purposes.

(i) To set the seed of the idea of change early, allowing it to develop naturally rather than establish a frontal challenge to the established ideas by the sudden presentation of a Strategy Proposal. Early germination of these ideas would also permit early action to be taken in complementary areas, eg. the establishment of a design team to study the technical merits of alternative Local Area Network Strategies.

(ii) The early identification of objections or areas of opposition in order to allow proposals in these contentious areas to be refined and strengthened accordingly.

The success of this strategy of gradual assimilation of the project ideas into the "Corporate Mentality" can be judged from subsequent chapters, however it must be stressed that this early flow of information does not remove the need for the formal submission of project documents. These are still required as inputs to the New Products Committee to obtain the necessary funds and resources. Prudent moves beforehand, however, should ease this task.

4.6 LESSONS LEARNT FROM THE PROJECT

It was generally intended that the method adopted for the project should follow "best practice" as recommended by the literature and overall this has been so. There are however, a number of lessons which have been learnt by the author as a result of the experiences of the project. Many such lessons were trivial and were assigned to experience along the way; many were of passing interest and have been mentioned in the narrative above; some, however, were of wider significance and interest either because they reinforce the general content of the literature in the special context of this exercise or because they extend the literature into new areas. These lessons are described in detail below. Many technical lessons have been learnt along the way, but it is not appropriate to discuss these here - they are mentioned in the relevant reports contained as Appendices and are also mentioned where appropriate in the subsequent chapters describing the product proposals. The lessons described below relate to the method employed.

4.6.1 Contrast Between Customer Active and Manufacturer Active Methods of Product Idea Generation

As described in the previous chapter, a very high proportion of the organisation's independent product lines came about in accordance with von Hippel's Customer

Active Paradigm of new product idea generation and this was shown to have been very successful in the context of this particular business. This method, however, cannot be relied upon to produce ideas on demand, either to meet strict targets of expansion or diversification, nor can it be relied upon to produce responses when an existing product line requires extension, which was the premise in this project.

In such cases, the manufacturer must take a much more active role in seeking out and defining opportunities and the means of exploiting them. This is what happened during the project described here, and the contrast between the two methods of idea generation is most interesting.

Firstly the Manufacturer Active method appears to lead to higher development costs and a higher risk to be tolerated by the manufacturer. If we take the Voice Messaging System submission as an example, this called for the assignment of over 30% of the organisation's uncommitted development effort to be assigned to the design of a trial system and design study to establish whether the idea should proceed to a production design. This is significantly higher than most other submissions, and there is no guarantee that this investment will be recouped. This should be contrasted with previous experiences of the commencement of new product lines which emerged from the Systems Business and for which

there was, from the start, a guaranteed incoming cash flow since initial developments were on a special-to-project basis for a particular customer.

The second area of contrast derives from the fact that under the Manufacturer Active method, market contact was restricted, in this case to the researcher, whereas in the "systems" type of business where the development is to an external specification, it is feasible for a wide variety of members of the organisation to contact the customer. In the wider search, contact is with more external organisations but is concentrated in the search team (in this case one person). The organisation must then take full responsibility for the specification of the product as contrasted with the customer specification (modified by the manufacturer) in the Customer Active Method. If, as is the case with organisations selling their skills in a general "systems-type" business, the organisation's skills are closer to the technology rather than the application aspects of the new product, then a translation function must be performed at the market/manufacturer interface between customer and manufacturer "languages". In the case of the Customer Active method, this translation is partially performed by the sales organisation, but owing to the accessibility of the intial customer, can be easily supplemented by direct contacts with, and by, other members of the organisation. In the case of the Manufacturer Active Methods, the market is less accessible to the

organisation as a whole and contact is much more channelled through the person(s) performing the initiating search, and he (or they) must perform Tushman and Katz's (1980) twin roles of a gatekeeper:

(i) translating between external and internal languages;

and

(ii) facilitating the external contacts of internal colleagues.

The increased need for the role of gatekeeper can be observed in the organisation from both the actions taken by the author as described in section 4.5 and also from the appointment of Product Managers to

"be the focus for the Sales Groups and..... interpret and filter (market demands) to formulate a coherent product development and marketing policy" (FCSL July 1979)

Product Managers have been appointed within the organisation after completion of the initial "systems" project to guide the product to a wider market which is, implicitly, a Manufacturer Active function.

The Manufacturer Active mode as described above can be seen to have a greater dependence on the role of key individuals acting as gatekeepers or Product Champions. Products generated by the Customer Active model would tend to have a more demonstrable market potential and be received with widespread acceptance by the organisation

as a whole since (certainly in the case of those of the organisation's products generated in this way) products do not make the transition from "projects" until their feasibility has been establised (usually by acceptance by the first customer) and until further contact has been made with the market (often via the first customer). This is a highly visible process to all departments concerned with the development.

In the case of Manufacturer Active methods, with the search concentrated in one department, feasibility and market contact is not as easily visible to the rest of the organisation and is highly dependent on the existence and effectiveness of those key individuals indentified in the literature - the "gatekeeper" and the "Product Champion" (Kotler 1976).

4.6.2 The Suitability of Postal, Telephone and Personal Interview Strategies

The literature describes the relative merits of these three interview strategies for obtaining market information (Rawnsley 1978):

Postal Questionnaires are useful where the sample is dispersed, or for horizontal or general purpose markets. They are likely to be cheap and quick (depending on reponse rate), more consistent in question phraseology, and allows the respondent to retain anonymity if so

wished. The disadvantages are stated as general absence of personal contact, lack of control over the time taken to respond and that the accuracy of replies cannot be judged.

Telephone Interviews are said to be cheaper than personal interviews, although more expensive than a postal survey. They permit a wide geographical spread to be comfortably managed, and allow probing of interesting or contentious answers, however interview length is likely to be restricted, and supplementary information (such as walking round the plant) is not available. Also interruptions and lack of concentration are possible and empathy is removed.

Personal Interviewing is claimed to be the most expensive strategy although it is the richest source of data, overcoming many of the drawbacks of the other methods. However it requires more resources to provide a similar coverage.

In this exercise all three strategies were tried very early in the project, as a result of which the drawbacks mentioned above were observed. In this exercise, whilst it was realised that telephone and postal techniques would be suitable for obtaining facts and statistics, they were not suitable for the development of an understanding of the opinions and preoccupations of Data Processing Managers. For this reason a strategy of personal interviewing was adopted for both Information

Gathering Exercises since this increased rapport, allowed a deeper understanding to be obtained by probing, flexibility and the observation of subsidiary clues. In the second Information Gathering Exercise, a deliberately flexible (thumb indexed) questionnaire was developed enumerating the areas to be covered, but allowing the respondent to develop his line of thought as he saw fit, whilst the interviewer flicked from section to section to record the responses. The interview strategy was also changed from interview to interview. Since the emphasis was on understanding, it was necessary to allow the responses of earlier respondents to influence the questions asked of later respondents so as to test the researcher's developing understanding of the issues.

The change to a personal interviewing strategy also influenced the philosophy of choosing the sample of respondents. Originally a large, structured sample of two hundred and seventy respondents was chosen for a postal questionnaire. This was unmanageable within the available resources for personal interviewing, and the number was slimmed down to about twenty, the majority of which were chosen because they were known to be advanced users of specific products in the field of office automation, and being advanced users, they were noted for their innovative thinking and influence on user thought in general.

4.6.3 The Submission of Formal Project Documents

It was initially envisaged that the project findings would be submitted as two formal project documents. Experience over the project now indicates that whilst such documents are still required to formally instigate the assessment process, it is desirable to establish at an early stage horizontal and vertical information flows into the decision making forums of the organisation so as to gradually influence the development of the "dominating ideas" and "significant actors" rather than staging a sudden frontal assult via a single document.

Not only does this allow time for the dominating ideas to change to be receptive to any fundamental differences in strategy, but it allows any new ideas to be fed to complementary developments at an early stage. Also it permits the identification of likely areas of opposition or dispute to allow appropriate action in these areas of the proposal.

4.6.4 Alertness to the Changing Environment

Experience with the Voice Messaging System proposal shows from the other side of events, the benefits of the horizontal and vertical information flows described in section 4.6.3. In this case, the author was the recipient of information from the significant actors, early knowledge of which allowed swift action to seize an

opportunity in an area outside the main project. This emphasises the necessity to be alert to changes in the enviroment of the oganisation and to be able to move swiftly to exploit them.

4.6.5 The Importance of Free Information Flow

Sections 4.6.3 and 4.6.4 have already pointed out two important aspects of the importance of free information flow in an organisation: the seizure of opportunities presented by the changing environment, and assistance in the process of submitting new business proposals.

The author's adoption of the role of gatekeeper was an attempt to further the dissemination of information gained in the course of this project. The fact that Chapter 7 can point to three major areas of development which benefitted from information inputs from this project supports to the observation that developments do not proceed in isolation. The mutual benefits which arise from a free flow of information can be significant, and, as has been shown in this project, the assistance of individuals at various levels in the organisation is necessary to achieve this goal.

4.7 CHAPTER SUMMARY

This chapter describes the method employed to produce the product proposals, and presents the lessons learnt by the author.

Firstly, the suitability of Customer Active and Manufacturer Active methods of product idea generation is contrasted. This shows that the previously successful Customer Active methods are not suitable in this case, and that other means have to be employed.

Secondly, two User Information Gathering Exercises are described, as a result of which, findings are presented on the suitability of postal, telephone and personal interviewing strategies.

Thirdly, the chapter describes how the information generated by these exercises and from other sources was presented to the organisation. Conclusions are drawn which link the work of Tushman and Katz (on the role of Gatekeepers) with the transition from Customer Active to Manufacturer Active methods of idea generation. Also, the importance of free information flow is demonstrated.

Finally, the chapter describes how a venture taken by a different subsidiary company presented opportunities to this study. As a result of this the chapter points out the importance of the organisation remaining alert to its changing environment, and re-emphasises the point made above on free information flow.

CHAPTER FIVE

THE OFFICE PRODUCT PROPOSAL

This chapter, and the one following, describe the two main product proposals which arose from this project. Both proposals were approved for further development.

The Office Products Strategy described here is the outcome of the mainstream activity towards which the majority of the project effort was directed. It comprises a set of recommendations as to application areas, target market segments, distinguishing product features and marketing emphases which together establish a long term framework within which existing and future product developments are to be judged so as to exploit future opportunities and meet future requirements. As stated in the original product brief (Appendix A), the proposal does not "prejudice the function of the Division's Design Department, but rather it..... (forms) a feasibility report on which detailed design can be based" and indeed as part of the strategy, the proposal describes a number of challenging product possibilities which, if realised, would present a sizeable market potential. The document sumbmitted to the New Product Meeting is presented here as Appendix I. As can be seen from the front sheet, it was presented and supported as a joint effort within Market Planning Group, and indeed, the paper was written collaboratively. It was, nevertheless, based substantially on the work described in this project.

5.1 FROM TERMINAL SYSTEMS TO OFFICE PRODUCTS

At its initiation, the project was conceived as an investigation into the market requirements for a "next generation" terminal systems product (PT7). The document included as Appendix I presents a strategy for a range of so-called office products to address the opportunities presented by the emerging Information Technology market. Clearly, the project diversified during its lifetime and an explanation of the relationship between the initial and final emphases is warranted.

The common theme linking the various stages of the project was that it remained a search for application product markets for the organisation's skills in computer systems and VDU manufacture. At the outset of the project, the main application area for these skills was in the supply of clustered, non-intelligent, VDU terminals which were used to access application programs running in host mainframe computers. Any intelligence which was possessed by the terminal system was used in making a Feranti-manufactured terminal system appear (to the host computer) as if it was an ICL or IBM manufactured system.

By the end of the project it had been realised that the falling cost of microprocessor intelligence and memory was such that it was becoming cost-effective to distribute that intelligence to various parts of a

computer and terminal network, even into the terminals themselves. As a consequence of this distribution, it would become possible to run independent application programs at various parts of the network according to the needs of the user, even up to the point where an individual user sitting at his own terminal could run his own application at the terminal, quite independently of any other programs run elsewhere in the network. By virtue of this "functional distribution" whereby individual users would become free of the restrictions and disciplines of a centralised mainframe architecture, the nature of the organisation's terminal business would change. It started as the provision of a product which was a relatively non-intelligent, direct emulation of a competing hardware product. It would become a business which comprised the supply of hardware and associated application software to address the needs of individual workers or groups of workers, and mainly office-based clerical, professional and executive workers at that. The application software to be provided would be intended to support and improve the efficiency of these office workers, by addressing their major functions of access to, and processing of, information and associated communication needs.

Appendices D and E show how the project emphasis changed from being one of looking for a product regeneration, towards that described above. This

resulted in the introduction of the terms "office products" and "Information Technology" to describe the new market emphases. There was not to be a revolutionary change, however, because of the inertia of both suppliers and users, in their change from old ways. The provision of a new generation, cheaper version of the existing PT7 product was still an important part of the strategy in order to provide a continuation of business. In addition to this, it was necessary to map out a longer term strategy into which this direct product regeneration would fit, in order to identify the longer term goals towards which the product should develop. This was particularly important since many of the potential application areas identified (such as Electronic Messaging and Information Dissemination - see Appendix I) were unlikely to be cost-justified on their own against strict business criteria. This justification, however, was made considerably easier if an existing base of VDUs and terminal products existed, justified against other conventional applications. Thus the project emphasis became that of identifying a longer term strategy and associated application goals, against which the shorter term activity of product regeneration could take place. This regeneration could then address the opportunity of selling a base of VDU office products, justified by their users against conventional applications. These products

would provide the easy migration path to more sophisticated, less easily justified but nonetheless beneficial applications. This evolutionary ability was a prime customer concern, as described in Appendices D and E.

5.2 THE ROLE OF THE INFORMATION GATHERING EXERCISES

In this thesis, considerable emphasis has been laid on the two major Information Gathering Exercises and the lessons learnt from them. As described in Chapter 4, it was not possible to make the size of these exercises such that they could be taken as statistically representative of the market as a whole, nor could market size and segmentation figures be drawn directly from them. Rather, these exercises were used to explore the realities of a number of computer installations and development plans, whilst relying on other sources (such as commercial market reports) to indicate the size of potential future markets.

It was possible to use literature, conference and seminar sources to indicate broadly the potential technological and application areas for next generation products, and then to monitor competitor and new-entry product announcements in order to gauge which of these areas were being or were likely to be addressed. The role of the Information Gathering Exercise was to approach a selected number of representative computer users in various application areas and at varying levels of sophistication in order to explore how far these advanced ideas had penetrated into the concerns of these representative users, and what sort of reception the new ideas received in discussion. It was also possible to explore the unaddressed concerns of these users which might provide ideas for market segmentation.

Furthermore, the Information Gathering Exercises provided the opportunity to explore the realities encountered by those advanced users who had begun to introduce advanced computer systems, so as to learn from their experiences.

Having identified the prime application areas in reality and the objectives and problems encountered by the users, it was possible to recombine this information with other information from the organisation's sales force and from the literature and proprietary sources in order to define target application areas, and the criteria by which product offerings in these areas would be judged and justified. The office product strategy document (Appendix I) lists these target application areas and justification criteria and proposes a series of component modules with which these target application areas could be addressed.

Beyond this, it was expected that a concerted effort between the Design Department and Market Planning Group would result in the development of product offerings to strict cost-justification targets. The marketing of these offerings, supplying users with ready made cost justification arguments, would then create markets for these products, as was the organisation's experience with the Telex Manager product which had achieved success by this method.

5.3 ALTERNATIVE STRATEGIES AND THEIR EVALUATION

As described in Chapter 4, the project plan envisaged that once the broad Product Concept had been identified, there would exist a number of alternative strategies for bringing the concept to reality and offering it to market. These alternatives had to be evaluated and the most suitable chosen. This is described below. This section deals with those alternatives which were eliminated, the next section deals with the elements of the selected strategy.

5.3.1 Emulation v Innovation

A large number of participants in the computer terminal market pursue a strategy of direct emulation of competing terminals from the mainframe supplier. This involves the supply of terminals which are almost exact functional copies of the mainframe terminals, differing perhaps only in styling. These emulatory terminals are so much of a copy that they can be substituted directly for the mainframe products, VDU for VDU, controller for controller in virtually any mix. The selling attraction of these products is contained in their lower price and faster delivery.

This approach was rejected for the Product Strategy for a number of reasons:

(i) The organisation's existing product and reputation was not based on this form of business;

(ii) In setting out the strategy at this early stage, there were no existing competitive products to emulate. To wait for such products to be announced would entail losing the value of an early start;

(iii) Part of the target market (IBM) was US based, and as such, information availability in the UK was delayed until after the US launch meaning that any such emulatory product would be vulnerable to US based competitors;

(iv) The strategy suggested the acquisition of knowledge and skills in a number of new areas, the cost of obtaining which in terms of time, training and development was likely to be high. An early entry to the market and a high product price were important in order to repay this investment. Emulatory products are by definition later entrants, and by practice, low cost;

(v) Emulatory products such as these are generally produced in large, international volumes. The volumes of the required business which the organisation required of

this product did not permit such economies of scale, and hence it was unlikely that such products could have been produced competitively.

Thus a direct emulatory strategy was not considered appropriate, and it was decided to concentrate on a strategy directed more towards an "innovative" or distinctive nature whereby the organisation's products would communicate with alien products as if they themselves were specific alien products, but would provide additional features and benefits to the user and the customer, more appropriate to his needs.

5.3.2 High Volume, Low Value Products

It was decided not to compete in the market segment of high volume, low value products such as single, non intelligent VDU products which were observed to fall in price to approximately £600 each or less during the course of the project. In order to achieve these low prices, such products were normally imported into the UK having been manufactured in high volumes abroad (sometimes in low-labour-cost areas of the world) to rigidly maintained specifications.

One of the objectives of the organisation was to maintain a balance of business amongst its various products so as to maintain its factory loading.

To change to the high volume, low price type of business was too radical a step to be contemplated in the face of the alternative, proposed strategy.

5.3.3 Specific Market Segmentation

The possiblity was considered of studying in detail the requirements of a specific market segment (e.g. a particular type of computer user such as estate agents or local authorities) and producing a product targeted closely at that segment. This was not ultimately proposed for two main reasons:

(i) The organisation's existing base of customers in the office products area (mainly PT7 and Telex Manager users) was spread broadly over a number of application areas and it was important to maintain a broad front so as to continue to support and build from this user base;

(ii) The organisation's experience in relation to what has been referred to as the Customer Active Paradigm indicated that the possibility of the exploitation of specific market segments could follow on from the offering of a range of technological skills to a broad front of users. It was felt that the development of office technology in the areas proposed was at an early stage, and

that users had not had enough experience of using the technologies to appreciate the necessary variations in emphasis to produce segments. Hence participation in a number of constituent areas of both technology and application was necessary at this stage, followed by the possibility of segmentation later. Failing this, early participation in a range of application areas would establish the necessary coverage and reputation so as not to require segmentation for success.

In acknowledging, however, the possibility of future market segmentation, lessons were drawn not only from the organisation's own experiences with the Customer Active Paradigm, but also from the development of Viewdata technology (Urwick Nexos 1981) in which a broad Viewdata capability was offered by the UK PTT and industry sources. This met a great deal of success in the travel trade industry sector, leading to the development of specific features to more closely address the needs of this sector. FCSL had chosen not to participate in the Viewdata (or videotex) market but it was felt that the experience of others in this area was not untypical of what might happen in the other new areas of electronic mail and messaging, and information dissemination. It was proposed that a broad product range was offered initially, in the expectation that segmentation might ultimately occur, at which point, early participants

might be best placed to exploit such requirements on account of their command of the technology and early user experiences.

5.3.4. Distribution of Other Manufacturers' Products

The alternative strategy of distributing and adding value to other manufacturers' products was unresolved in the strategy proposal, since it was very dependent on the reponse from Design Department. There existed many foreign (notably US) manufacturers who had a lead in the development and application of such products for their home market and the majority of UK native participants in the Office Technology market had chosen to distribute such products.

It was acknowledged that some products would have to be "bought-in" in this way to enhance the organisation's product line in areas where

the skills and technology required were far removed form those of the organisation (eg. xerographic or laser based printer/copiers);

or the technology involved was so far advanced that the start-up investment was high and timescales long (eg. text processing and shared resource processing software);

or certain products had achieved such market dominance as to be virtually standards in their field (eg. Digital Research's CP/M operating system software for personal computers and workstations).

In other areas, it was the organisation's policy to manufacture in-house as much as possible and hence achieve added value and loading on the existing factory. This would, however depend on the Design reponse indicating what could be designed and built in-house and to what timescales.

5.4 ELEMENTS OF THE PROPOSED STRATEGY

Having described those alternative strategies which were not proposed, it is now appropriate to examine the various elements of the proposed strategy. The document presented to (and accepted by) the New Products Committee is contained here as Appendix I.

Section 5.3 above, describing the rejected alternative strategies, shows that the proposed strategy is based on products with innovative or distinctive, higher value features, manufactured in medium but not international volume for initially a general market, and designed and manufactured in-house where possible. Other elements of the strategy are described below.

5.4.1 Technical Aspects

The strategy document was not intended to provide detailed product specifications and designs, but to indicate target market areas, broad pricing goals and implementation details or potential product distinctions where these had a direct bearing on the marketing strategy. This was done by producing two sets of proposals as below.

5.4.1.1 Functional Areas

Nine functional areas were indentified as listed in Appendix I. Of these, four were identified as able to be directly cost-justified in isolation by users - these were already existing functions which had achieved a significant penetration to date and which provided hard, definable benefits, or whose entry cost was low:

High Performance Data Entry;

Word/Text Processing;

Personal Processing;

Electronic Mail (as Telex).

The remaining functions of Electronic Messaging, Shared Resource Processing, Information Dissemination, Access to External Databases and Electronic Mail (beyond Telex, into TELETEX and other areas) had not achieved significant penetration. They imparted "softer" benefits relating to better decisions, speedier or easier access to information, faster communications, less wasted time, etc. These could not be converted into hard cost justification as easily as the former functional areas, but experience (Bair 1973, Tapscott 1982) indicated that they were nonetheless valuable in use. The strategy proposed that the former four functional areas are considered as applications in their own right but also as means of distributing terminals and computing components throughout an organisation which can later be included in more widespread mail/messaging/information systems, hence reducing the investment directly attributable to these

"secondary" functional areas. The evolutionary and marginal costing philosophy is a key element of the strategy and affects the design of the overall product architecture and individual components.

The final functional area of Voice Messaging is dealt with more fully as a separate proposal in Chapter 6 but is also included in this proposal to emphasise that this product should be considered as another part of the overall strategy, although separable for sale as an isolated product where necessary.

5.4.1.2 Component Modules

Because the Application Areas of the products are defined to allow an evolutionary implementation, then the product hardware was defined in terms of a number of common component modules which could function in the various application areas according to configuration and software. The product architecture assumes the availability of a communications medium linking the component elements, but this communications medium is considered as an adjunct rather than a pre-requisite for system implementation. The strategy calls for the functional benefits to be achievable over various communications media (the Ferranti Local Area Network - see section 7.2; the Ferranti-GTE PABX; alien Local Area Networks; or alien PABX's). In defining the product strategy in this communications-independent way, the

proposal differs from many competitors who provide a similar mix of functions. These competitors, however define the functions in terms of their own proprietary communications system, in (at worst) an attempt to lock out alien devices, or (at best) make it more costly to connect alien devices. This flexibility of communications medium for the proposed product is a further way of addressing the evolutionary requirement identified during the Information Gathering Exercises and which forms a vital part of this strategy. The user can implement the advanced features of the Ferranti product range at marginal cost using, where necessary, the local area network or private telephone system installed for another application. To emphasise the medium-independent nature of these products, the communications system is not included as a component module, but was already being addressed in a parallel development (see section 7.2).

The range is defined in terms of workstations (VDU/keyboard devices providing the user interface to the system, and generally used by one user at any one time) and resources (system elements performing a function common to a number of applications and users - eg storage, external communications or large scale, common processing).

Four workstations are defined, addressing the varying needs of secretarial, clerical, professional and executive office workers by their varying

sophistication. The definition addresses the evolutionary/marginal costing requirement by calling for upgradability in the installed workstations such that at the outset, the customer can buy a workstation to operate in simple, character-based data entry or text processing mode and hence provide for the user that functional benefit at an attractive cost. However, should the user at some future time wish to upgrade the function of his workstation to access, for example, videotex (Viewdata) information or facsimile information, he could retain the majority of his investment (screen, tube, power supply, chassis, casing) and by a relatively cheap board change (rather than a complete workstation replacement) achieve the advanced functions.

The strategy acknowledges that many forms of alien, simple workstations already exist in use and that, by virtue of the application evolution philosophy, any successful office product strategy should be able to encompass the existing base of non-Ferranti VDUs. This is set as one of the demanding, product distinctive design goals raised as part of the strategy.

The shared resources of the product architecture are defined in terms of common functions to be performed:- storage, processing and external communications. The most sophisticated of these is the filing resource since this addresses the fundamental aspect of office work, the storage and retrieval of information. This information

can be in many forms, and can be categorised and retrieved according to many formal and informal systems. The Information Gathering Exercise and other sources indicated a high degree of interest in improving the effectiveness of storing, keeping up to date, and retrieving such information as a method of improving office efficiency. The requirement for what is referred to as an image input device for such a filing system acknowledges that there will not be a revolutionary acceptance of electronic office systems, but that conventional, paper based methods will remain long into the furture, and that some method of including paper-based information into electronic systems will be required in facsimile or image form. The device proposed combines this requirement with the evolutionary philosophy underlying the strategy and with the reality of the existence of a large base of character-driven VDUs. It proposes a sophisticated image input device containing character recognition facilities enabling restricted use of existing, non upgradeable, cheap, character based VDUs for information retrieval. The new Ferranti devices, of course, would be upgradeable where required to give full image-based facilities.

5.4.2 The Marketing Mix

The target functional areas and component modules described in the Strategy Proposal and in the section above are quite similar in many respects to corresponding

aspects in the strategies of competing organisations. The distinguishing features of the Ferranti Product Range were not to be found in the target market and broad architectural philosophy (in fact, general similarities were required in these areas to ensure the sucess of the strategy) but the distinctive features were to be found in the overall Marketing Mix, defined by Kotler (1976) in terms of the four P's - Product, Promotion, Price and Place.

5.4.2.1 Product

A markedly distinctive feature of the product was to be its ability to be applied by the user in an evolutionary manner, installing a base system against easily cost justified applications, and then enhancing this system, at marginal cost, to introduce more advanced features providing "softer", less easily quantified benefits at correspondingly less cost. Following on from this philosophy, the strategy recognised the need to incorporate not only the existing user base of Ferranti product users, but also alien products in areas such as Word Processing or Personal Computing where large, existing, non Ferranti user bases existed already. This acknowledgement of, and support for, alien devices would be a strong distinguishing feature when set against the likely majors in the market who sought to provide all elements of the range exclusively and/or to restrict their products to one communications medium only.

The strategy also acknowledged that the users of such office products would be, on the whole, people with minimal knowledge or training in computer science and whose main interest would be in the application rather than technology. For such a market, a very important factor in the purchase decision would be the ease of use of the system. For this reason, it was set as a design goal that there should be a simple, logical and consistent user interface across the Product Range which would present the product features in the logic of the user and in terms and vocabulary understandable by him/her. Early entrants to the market providing a fragmented product range with esoteric user interfaces were already finding that this was an obstacle to adoption and success. By attention to these aspects, the Ferranti product would hope to avoid such problems.

An extension of this issue addressed the application area of personal processing, whereby it was acknowledged that the organisation could not possibly meet the personal processing needs of all potential users. Indeed it was unlikely that any single supplier could. Instead, the area of Personal Processing was to be addressed by the provision of workstations which supported three basic software applications:

(i) text processing

(ii) a spread sheet, business calculation package;

and (iii) an easy to use program generator package.

In order to do this, the workstation would support the operating system CP/M, a proprietary product of Digital Research Inc., which had established such a market dominance as to become a virtual standard for the support of a wide range of personal application software from a variety of sources. By supporting CP/M, the workstation allowed the user a virtual free hand in choosing his application software. From the point of view of the user interface, it was unfortunate that as a consequence of this mode of supply of personal application software, such packages were invariably written to assume minimal workstation features, and that the user interface could not assume the provision of special Function Keys to control the various features of the package, but had to resort to a number of esoteric code sequences generated directly from the keyboard to invoke the various commands. In order to extend the Personal Processing, it was proposed that the organisation investigate and develop features incorporated into their workstations such that the keyboard, particularly, could be easily configured by the user to generate the esoteric code sequences from single function keys.

As well as the above features, it was assumed that the normal Ferranti standards of good design, good support and maintenance, and high sytem resilience would apply, to obtain for the Product Range as good a reputation as that possessed by existing products.

Ultimately, it was envisaged in the strategy proposal that market niches would develop providing opportunities to tailor the general features of the product range to produce products configured for the needs of particular segments. The experience of the organisation with the Customer Active Paradigm indicated that in order to exploit these niches, it was necessary to establish a capability in the contributing technology areas and to participate in the market early and on a broad front. Having established such a broad capability and early market presence, the strategy looked forward to the exploitation of specialist market niches as a second phase, having nurtured approaches from specialist sectors by the mechanisms outlined in Chapter 3.

It has been mentioned above that the strategy proposed an innovative rather than emmulatory nature for its products so as to create distinct product identities, to provide a "leading edge" reputation and to secure product margins. Posibilities for such innovative aspects were identified, where appropriate, as part of the function and module descriptions, and a resume of the main possibilities is presented at the end of the strategy proposal.

5.4.2.2 Promotion

Having established the elements of the Product Range philosophy as above, it was envisaged that it would be

promoted on the basis of those elements of the philosophy designed to address the major concerns of users. It goes almost without saying that the product should have been designed to fit the applications, and that the establishment of a functional specification, and assessment of product offerings against this requirement is an early exercise in the purchasing process. Having met the functional requirement, then, the Ferranti Product Range would possess other promotional and selling features designed to meet those concerns indentified as important to customers and users during the Information Gathering Exercises.

5.4.2.2.1 The Cost Justified Image.

The Information Gathering Exercises, supported by information gathered from the press, conferences and seminars and cost-justification exercises performed in-house had indicated the problems likely to be encountered, and predicted customer concern regarding how the required expenditure would be justified for some of the more advanced applications such as Electronic Mail, Electronic Messaging and Information Dissemination. Many of the currently available product offerings were highly priced and experimental and were being promoted on their technical merit and installed by users as small trial systems. Whilst this combination of high price and small installation might have been sensible for early participant suppliers so as to recoup investment and

obtain early market response, it was not suitable for early users in that small, high priced systems are hard to justify in strict terms, and do not provide the full range of benefits imparted by a widespread system.

On the other hand, the organisation's experience in promoting the Telex Manager product on an explicit cost justification theme indicated that this approach could be very successful. One series of advertisments had the headline "For a Company with a Telex Bill of over £15,000, the Message is Clear..... Telex Manager". This was designed to catch the attention of the target market, and produce enquiries. Other supporting documents were then provided to the prospect, showing how Telex Manager could be cost-justified against telex bills of this size. The resulting volume of Telex Manager orders made the product and its method of promotion a major success for the company.

By being based on an evolutionary, marginal costing strategy, using the existing base of easily justified applications to lay the groundwork for more advanced systems, and by designing the products to be priced against the justifications indicated in the strategy, it was intended that the products could be promoted into areas for which their usage was cost justified, thus giving the whole product range a cost-justified image.

An example of an early cost-justification exercise performed as part of the project, indicating target selling areas for a TELETEX product is included as Appendix J (see also Section 7.3)

5.4.2.2.2 Application Evolution

The ability for a user to evolve his system as required was an element mentioned above of the cost-justified image of the products. This was also an element which could be emphasised in its own right to promote the products. The Information Gathering Exercises had indicated a concern amongst users to be able to introduce new features and applications at their own rate, dictated by their own needs, and also to be able to protect their existing investment in hardware and software for as long as possible. This was supported by the experiences of the organisation's sales force.

Early competing products been introduced in a fragmented way, addressing isolated application areas and preventing easy migration or compatibility between areas. Such products had attracted a high degree of initial interest, but were later viewed with some suspicion since they did not afford users the required flexibility.

In order to overcome such problems, the Strategy Proposal set as design goals the requirements that each element of the product range should be integratable with

other elements; that the user interface should be simple, logical and consistent across the whole range; and that users should be able to start from any point in the range (including existing PT7 and Telex Manager Products) and migrate to include any other feature. To this end, specific requirements were introduced such as upgradable workstations.

Also, an evolution strategy starting from existing products was mapped out as part of the proposal.

5.4.2.2.3. Alien Systems Elements

It was an aspect of the requirement for application evolution described above, that the organisation's products would encounter installed alien devices which would be required by users to be included in advanced mail and messaging systems as part of the marginal costing evolutionary strategy. This was particularly likely in the developed markets of Word Processing and Personal Processing in which the organisation had not been an early participant.

In order to adhere convincingly to the cost justified, evolutionary image described above, it was necessary to be able to integrate such alien devices into the product application, and also to be able to use alien communications media (such as Local Area Networks or digital PABXs) where they already existed on a user

site. The Strategy Proposal stated this as a design objective of the range.

The organisation already had experience of the integration of alien devices into a product by virtue of its TELETEX development, (see Section 7.3) part of which allowed alien Word Processors to be connected to the national TELETEX network via a Ferranti adaptor. It was proposed that this mechanism could be used to integrate, where necessary, alien Word Processors into Ferranti functional products and that a similar development could allow alien Personal Processors to be integrated.

5.4.2.3 Price

At the stage of the preparation of the Strategy Proposal, it was not possible to set specific cost and price targets for component modules. This would follow after more detailed design assessments. However as part of the cost-justified image proposed for the product range, it was possible to indicate how the constituent application areas would be justified by users and this would indicate broad pricing targets.

Within the confines of the cost-justified image, however, the setting of product pricing was envisaged as an iterative process, of which this would be the first stage. Such a process is schematically represented in Figure 5.1. The first two activities of defining target

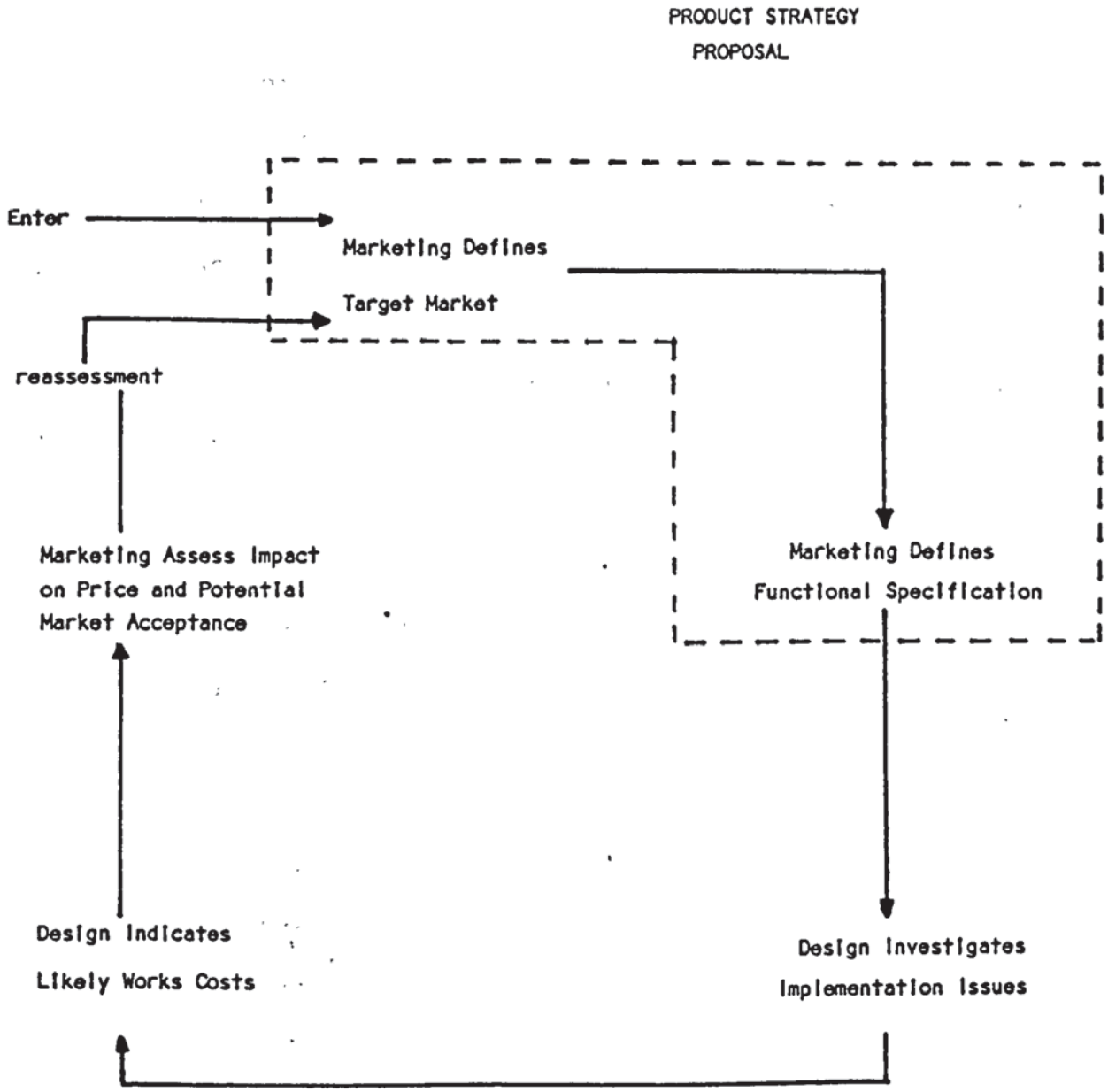

FIGURE 5.1 Schematic Representation of the Iterative Pricing Process

markets and functions had been performed in the preparation of the Strategy Proposal. Following the acceptance of the proposal by the New Products Committee, the Design Department would repond with development effort and works cost estimates which would allow Marketing to assess the effect of these estimates on selling prices, and the market acceptance of the products at those prices. This in turn might cause a reassessment of the Strategy, leading to a further iteration.

This process occurred during the TELETEX deveopment in which unavoidably high works costs for the product caused a reassessment by the author of potential market acceptance of the service and the product in the light of both device costs and service tarrifs. The reasessment is given in the paper included here as appendix J. It was expected that similar iterations would take place as part of the Office Products Development.

5.4.2.4 Place

In Kotler's (1976) terminology, the place category represents the sales and distribution methods employed for the product. In this case, only two possibilities existed - direct sale or sale via distributors. The choice in favour of direct sale was relatively easy to make on account of the organisation's existing direct sales force, and the expectation that an indication of market segmentation would be gained via this channel.

Additionally, because of the organisation's likely production volumes and works costs, past experience indicated that the expected margins could not be offered to attract distributors.

There were, however, two exceptions to this general strategy:

(i) the organisation already had some distributors in selected export markets, on account of its systems business. Where appropriate, these could be used to obtain export sales.

(ii) by virtue of the organisation's association with the joint-venture PABX manufacturer Ferranti-GTE (see Chapter 6) the possibility existed to integrate some products (such as the Voice Messaging System) closely with the PABX, and hence use the European and American associated GTE organisations as export vehicles.

5.4.3 Market Size

Imports comprise a high proportion of the UK computer market, and are approximately equivalent in value to the total domestic manufacture (see Figure 5.2.). UK computer system imports are dominated by products orignating in the US and Eire (whose own computer

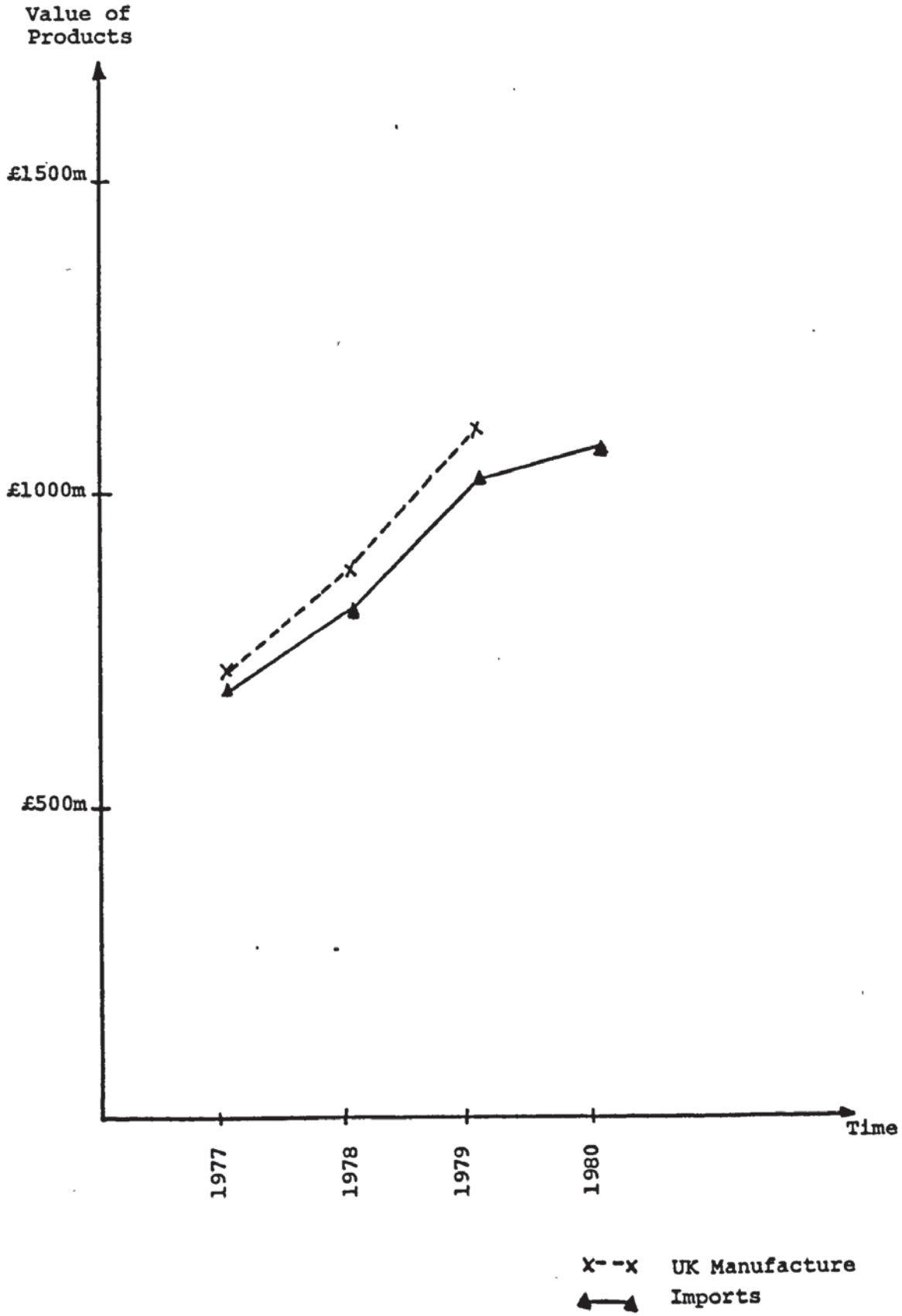

FIGURE 5.2 Supply to UK Computer Market

Source: Central Statistical Office

Year / Source	1978	1979	1980
USA	48.3%	45%	52.2%
Eire	19.5%	16.4%	14.1%
West Germany	12.6%	14.0%	13.3%
Italy	5.1%	7%	3.0%
France	4.1%	7.5%	5.9%
Netherlands	2.6%	2.7%	---
Others	7.8%	7.4%	11.5%

FIGURE 5.3 Source of UK Computer System Imports

Source: Central Statistical Office

manufacturing capability is dominated by US companies) - see Figure 5.3.

In the light of these facts, it is to be expected that the UK industry would be led in terms of technology and applications by US industry, and that a "Precursive Trend" type analysis (Jantsch, 1966) based on US events might indicate future UK trends. Figure 5.4 confirms this expectation by indicating that in later years (1974 onwards) deliveries of computer equipment in the UK appear to lag the trends in the US by approximately one year and in absolute terms are approximately an order of magnitude less. (Note that the apparent discrepancy between the value of UK deliveries as shown on Figure 5.4 and the sum of Domestic Manufacture plus Imports from Figure 5.2 is accounted for by exports and re-exports which must be subtracted from the values of Figure 5.2, giving the domestic deliveries as shown in Figure 5.4)

Hence the reported success of US experiments and early products in the functional areas of Electronic Mail, Personal Processing, Electronic Messaging, Shared Resource Processing, Information Dissemination, Text Processing and access to External Databases (Bair 1973, Bellinger 1980, Dordick 1979, Ellis and Nutt 1980, Engel et al 1979, Tapscott 1982) can be expected to result in the offering of US products to the UK market. Surveys such as that produced by Urwick-Nexos Limited (1981 A) indicate that UK interest in these areas is increasing -

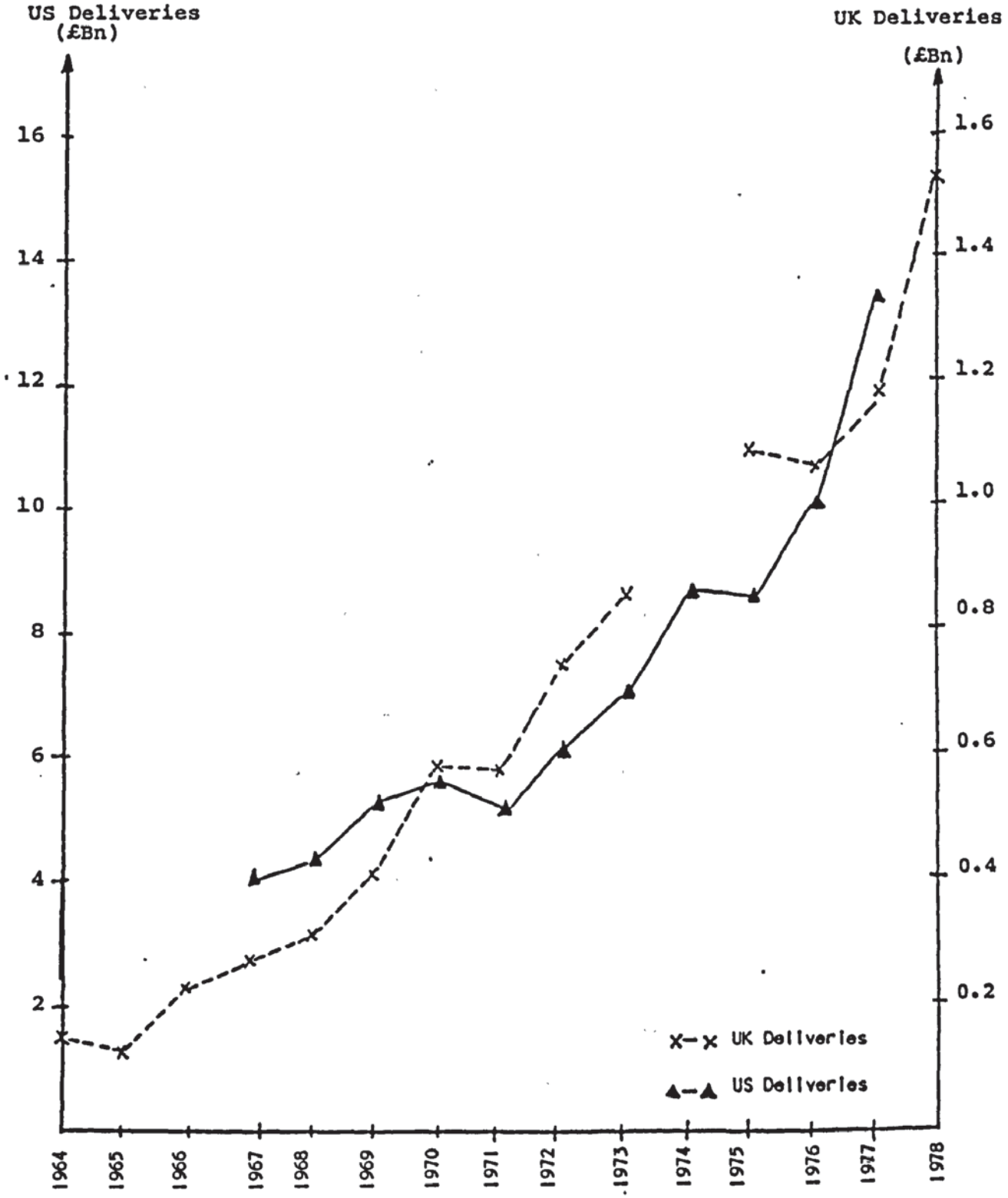

FIGURE 5.4 Deliveries of Electronic Computers and Peripheral Equipment US/UK

Source: OECD

they found that 66% of organisations contacted in their survey intended to increase the effort allocated to office automation.

Despite the fact that research and product offerings in this area is US-led, acceptance of the products by customers will depend on UK-based considerations such as conventional communication costs, the way in which UK personnel spend their working time, the number and balance of UK personnel , etc. It was sufficient for this proposal to indicate the broad market potential in the areas indicated.

As an indication of the absolute maximum size of the potential UK market, figures from the Central Statistical Office, the International Labour Organisation, and the Department of Employment indicate that there are roughly 850,000 business establishments in UK (1977 Census of Employment Figures) of which 53,725 employ more than 50 people and can be considered as prime targets for the organisation's products described here.

These 53,725 establishments employ approximately four million managerial, administrative, technical and clerical staff, of whom approximately 500,000 are secretaries. This sets an absolute top limit for usage of office terminals, although it would appear unreasonable to assume that full penetration (one terminal per employee in the relevant occupations) will ever be reached.

Some indication of likely penetration can be gained from consideration of the Airline Industry which was an early and enthusiastic user of computer technology, and is widely accepted as having a very high penetration of computer terminals. The Eurodata Foundation Report (Logica 1980) indicates that the penetration of terminals in the Airline Industry may be as high as 1 terminal for every 10 employees (of all grades) which can be scaled to 1 terminal for every 4 administrative, clerical, technical, or managerial workers by using the average ratio of white collar to blue collar workers for the transport and distributive industries of 1 : 1.5 (obtained from figures in UKITO 1981). The Eurodata Foundation Report indicates that this penetration in the Airline Industry is close to saturation, and no further significant growth in volume is expected.

Thus, if we use this penetration of 1 in 4 as a target across all industries, we obtain a ceiling of one million office terminals in organisations employing 50 or more people. If we assume that to achieve this penetration, every establishment of the target size must have an office communication system installed, this sets the maximum number of systems at 53,725 as above with an average of slightly less than 20 terminals per system.

This can be compared with the 1980 UK installed base (in organisations of more than 50 employees) of data processing computer terminals, word processing, terminals

viewdata terminals and personal, desk top computers of between 250,000 and 300,000 (based on figures from International Data Corporation, Pedder Associates and UKITO).

Thus the organisation will be participating in an expanding market. For an indication of equivalent yearly market size, we can assume linear growth from the 1980 figures to 85% of full penetration (850,000 terminals) and assume three rates of penetration, and convert the installed base growth to annual new shipments as below:

Fast growth (85% by 1990) giving 55,000 new terminals p.a.

Medium growth (85% by 1995) giving 35,000 new terminals p.a.

Slow growth (85% by 2000) giving 27,500 new ternimals p.a.

To these figures must be added sales which replace existing terminals, however one element of the proposed strategy is to seek ways of exploiting the existing base of VDU terminals to provide advanced application facilities, and so firm design proposals are required for a meaningful appraisal of this market segment. However, consideration of the terminal sales in the years 1977 and 1978 (approximately 30,000 and 35,000 respectively) shows the replacement sector to be potentially substantial, unless ways of extending the useful life of existing terminals can be found. It is highly probable

that there will be a high user requirement to find ways of protecting their investment.

Thus the strategy can be seen to call for the organisation's participation in an expanding market, in which it can extend its existing low, controlled market share philosophies (starting from its 1980/81 sales of approximately 1,000 terminals) to achieve its desired growth in business from this product area. The market size figures given here are necessarily outlines only, since more detailed appraisals are meaningless without specific design proposals which were expected to follow at a later stage.

5.4.4 Company Strategic Fit

The strategy poposal, as presented, was designed for a high degree of company strategic fit in addressing the needs

(i) to ensure continuation of the current business area of PT7 and to map out a longer term architectural and evolutionary stategy for this product and for Telex Manager;

(ii) to seek new product areas to support the organisation's desire to move away from a Systems Business oriented operation towards standard products requiring minimal Systems and Engineering development and support;

(iii) to support the expansion of the Commercial Products sector of the organisation's business (represented by PT7 and Telex Manager,) to become 33% of turnover by 1990;

(iv) to achieve the above targets whilst maintaining and possibly increasing design and workshop loading;

(v) to identify target market areas in which the organisation's reputation for high quality engineering design could be maintained, whilst not being exposed to low price, low quality competition.

The acceptance of the Strategy Proposal at the New Products Meeting in March 1982 emphasises the acceptance of this strategic fit.

5.5 CHAPTER SUMMARY

This chapter presents the main proposal presented to the organisation. It contains recommendations for a long term framework of user requirements for the continuation of the organisation's terminal systems business. The emphasis of the project changed somewhat during its life from considering terminal systems alone, and finally considered their role within application areas of Information or Office Technology. A common theme throughout, however, was a search for application areas for the organisation's skills in computer and VDU technology.

The chapter describes the role of the Information Gathering Exercises, describes how a number of alternative strategies were considered as means of achieving the organisation's objectives, and why the proposed strategy was chosen in preference to those which were rejected. The chapter then presents the elements of the proposed strategy, and describes how this would meet the needs of the market place, and provide a distinguishing product identity.

CHAPTER SIX

THE VOICE MESSAGING SYSTEM PROPOSAL

This chapter describes a product suggestion which was a spin-off from the main research exercise concerning computer terminal systems. The main exercise developed into a study of terminal related opportunities in the emerging office automation products market, which led to the author studying the objectives, justifications and limitations of such products. Experience in the main exercise also led to the realisation of the importance of the establishment of horizontal and vertical information flows from the project so as to gradually influence the development of the organisation's "dominating ideas" and also, where necessary, to allow early use of the project findings by parallel developments. This product suggestion demonstrates the importance of similar, reciprocal information flows in that early knowledge of the actions of another subsidiary company allowed swift movement to exploit the opportunities which had arisen for this organisation as a result of those actions - swift action was necessary in this case because rumours of impending announcements of similar products were beginning to emanate from America. This product also illustrates the benefits which resulted from not drawing the boundaries of the project too firmly so as to allow the seizure of other opportunities.

6.1 THE ORIGINS OF THE IDEA IN THE TERMINAL SYSTEMS EXERCISE

The principal objective of the project was to identify opportunities and requirements for the continuation of the organisation's computer terminal systems business. As the project developed it became clear that this might involve exploration of the opportunities presented by the developing "office automation" market (Appendix B and see also Healey and Woodward 1979 for an introduction to the concept of office automation). This was confirmed by the interest observed in this area during the first Information Gathering Exercise (Appendix D), so that the second Information Gathering Exercise became a more detailed investigation of those aspects of office automation which were related to terminal systems. This exercise did not specifically address voice-related issues, but it and other work did identify the objectives of office automation in general to increase the efficiency and effectiveness of office workers (managerial, administrative, technical and clerical grades), the costs of which were increasing substantially because of wage inflation.

By number, managerial, adminstrative, technical and clerical grades accounted for 30.8% of all industrial employees in 1980, and comprised a substantially higher proportion in certain industries eg. 65.3% in Electronic

Computers, 58.5% in Radio, Radar and Electronic Capital Goods, 44.5% in Aerospace Equipment Manufacturing and Repairing and 44.4% in Photographic and Document Copying Equipment Manufacture (Employment Gazette, June 1980). The second Information Gathering Exercise (Appendix H) identified that users required an evolutionary rather than revolutionary approach to office automation in which the technology fitted the enterprise rather than vice versa, and would replace existing tasks in well defined applications which could be cost justified against definable measures. It was realised that office automation could also bring about qualitative improvements such as "better decisions", "swifter information" or "more effective management" but these could not easily be measured and had to be supported by more quantifiable benefits in any cost justification equation.

Furthermore, an incremental approach to office automation strategies had been observed in which established products (such as Word Processing, Data Processing or new generation PABXs) which had easily definable benefits and could be proven to be cost justified, would be installed to perform their prime functions and then would be used as bases of further moves towards office automation (such as electronic mail) thus giving a "marginal cost" approach to the more qualitative benefits. The PABX figured largely in the plans of many of the users contacted since it apparently

provided the necessary infrastructure of communications to the desk of every office worker, and for this reason was seen by users as a strong contender for other Local Area Network based office communication strategies.

Finally, the first and second Information Gathering Exercises indicated that there was a somewhat negative attitude towards VDUs to be observed amongst certain office workers and that this might prove an obstacle to VDU-led strategies. There was also a body of opinion which maintained that current VDUs were too expensive to be justified against the early stages of an evolutionary, incremental strategy as described above and that costs would have to fall to allow widespread adoption.

Thus by the end of the second Information Gathering Exercise, the indications were that there would be a market receptivity for a non-VDU-based, PABX-led, evolutionary office automation strategy involving incremental task substitution and based on a more familiar method of communication than keyboard typing (possibly voice based). However, since this opportunity was beyond the scope of the project and since the organisation was not in the business (nor was it likely to be) of supplying PABXs, work in this area was abandoned in favour of work to identify methods of surmounting the obstacles to VDU-based office automation strategies.

6.2 THE CATALYST - THE PABX JOINT VENTURE

In the summer of 1981, the confidential information that another Ferranti subsidiary company was negotiating with an American firm to manufacture PABXs in the UK (as a result of government moves to liberalise the supply of such devices in the UK - Hansard 16/11/81) was the catalyst which caused the concept of a voice-based electronic messaging system to be revived. This was made more pertinent by the emergence of indications that such devices were already in development in America and might soon be announced for the general market (Business Week June 1980).

Contact with the other subsidiary company established that, whilst negotiations were still progressing, the intention would be that Ferranti held the majority stake in the joint venture company; that the intention was to produce only PABXs in the early years of the venture; that the new company would be willing and enthusiastic to support other related companies producing PABX-based products; and that the US partner in the joint venture did not appear to be developing products similar to those proposed (this was later confirmed from other independent sources) and that even so, differences between US and UK regulations meant that a US product might have to be substantially adapted for UK use.

This information cleared the way for the preparation of the New Product Submission for the organisation.

6.3 THE PRODUCT:- FUNCTION, ATTRACTION AND JUSTIFICATION

Published research (Minzberg 1973, Copeman et al 1963, Engel et al 1979, Horne and Lupton 1965) indicates that a substantial proportion of office work is concerned with communications-based activities:- external and internal, textual and aural. The ability to increase the effectiveness of these communication processes would considerably improve the efficiency of office work, and it is to this end that many of the developments in office technology had been directed, eg. Word Processing, telephones, information retrieval systems, viewdata systems, electronic messaging systems etc. Experience with experimental systems indicated that identifiable benefits can, in fact, be obtained (Bair 1979, Engel et al 1979, Appendix H [Company B]).

Personal experience indicates that telephone communication is inefficient - incoming telephone calls interrupt work-in-hand leading to disruptions in concentration and thought processes, outgoing calls are beleaguered by engaged lines, respondent not available etc. Incidence of "telephone ping-pong" (A phones B who is unavailable and so leaves a message, to which B responds but A is busy and so leaves a message, to which A responds but B is out etc, etc) are frustratingly common and both UK and US telephone authorities state that less than 30% of callers reach the person they were trying to contact (Ellis 1981).

Experience within the organisation following the introduction in 1981 of an advanced function PABX which allowed certain users to select "Do Not Disturb" mode and bar all incoming calls at certain times, showed that a maximum of 26.5% and an average of 11.5% of those able to use this facility did use it at some time during the day, thus emphasising the disruptive effect of incoming phone calls, and the desire for office workers to cut themselves off from interruption at certain times.

The function of the Voice Messaging System as proposed was to help overcome the drawbacks of the telephone system by providing a voice "store and forward" facility allied to an organisation's PABX. Incoming callers reaching an engaged or no reply extension or having their call received by someone else (because the person they wanted was unavailable) would be able to leave a message in their own voice, thus removing the need to either ring back, or to leave a message with a third party which is likely to be misinterpreted or mislaid. Recipients would be able to select "Do Not Disturb" mode more freely knowing that incoming callers would not be inconvenienced. They would also be able to select the time which most suited them to go through incoming voice messages without disruption to other work. Recipients would also be able to interrogate their voice "mailbox" from anywhere in the world by phoning in, thus ensuring that travelling personnel could keep more

closely in touch with events at the office outside office hours, and transcending geographical time zones. Recipients would also be able to leave personal responses for callers along the lines of

"This is Tim Jones. I'll be away till 27th March. Please refer urgent matters to John Smith on extension 1234 or else leave a message for me."

This would eliminate the frustration for incoming callers of not knowing whether their target is likely to be unavailable for an hour, a day or a month.

So far, the product function as described is similar to that of a telephone answering machine on the user's desk, but the product as proposed is much more sophisticated than that, allowing recipients to respond to messages by sending a reply to the originating extension (if it is an internal call) without having to redial the caller's number. It would allow recipients to play back messages from their mailboxes faster than they were recorded, thus reducing the time spent on the potentially tedious task of working through a mailbox. (Pitch correction techniques, however, would remove the "Donald Duck-like" babble normally associated with tape recorders playing back at high speed - Schiffman 1974). As with paper messages, it would be possible to forward messages from one recipient to another for action, with

comments from the original recipient appended to the beginning. Messages would be classed as Routine, Priority or Immediate Delivery, callers could designate messages as being required to be delivered at a certain time on a certain day, thus allowing the product to operate as a vocal diary. One caller would be able to dictate a message and distribute it to a number of recipients by specifying a distribution list.

Even more advanced versions of the product would also be able to be used as an office dictation system or to have archive and search facilities and editing facilities for the preparation and filing of verbal documents.

The intention would be that the system would initially be used to leave conventional messages, but that in time, users could be encouraged to use it for "non-real time" conversations for non-urgent matters by dialling direct to a recipient's voice mailbox, rather than trying first to contact the recipient. This would considerably reduce the intrusiveness of the telephone in distracting people from their work, and would instead allow them to decide when they worked through and responded to their mailbox. It will be seen that the system as proposed, performs a similar function to VDU-based electronic messaging systems (Engel et al 1979, Bair 1973, Bellinger 1980) which have been demonstrated as effective. The differences being, of course, that the system as proposed is based on the familiar technology of

the telephone rather than the (to many) unfamiliar technology of VDUs (which some see as an impediment to the acceptance of such systems - Appendix D). The voice based system carries more information in terms of intonation and expression of voice, everyone can use it from anywhere in the world with access to the telephone, and finally (and perhaps crucially) the device would be designed to be cheaper:

If (for convenience) we assume an average "white collar" salary to be (in round figures) £10,000 p.a., and that a voice or electronic messaging system similar to the one described by Engel et al could make this average office worker 5% more effective (i.e. save 24 minutes in an 8 hour day) by reducing interruptions, distractions, wasted time and frustrations, then in a full year, this would be worth £500 (neglecting all overheads) and this could be set against the investment required to bring about this improvement with a one year payback.

For a VDU-based system, £500 would not even buy one VDU and keyboard, let alone a share of the necessary communications and processing facilities required for such a system. A voice-based system would be based on existing

handsets, cabling and PABX and, as is proposed below, would have a target selling price of £400 per user, falling to £300 or even £200 after 3 years. This is obviously well within the available budget and relatively attractive.

6.4 MARKET RESPONSIVENESS

Speed of preparation of the proposal was extremely important because of the increasing frequency of rumours of work by a number of American organisations on similar devices. If, as was highly likely, these rumours were substantiated, the American products would be announced in 1981 for first delivery in 1982. Because the introduction of technically advanced products in the US by American designers had traditionally preceded their availability in the UK by twelve or eighteen months, it appeared that the American devices would be available in UK in late 1983 or early 1984. This also coincided with the proposed liberalisation of British Telecom's monopoly of supply of PABX equipment in 1983 and hence gave a target for the availability of the organisation's product. An early start on development was important.

There was no time to do a market survey specifically related to this product, hence decisions had to be made on the basis of the evidence available, which was considerable:-

(i) there was the evidence, as described in Section 6.1, that an opportunity existed for a non VDU-based, PABX-led, evolutionary office automation strategy involving incremental task substitution and based on non-keyboard communications (possibly voice). The product conformed to this;

(ii) there was the report in Business Week (June 1980) describing the successful implementation of such a system by a large American corporation, and interest by a number of others;

(iii) there was the restricted cost justification argument given above which showed that such a system would be relatively more attractive than VDU-based electronic messaging systems which had already achieved a degree of sucess;

(iv) there was a report from a firm of American Consultants (Yankee Group 1981) which, in considering the various technically conceivable forms of internal and external electronic mail, considered the possibility of voice mail and showed that its benefits could go beyond the savings in time, concentration and frustration considered in Section 6.3 and could produce savings because of shorter messages (less chat), fewer uncompleted calls, more use of off peak tariffs (by timed delivery voice store and forward), reduced paperwork and resultant savings in clerical personnel, direct savings in executive time, and possible resultant effects on salesperson performance and inventory control. Full details of the justification cannot be given here since it is covered by copyright. However, in summary it stated that if all direct and indirect savings were possible, then such a product would be even more attractive than the restricted

analysis presented in Section 6.3 and far more attractive than a VDU-based message system producing the same direct and indirect benefits. The analyses in Section 6.3 and (iv) above suggested that, although there was very limited awareness of such devices at present, the cost justification arguments were such as to create a market once the devices became available, particularly if these benefits could be demonstrated to potential purchasers (this would be part of the extended "user friendly" strategy proposed in the Office Products Concept Proposal - see Appendix F and below, section 6.5.2);

(v) there was the evidence of a commercially available survey (Urwick Nexos, 1981 A) which established a 4% awareness of voice store and forward technology in a survey of 524 UK business organisations, of which 89% of those aware of the technology registered a positive interest. This of itself is inconclusive evidence owing to the very low level of awareness, but when taken in combination with the other evidence presented here, it does provide the corroboration that those who are aware of the technology are generally in favour;

(vi) there was the evidence of an American consultant's prediction of a US market for such products of $500 million by 1985;

(vii) finally there was the evidence of an existing user of the organisation's products who was respected as having advanced views on technology. When this user was contacted to ascertain views on voice technology, it transpired that he already had an investigation in hand into the potential benefits of such products. The user felt that these benefits could be considerable and along the lines of those described above. One of his investigations was the use of telephone answering machines to simulate giving part of the function of a voice messaging system.

The combination of the evidence as presented above was overwhelmingly favourable. Whilst the review of the evidence could not be described as comprehensive in that a specific market study was not performed for this product, it was considered adequate under the circumstances for two reasons:

(a) speed was essential in deciding to embark on the development;

(b) there was such a low level of user awareness of such products (see (v) above) that a specific study would be inconclusive.

Thus it was decided to proceed with the submission on the basis of the evidence given above, in the belief that if the proposed benefits were achievable, then a market

could be developed for such a product. This proviso was incorporated into the proposed product strategy in that it was decided to recommend a two part development, the first part to comprise two parallel paths-

- an investigation of advanced methods of speech compression necessary for efficient storage usage and cost competitiveness
- the design and construction of a trial system (not yet based on advanced speech compression techniques) to allow the investigation of the benefits achievable and also the user related aspects which were felt to be very important.

Should this first stage prove successful, then the decision to proceed to a production device (hopefully carrying forward as much as possible from the trial system) would be made. It is interesting to note again the higher risk and investment that was necessary in this, a manufacturer-inspired development, than in previous customer-inspired developments (see Section 4.7.1.).

6.5 PRODUCT FEATURES

6.5.1 Basic Features

In defining the features required of the product, it was possible to take as models, the features of VDU based messaging systems and conventional telephone answering machines, both of which formed the likely competition for such a device. This led to the definition of the basic features of storage, retrieval (local and dial-in), security, auto reply, message forwarding, broadcast messages, timed delivery, priority messages, personal pre-recorded response and editing features. In addition, centralised dictation machines using telephone handsets formed the inspiration for similar features on this device. The conversation with the organisation active in investigating the possibilities of the technology provided the suggestion to be able to record and file two way conversations. Finally, an article discovered during the investigation of speech compression techniques (Schiffman 1974) provided the inspiration for the "Fast Retrieval" feature which was felt to be potentially attractive.

This comprised the initial definition of features which were likely to be influenced or modified by the experience of the trial system, and by further investigations nearer to product launch. As the details of competing products became known, not only had all the

features of the US devices been included in the specification, but also additional features had been proposed which would lead to a superior performance.

6.5.2 "User Friendliness" Features

The earlier research (Appendix D) had identified the important requirement that office automation products should be "user friendly" i.e. because computer based devices were likely to be used in increasing numbers by office workers with no knowledge of computer systems (nor indeed any interest in, or need to know about, such things) then the man/machine interface should be such as to favour the users, allowing him to use the machine with minimal training, adaptation and disruption.

The Product Concept Proposal (Appendix F) extended this requirement by pointing out that there are many more individuals who come into contact with such products than just the ultimate user, and identified sales staff, customer purchasing authority, design and development personnel, and installation and maintenance staffs as all requiring features and facilities to make their interaction with the product easier, with a hoped-for positive effect on product sales.

It was a firm intention to apply this philosophy to the voice messaging product, and the various approaches to this are described below.

6.5.2.1 The User of the Device

Fundamental to the product concept is the fact that the device performs a similar function to VDU-based electronic messaging systems (which have demonstrable benefits) but that it is based on the familiar process of speech and the telephone system, rather than on the (to some) unfamiliar and discouraging technologies of VDUs and keyboards, and this is decidedly beneficial. Furthermore, a voice-based system carries more information in terms of tone of voice and intonation.

Even so, difficulties do arise in the use of advanced systems, even those based on familiar foundations. Users of VDU-based messaging systems have complained about the complication of learning the system commands and the necessity to remember them through periods of little use. Experience with the installation by the organisation of an advanced PABX giving many powerful new user features showed that, at least initially, many of the additional features were not used because of the complication of selecting and remembering them. To take an example - the PABX provided an Abbreviated Dialling feature whereby selected external numbers could be dialled by a four number combination, rather than dialling the full number. The evidence was that, despite this benefit, a significant number of users did not use this feature because of the complication of remembering the dialling procedure. It is, however, possible to induce such users

to experiment with such features, if sufficient stimulus is provided. In this case, the placing of the directory enquiries number in the list of numbers available from the Abbreviated Dialling feature and the barring of all calls directly to this number, resulted in a large increase in the use of the Abbreviated Dialling facility by generating a base level of usage of this feature, which then escalated to using the rest of the list.

It was intended to use a similar stratagem to induce widespread usage of the voice messaging system. By designing the process of leaving a message to require minimal caller effort, i.e. by automatically referring calls to busy or no reply numbers to the relevant voice Messaging Extension, it was intended to provide a base level of message-leaving traffic, which would cause recipients to learn the more complex (but hopefully still simple) procedures of message retrieval by providing the stimulus of there being messages to retrieve. The provision of special tones to signify waiting messages is also considered important in this respect in that it removes the need for speculative (and presumably often wasted) interrogation of a mailbox to see if any messages are awaiting attention. This base use by auto referral of calls to the VME was also expected to lead to experimentation with other features such as direct dial to a VME for non-urgent messages, once the initial benefits are discovered by users.

Vocal prompts are, where necessary, intended to guide users through more complex procedures, although it is intended that an experienced user should be able to select the required option without waiting for the system prompt.

Fast retrieval is envisaged as a further user convenience feature, since the ear and brain can interpret a message faster than the caller's voice dictated it. Fast retrieval with pitch restoration should assist in skipping through a tedious list of messages, whilst being able to fall back to natural speed for important sections.

Overall, the system would be designed so as to be consistent, logical and predictable in use and to use the logic and vocabulary of the user rather than the system.

The system would be designed to be more usable than many of its potential voice messaging competitors, in that when used in conjunction with the joint-venture PABX, non intrusive but effective notification of waiting messages would be achieved by the use of special dialling tones. This is a superior method to those used by other systems which are not closely allied to a PABX, in that in these cases, users have to speculatively ring their mailboxes to check if there are any new messages for attention. This could lead to frustration if no messages are waiting, with a consequent loss of confidence in the system. The notification of messages by special tones

removes the need for speculative interrogation (except when the user is away from the office) and is seen as a better method.

Experience with the trial system would also lead to further user convenience features being designed into the production system.

6.5.2.2 The Salesman and Customer Purchasing Authority

If the tasks of the salesman and customer purchasing authority can be made easier and more effective, then product sales should benefit. Two steps in particular can be taken with this product to ensure that this should be so.

Firstly, the product is easily demonstrable either by dialling in from the customers premises to the system in use by the organisation, or by a visit to the organisation's premises by customer staff. It is also conceivable that a limited number of customer's staff could try out the system by dialling in across the telephone network. This would not fully demonstrate all the functional and user-convenience features, but a limited trial would be possible.

Secondly, since some of the benefits of the system are qualitative rather than quantitative, and some customers might be unclear as to how best to perform a

cost justification analysis, it is intended that the sales literature produced to support the product should cover this point in detail, showing typical benefits actually obtained in use, and recommending cost/benefit assessment methods best suited to the product. This system is similar to that used to great effect with the Telex Manager product and benefited both salesmen and customers alike.

6.5.2.3 Development and Installation Staff

It is firmly expected that competitive pressures will force additional features and facilities to be incorporated into the product over its lifetime. Furthermore it will be necessary to perform some configuration procedures for each customer at installation so as to specify the size of the system, number of users, extension numbers, feature mix etc. It was a design objective that these processes should be made as easy as possible by the system design, although the exact form of these measures was not known at the time of the submission, since they were dependent on the detailed design of the system.

6.5.2.4 Maintenance Staff

In a system of this complexity regular maintenance is necessary. Furthermore, successful usage will inevitably lead to reliance on the system in certain respects. Thus

regular maintenance and swift response to malfunction are vital. Specific measures to ensure this are, as above, dependent on detailed design, but possibilities to be considered are self test features within the device giving user-understandable diagnosis and recommendations as to remedial action; "fail soft" such that faults in one part of the system affect other users as little as possible; remote diagnosis features from the organisation's maintenance premises to reduce maintenance response time, and ensure that correct replacement parts are delivered to site. Further detailed specification is not possible until the production design is produced.

6.6 PRODUCT COMPETITIVENESS AND IDENTITY

It is important that a new product proposal contains an indication of how the product will differ from its competitors, and what its strengths are.

In this case, the principal market for the proposed device would be for use in conjuction with the PABX products of the joint venture. In this case the design of the device would be closely aligned to the features of the PABX giving a much more elegant user interface than other "stand alone" products which were beginning to be talked about at the time of the proposal. In addition to this the Design Department felt that they could possibly make some progress in making store usage of this device more efficient than that of the competition in which case, the market for such a device could be extended to non joint-venture PABXs, although with a restricted user interface.

Finally, the Fast Retrieval feature was apparently unique to the specification of this device (although not too hard to copy) and would be a further distinguishing feature.

6.7 ATTRACTIONS FOR THE ORGANISATION

The product, as described above, was attractive to its potential market and was potentially distinct from, and superior to, its competitors provided satisfactory answers were obtained to the technical and usage questions identified in the above narrative.

It remained, however, to establish that this was an attractive product for the organisation to supply since it required a higher degree of risk and investment to be tolerated than previously, and it also required the acquisition of speech-processing-related skills which were not in the organisation's existing armoury.

The product was principally attractive to the organisation since it was a computer based product, and an application vehicle for the equipment products of the organisation. It corresponded to the sought-after category of a volume, standard product sold with minimum development being devoted to each customer. In addition it was an entry to the office automation market (see also Chapter 5), but furthermore it was an alternative entry point which avoided the conventional entry market of Word Processing, which was by then so crowded as to be unattractive to the organisation. Finally the product as conceived was a well bounded product, suited to the

organisation's philosophy of exploiting market niches which did not involve the overstretching of the organisation's resources by requirements to support a broad front of product variants.

6.8 CHAPTER SUMMARY

This chapter describes a subsidiary new product proposal which arose from the project. It was submitted to, and approved by, the organisation's New Product Committee in October 1981.

The identification and acceptance of this proposal illustrates how product ideas can arise in unlooked-for areas, and emphasises the need for both researcher and organisation to maintain a broad outlook on product search exercises.

The Chapter describes the origins of the idea in the main exercise described in previous chapters, and how the idea was resurrected and developed as a result of a catalytic event outside the direct control of both the organisation and the researcher.

The product proposal is then described in some detail, showing how it would be attractive to both user and developer alike, and how the product competitiveness and identity were envisaged.

CHAPTER SEVEN

OTHER INFLUENCES OF THE PROJECT

The main outcome of the project as it was originally envisaged has been described in Chapter 5. Chapter 6 describes the preparation of another New Product Proposal which arose as an offshoot of the main project. In addition to this large project offshoot, the project had smaller but nonetheless important influences in other parts of the organisation's business as a result of the author's adoption of the role of "gatekeeper" (as described in Chapter 4, Section 6). Participation in these developments is described below.

7.1 "USER FRIENDLINESS"

The early stages of the project (Appendix D) confirmed that there was a distinct requirement that future products should be "user friendly" since they were increasingly likely to be used by individuals with no knowledge or understanding of the technical aspects of computer systems, nor any need or interest in gaining such knowledge. Their interest would be in how the system could help them in their work. This was a requirement to hide the technology behind a user interface which was simple, logical, consistent and predictable in operation and understandable by the user with minimal training. The Product Concept Proposal (Appendix F) extended this usual definition to encompass not only the people who actually used the device as part of their job function, but also all other individuals who were likely

to come into contact with the device. The Concept Proposal identified:-

Sales Personnel;

Customer Purchase Authority;

Design and Development Staff;

Installation Staff;

Direct and Indirect User;

and Maintenance Staff;

as requiring particular attention in this matter.

The implementation of a design aim of "user friendliness" is very much dependent on the function and design of the product itself, and can require a lot of effort dedicated to this end. Sutton, 1978, concludes that in producing interactive business application software the necessary programming effort is much greater to provide the user interface than to program the algorithm. Because this effort is largely peculiar to the function and implementation of the product concerned, then these aspects are described as part of the account of the individual products proposed as part of this project.

However, as a result of the body of the information on such matters built up over the course of the project, the author was called on from time to time to give an ad-hoc input to aspects of the design of other products which were being developed at the time of the project. Since the developments concerned were the responsibility

of their respective development teams, information was required from the author in the form of an independent, outside opinion and swift answers were required on the basis of available information rather than by the construction of elaborate and rigorous tests. The more important contributions are described below.

7.1.1 VDUs and Keyboards

The organisation had a large commitment to the design and supply of VDUs and keyboards as part of its catalogue of general purpose computer equipment, and also as part of its standard product ranges. At the time of the project, there was much discussion about the health, safety and postural effects of VDUs, keyboards and workstations, with employers and unions paying increasing attention to such matters and a number of organisations producing recommendations for their members to follow. The author contended that these would become market requirements as a result of the influence of the organisations producing the recommendations and compiled a summary against which future product designs could be judged, and with the intention of identifying a specification which could satisfy all the recommendations. This bibliography consisted of the recommendations from the following sources:

The Association of Scientific, Technical and Managerial Staffs (ASTMS 1979);

The Association of Professional, Executive, Clerical and

Computer Staffs (APEX 1979);

The Banking Insurance and Finance Union (BIFU 1980);

Cakir, Hart and Stewart, 1979 - this publication provided a checklist of features which was subsequently used on more than one occasion by the organisation's customers to assess products.

Soon after the preparation of this document, however, it was decided by higher authorities that the tracking of such recommendations should no longer be classed as a market requirement, but as a technical consideration and responsibility passed to the Design Department. The author's involvement did not end there, however, since it was contended that if the organisation's products conformed to these recommendations, then capital should be made of this in the promotional and sales strategies, and it was his responsibility to achieve this for those products with which he was concerned.

7.1.2 The Telex Manager Product

This product was in development at the time of the project and was considered to be another of the organisation's offerings for the office technology market. The author's advice was sought on three occasions on the following subjects

- general user convenience features (to which the bibliography mentioned above formed the response);
- acceptability of the keyboard layout;
- a general assessment of the operator interface.

The original keyboard layout is shown in Figure 7.1, the proposed changes are shown in Figure 7.2 and the reasons for these proposals are given below, referring to the original keyboard layout:

(i) The ESC key is the first key in a number of two key control sequences. Whilst ESC 'P' etc have passed into common computer parlance, it would be meaningless to a non-technical computer operator. It was recommended that the ESC key be replaced with a gold coloured key since this is used on a number of other VDUs, Word Processors and calculators to signify the first key of a two key sequence, and standardisation in this respect would be desirable. In addition, the keys used in conjunction with the ESC or gold key (P,M,S,T) in this case should be changed to a different shade of grey from the rest of the QWERTY pad, and have their alternative functions engraved on the leading edge, facing the operator.

(ii) The LOCAL key changes the mode of operation of the device between LOCAL and DUPLEX by repeated pressing. The screen displays a message signifying whether it is in LOCAL or DUPLEX mode, thus the key should be engraved with both LOCAL and DUPLEX to correspond.

(iii) PRINT MSG causes text on the screen to be printed out. It was felt that this should be labelled PRINT TEXT so as to be more explicit and also to correspond with the key described in (vii) below.

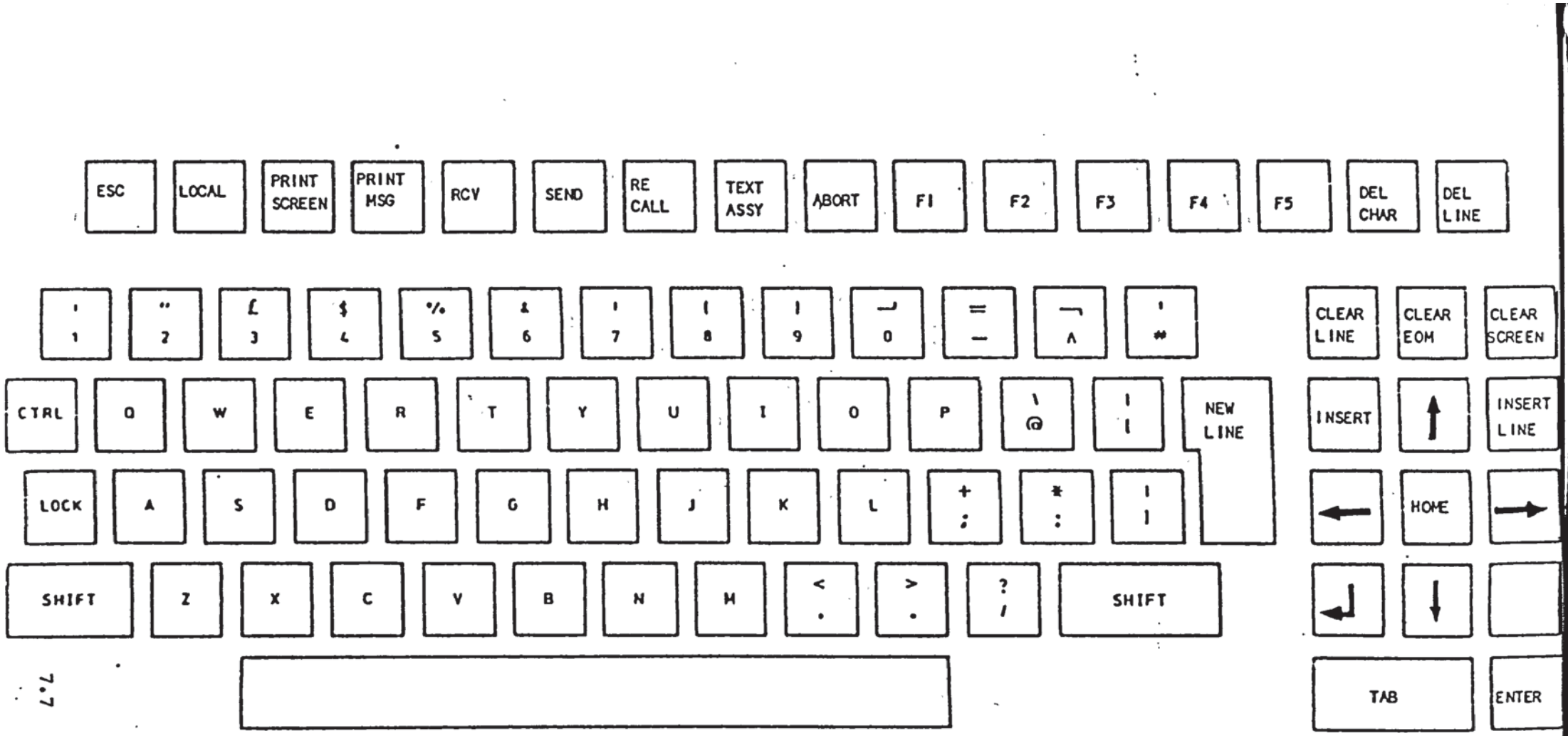

FIGURE 7.1 Original Telex Manager Keyboard Layout

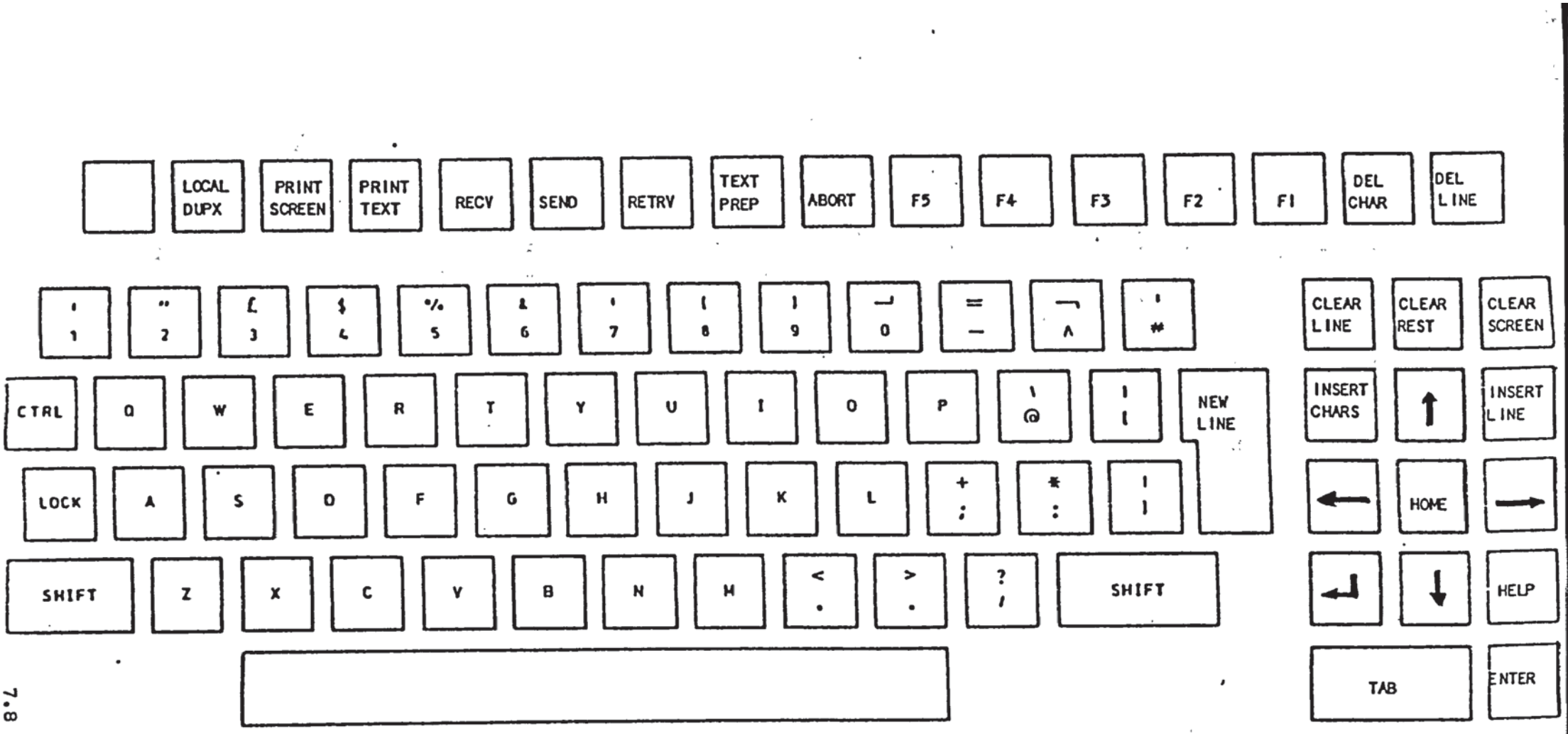

FIGURE 7.2 Proposed Telex Manager Keyboard Layout

(iv) RCV causes the device to operate in RECEIVE mode as opposed to SEND, RECALL or TEXT ASSEMBLY modes. These modes can also be selected by typing the first three characters of the mode name in the QWERTY pad. It was felt that the key should be labelled RECV so as to signify this more clearly.

(v) The SEND key actually caused DESPATCH mode to be selected from a menu of prompts. SEND was a good, short, explicit label and it was recommended that it should be retained, with the software changed to modify DESPATCH to SEND on the menu and elsewhere.

(vi) RECALL to become RETRV (retrieve) so as to distinguish it from RECIEVE mode when selected by typing the first three letters on the QWERTY pad.

(vii) TEXT ASSY allows text to be manipulated on the screen. It was felt that this should be TEXT PREP as this is a more widely used expression.

(viii) Keys F1 to F5 should be reversed to become F5 to F1 to allow for a possible future increase in the number of mode keys (RECV, SEND etc) and reduction in F keys by substituting F5 first and leaving F4 to F1 unaffected.

(ix) CLEAR EOM causes the clearing of the screen from the current cursor position to the end. It was felt that the label CLEAR REST would be more explicit.

(x) INSERT allows characters to be inserted into existing text. The label INSERT CHARS was felt to be more explicit and more consistent with other labelling.

(xi) The "dangerous keys" CLEAR SCREEN, CLEAR REST and CLEAR LINE were uncomfortably near to the cursor control and insert keys, resulting in possibly catastrophic results from a keying error. It was recommeded that these keys should operate a software interlock, causing (after the first depression) a screen prompt to ask, eg.

"Do you really want to Clear the Screen"

and requesting the user to press a second time if so. An intentional double stike would have the desired effect without bringing up the prompt.

(xii) The unlabelled key could be used to provide a HELP facility by recalling appropriate menus when pressed.

The third involvement with this product came during the internal trials period. The author was asked for a general appraisal of the operator interface. To do this the author passively observed the product in use by an operator/demonstrator for a period of $1\frac{1}{2}$ hours and noted all the errors and mistakes, and their apparent causes. The observations which arose are described below.

(a) System prompts and operator messages appeared on the bottom line of the screen, immediately above this was an inverse video status line giving

information about the speed of the communications line, LOCAL/DUPLEX mode operation etc. The information on this status line was largely irrelevant to the operator and therefore need not be displayed all the time, and furthermore, the inverse video presentation drew the eye to this part of the screen unnecessarily, and tended to distract the operator from the more important bottom line prompts and information. This was unsatisfactory.

(b) When the length of a received telex was longer than the screen, the information was scrolled upwards. Information was displayed at the beginning of th telex relating to calling and answerback telex codes, internal message indentification numbers and other information which was not always relevant to the operator, but which needed to be displayed with the telex proper for those infrequent instances when it was required. Instances were observed (when long telexes were received) of this information appearing on the screen and then being rapidly scrolled off the top. This did not occur with telexes shorter than the screen, since both the preceeding information and the telex proper could be displayed at the same time. In the case of long telexes, the system designer had arranged for the header information to be scrolled off the screen as unimportant, giving priority to

displaying as much of the body of the message as possible; the less important header information could then be scrolled back onto the screen by the operator. Confusion occurred since information appeared on the screen and was rapidly scrolled off before the operator had chance to assimilate it or realise that it was unimportant. The confusion arose because the operator felt that something had been missed. It was recommended that either the header information should not be displayed at all, or that, if it was displayed, it should be displayed in preference to later telex contents, until the operator could assimilate the information and manually remove it from the screen.

(c) Some confusion over terminology was observed - eg. the command "RECEIVE MESSAGE" caused an already received telex to be recalled to the operator's screen. These observations reinforced the recommendation that the operator interface should appear to have the logic and terminology expected by the operator.

7.1.3 Sales Staff and Customer Purchasing Authorities

The first Information Gathering Exercise emphasised that future products should have features which assisted the organisation's salesforce in demonstrating the benefits of the products and also which assisted

customers in assessing the value of such benefits, especially when these required assessments which were new to the user organisation.

The implementation of such features in the products proposed as a result of this project is described in the appropriate sections on those products. However, the Telex Manager product was the first office-based product to be released after the first Information Gathering Exercise. Whilst the author cannot claim to have played any part in the design of such features into this particular product, two points are worthy of mention since they admirably demonstrate the fulfilment of the requirement.

Firstly, in order to demonstrate the function and effectiveness of the product, each member of the salesforce promoting the Telex Manager product was issued with a portable VDU terminal. This terminal allowed the salesperson to demonstrate the system from the customer's premises by means of a telephone link to the organisation's system in Manchester. A typical demonstration might involve the use of the portable terminal to demonstrate the telex preparation facilities, and the telex thus prepared could be sent immediately to the customer's own telex machine. The portable terminal could then also be used to demonstrate the more advanced features of the system. Such on-site demonstrations were

very powerful sales aids and received much praise from customers.

Secondly, two of the benefits of the Telex Manager product were that it reduced the number of telex lines needed for a given telex traffic load, and that it made the telex preparation process more efficient. The first of these two benefits can be considered "hard" and easily quantifiable, whereas the second is a "softer", less familiar benefit which some users might not know how to quantify directly. The sales literature available with the product contained one document which was designed specifically to illustrate these "soft" benefits, showing where they occurred and demonstrating how they could be quantified. Illustrations were given from experience with actual installations. Whilst customers, obviously, were at liberty to check these figures and to use their own assessment criteria and methods, this document was praised as a very useful weapon in the salesforce's armoury.

7.2 LOCAL AREA NETWORKS

The Product Concept Proposal (Appendix F) identified local communications and the developing market for Local Area Networks as a necessary area for investigation. The second Information Gathering Exercise took this investigation further. The issue of Local Area Networks, however, had a wider significance for the organisation, beyond this one project, and the New Products Committee sanctioned, in Spring 1981, a design study to investigate LANs as an area in itself. This is a very complex area with many interacting technical and market influences, and a description of the full study is beyond the scope of this document. However, the author contributed to this study on a number of issues, and this participation is described below.

7.2.1 What are Local Area Networks?

It is very difficult to arrive at a single definition of a Local Area Network because of the wide range of philosophies, designs, implementations and uses of systems laying claim to such a description. An attempt to isolate those aspects common to all such systems would state that a Local Area Network provides an information transmission service common to a wide range of (computer or microprocessor-based) devices and is normally confined within the boundary of a single site such as a manufacturing plant or a suite of offices.

Thurber (1981) produced a taxonomy of experimental Local Area Network architectures, and these were followed by a flood of commercially available products (catalogued by Urwick Nexos 1981B).

Local Area Networks provide the means of linking together the various elements of computer or office systems, providing the means of communication between the constituent elements. In this way, dedicated links between a computer and its terminals, or between a PT7 controller and its VDUs could be considered a rudimentary local area network, but had been considered simply as "communications links" from the origins of computer technology. "Communications Links" were dignified with the term Local Area Networks mainly as a result of two forces (although there were others):-

(i) the gradual spread of computer terminals and devices into more and more areas (literal and figurative) of business, and the consequent expense and inconvenience of running the necessary cables to and from each device, and of adding new cabling each time a new device or system was added or moved;

(ii) the spread of computer intelligence from central mainframe computers into smaller, cheaper and more widespread devices such as intelligent terminals, Word Processors, personal computers and even such things as photocopiers, facsimile devices, and printers. This distribution of

intelligence altered the basis of the flow of on-site computer communications

FROM that associated with a number of non-intelligent devices exchanging information over dedicated lines with one large centralised intelligence

TO that associated with a number of highly intelligent devices exchanging information with each other as peers.

These two forces gave rise to the concept of Local Area Networks which in the extreme would function as a site "Information Service" in the same way that other services such as electricity, gas, water and telephone are provided as part of the fabric of a building when it is built, (and only occasionally need to be modified) yet accommodate many changes in usage patterns over the life of the building. The "Holy Grail" of such developments was the plug on the wall marked "Information" which would provide the basic communications facilities to which communicating devices could be attached at will and moved around as necessary, without the need to rewire each time.

Many products were designed and offered to the market to satisfy such a need, and the products varied widely in their

communication medium (coaxial cable, twisted pair cable, multicore cable, optical fibre);

speed (ranging from hundreds of bits per second to millions of bits per second);

topology (star, ring or branching bus);
method of interleaving communications (time or frequency division multiplex);
method of controlling access to the medium;
supplier (computer manufacturers, PABX suppliers, independent companies).

With such a large number of available systems, and such a discrepancy between them, it was not surprising that a great deal of user interest was observed, but not much activity owing to the lack of clarity of the relative merits.

7.2.2 User Requirements

The original technical and cost benefits of Local Area Networks were described above. However, other forces influenced the development of such systems, driven on by the desire of computer users not to be constrained to obtain all their computer equipment from one supplier. This desire to purchase elements of computer systems from the suppliers of "plug compatible modules" (PCMs) was fundamental to the existence of such products as PT7 and was found to be widespread by the first Information Gathering Exercise (Appendix D).

This market requirement for interconnectivity of different manufacturer's computer systems resulted in many committees being established around the world to

consider the development of international standards for computer systems. Committees were set up by various standards bodies such as the Comité Consultatif International de Télégraphique et Téléphonique (CCITT), the European Computer Manufacturer's Association (ECMA), the International Standards Organisation (ISO), and the American National Standards Institute (ANSI). One of the most influential committees of this type was organised by the American Institute of Electrical and Electronic Engineers (IEEE), known by them as Project 802 and considered standards for Local Area Networks. The recommendations of this committee were eagerly awaited by both manufacturers and suppliers but were a long time in preparation because of the highly complex issues to be resolved in reconciling the approaches of all the existing suppliers of computer systems. This committee followed on from the work of another highly influential body, the ISO which produced recommendations on Open Systems Interconnection which were highly influential on supplier's thinking (Zimmerman 1980)

These moves towards standardisation and open systems interconnection would eventually satisfy the user's requirements for multi source supply of system elements and also satisfy another desire for the ability to share between systems such expensive elements as large backing stores, printers and communications facilities, hence reducing duplication and thus overall system cost. These and the desire for cheaper, more flexible communications

systems as mentioned in 7.2.1 constituted the market pull for the development of Local Area Networks.

7.2.3 The Influence of This Project on the Organisation's LAN Development.

The Local Area Network Study commissioned by the New Products Committee was faced with some very complex issues in order to decide on an LAN strategy to be adopted by the organisation, and these issues went beyond the requirements of this project. There were three main strands to the study:

(i)LANs as a product: by means of the Videodata product, the organisation was a very early entrant into the Local Area Network market. With the subsequent entry of other supplier's offerings, the organisation needed to consider the future of this product as part of its equipment and product business lines as a result of the new market pressures.

(ii)LANs as a design philosophy: subsequent market entrants after the Videodata product had taken the concept of LANs beyond that of cheap, adaptable cabling systems, towards that of being elements in a distributed design philosophy based on the spread of computer intelligence into more and smaller system elements such as terminals and printers. The organisation had to consider its strategy

towards LANs in the light of its overall equipment philosophy, in which it was desired to exploit the advances represented by LANs and the distribution and miniaturisation of intelligence, yet whilst preserving the sales life of its existing products and equipment.

(iii) LANs as agents for compatibility and standardisation: as described above, the coincidence of LAN developments with the developments for Open Systems Interconnection made LANs agents for standardisation. However, the multiplicity of LAN philosophies and implementations made standardisation difficult, and many candidates for standards emerged both from standards organisations and from commercial organisations seeking market-led or ad-hoc standardisation. In view of the organisation's commitment to exploiting niches in the plug compatible terminal market, and elsewhere, the organisation had to consider which of the proposed standards was likely to triumph in order to permit early moves to exploit the opportunities presented.

Thus it can be seen that the remit of the LAN Study Group went far beyond the requirements of this project. However, the author had a close association with the study because of those requirements and because of his investigations of the subject as part of his research. The influences brought to bear on the study are briefly described below.

7.2.3.1 Cost of Connections:

The second Information Gathering Exercise (Appendix H) had shown that users would require to use LANs as a method of supporting the distribution of computer terminals throughout their organisation. The exercise had also shown, however, that current costs of such terminals was too high to be justifiable in many instances and that cost reductions were being sought. Hence a fundamental requirement of any LAN would be that it should be able to support a cheap method of connection for terminals and that a figure of £50 in a terminal cost of £900 would appear to be a good target in view of the enthusiastic reception of a low performance LAN with such a cost.

7.2.3.2 The Role of Functional Products:

The Videodata product had achieved success as a cost justifiable cabling system. The second Information Gathering Exercise (Appendix H) indicated that as well as this type of opportunity, there was also a number of organisations who would consider the introduction of a LAN as part of a functional product such as an electronic mail/message system or a PABX. This was evidence of the evolutionary, marginal-justification strategy of office automation described above: if the infrastructure of office automation (particularly the communications system and terminals) could be paid for by the introduction of

a system with quantifiable benefits, then subsequent systems with more qualitative benefits could be introduced using these existing facilities at less direct cost, the justification of such qualitative benefits being problematical.

With the entry of more suppliers into the LAN market providing LAN-based functional products, the opportunity for LANs as independent products, would be eroded, and thus the consideration of a LAN strategy could not be considered completely independently from consideration of functional products which would be supported by the network.

7.2.3.3 The Interface of Alien Products to the Organisation's LAN

As described in the Product Concept Proposal (Appendix F), the organisation did not expect to produce all the elements of office automation. It did not, for instance, envisage manufacturing intelligent printer/copiers or optical character readers to its own design. Hence any LAN strategy should choose such interface methods and standards as to permit the connection of "alien" products selected either by the organisation as "bought-in" items or by the customer as plug compatible modules.

7.2.3.4 The Interface of The Organisation's Products to Alien LANs.

Complementary to the above was the realisation that where the organisation sought to supply LAN based functional products, there could be no guarantee that the organisation's LAN would be the first into the customer's organisation, hence the organisation's LAN strategy should not constrain its functional products to compatibility with the proprietary LAN only. It should also permit their use with other LANs which they might encounter in the field.

7.2.3.5 The Higher Levels of Open Systems Interconnection.

Where independent, alien functional systems shared a LAN as a common transmission medium, but did not intercommunicate, then the LAN could be viewed as a piece of hardware. However, the user requirements for the shared use of expensive system resources such as large printers or communications facilities implied that such alien systems could not be totally independent. This meant that the attention of the study group had to go beyond the hardware level at which it started and encompass some of the higher, software elements of the Open Systems Interconnection recommendations. The team was expanded accordingly.

7.2.3.6 The role of the PABX

The Product Concept Proposal (Appendix F), confirmed by the second Information Gathering Exercise (Appendix H) had pointed out the potential importance of the PABX in providing office information communications facilities. With expansion of the interest of the study group into the areas of open systems software and functional products, it was necessary that these considerations should also include using PABX communications facilities, in addition to the coaxial, fibre optic or multicore cable transmission media considered at the outset.

Additionally, the involvement with the joint-venture PABX company over the Voice Messaging System product (Chapter 6) was also useful here in that contacts were established with regard to information communications which were later of great use to the LAN development.

A description of the outcome of the LAN Study is beyond the scope of this thesis. Specific aspects of LANs are described in more detail at appropriate parts of other chapters.

The description given above, however, does illustrate the interaction between developments which was observed as part of this project.

7.3 THE MARKET FOR TELETEX

During the project described here, British Telecom, the UK PTT, declared its intention to provide a Teletex service for UK subscribers, in order to overcome some of the acknowledged shortcomings of the existing Telex service. The organisation decided to address this opportunity to provide terminals for the new service. The author was called upon to assist in the assessment of the market potential for Teletex devices, and hence in the formulation of a product strategy.

After a brief description of the Teletex service, this section describes the author's work in this area, firstly illustrating how the initial rough market potential figures were obtained, and then showing how the product strategy had to be revised in the light of estimates of the likely cost of a Teletex interface.

This re-estimation illustrates the iterative nature of market sizing work, as referred to in Section 5.4.2.3.

7.3.1 The Teletex Service

In 1981 British Telecom declared, its intention to provide a Teletex service to UK subscribers. The service was intended to provide a national and international electronic mail service from Teletex terminals on

subscribers premises. The service would, however, be superior to the existing Telex service in that it would

(a) be faster, transmitting at 1200 or 2400 bits per second;

(b) be cheaper, using telephone or PSS lines rather than the separate Telex network;

(c) be easier to operate since it would permit the transmission and receipt of text without direct operator intervention;

(d) produce better quality correspondence since it would be able to transmit upper and lower case characters, characters from foreign (non Roman) alphabets, and limited special symbols;

(e) produce more accurate correspondence since it was assumed that the text would be produced on terminals with text editing capabilities;

(f) be more widely supported since the PTT would not monopolise the supply of terminals, but would restrict its role to the provision of the service and the certification (possibly by delegation) of terminals from independent suppliers.

The service was to be introduced in 1982 with early interconnection to the Telex network so as to give Teletex subscribers access to the 90,000 UK Telex users and hence avoid the ubiquity and critical mass problems which faced the Telephone and Viewdata services at similar stages in their introduction.

7.3.2 Initial Assessments

Information was obtained from British Telecom to the effect that they expected the Teletex service to comprise 100,000 connection points by 1990, thus supplanting the existing Telex service which was of approximately the same size in 1980. This initial estimate of the growth in attached devices is shown on Figure 7.3.

This was compared with the organisation's existing estimates of the growth of the communicating Word Processor market (obtained from its sponsorship of the UKITO Office Technology Action Group Project) and these figures show a similar, if somewhat earlier growth based on the proprietary protocols of the various independent manufacturers rather than the standards of the Teletex Service. These figures are also shown on Figure 7.3. These two sets of figures appeared to correspond reasonably closely and to give some indication of the likely size of the market for Teletex attached devices. The OTAG figures, however, also indicated that a sizable existing base of potentially-communicating Word Processors would exist preceding the availability and user acceptance of the Teletex service, from which the Teletex user base would substantially emerge.

It also became obvious from information gained in the Office Products study described previously that each point of attachment to the Teletex service was not likely

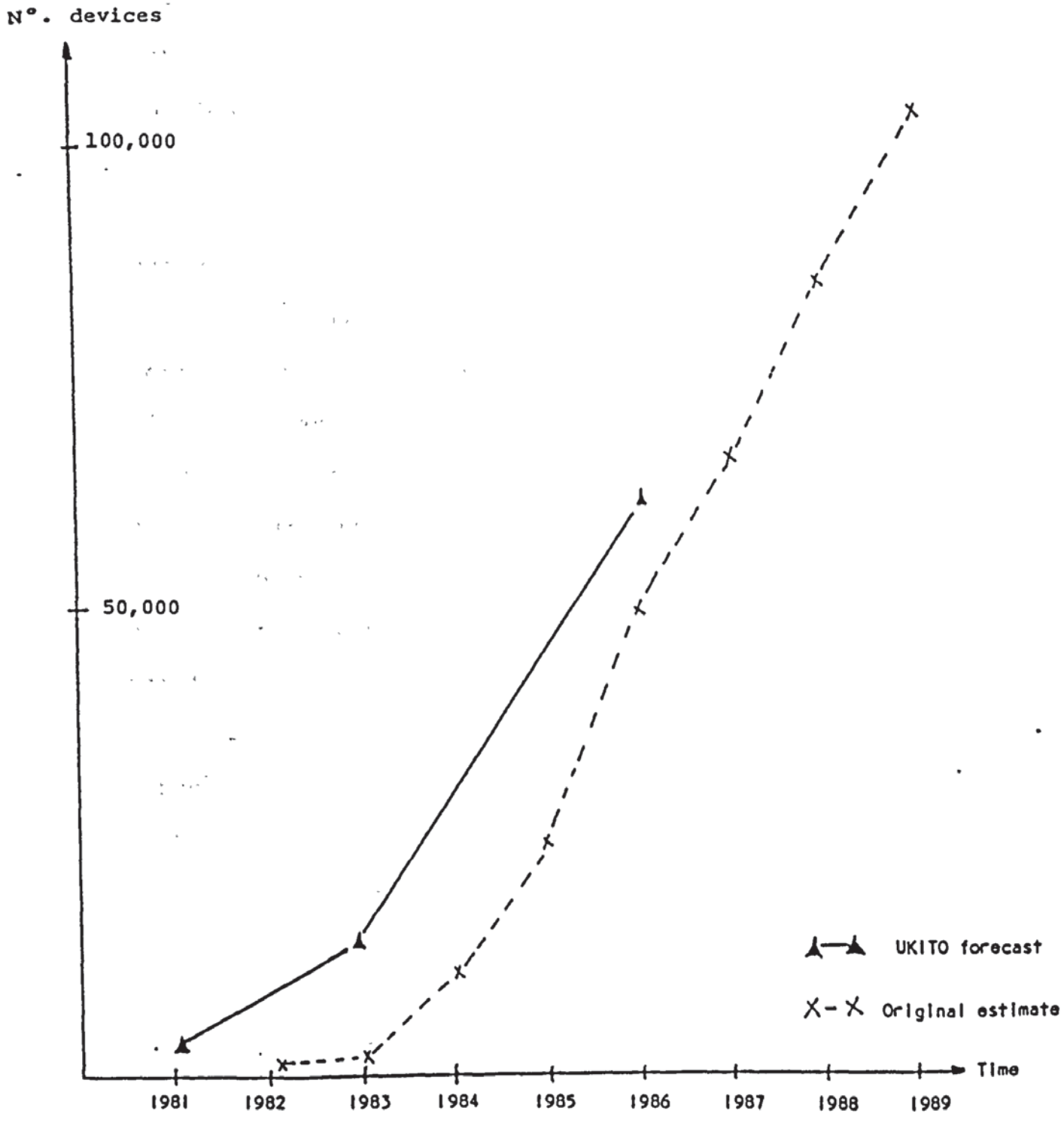

FIGURE 7.3 Growth of Teletex User Base

to be restricted to one terminal device (as was the Telex service). The Office Products study had indicated the potential for clustered, organisation-wide communications systems based on Local Area Networks or PABXs, and it was likely that these would share the gateway to the Teletex service amongst a number of terminal devices.

Thus the organisation's perception of its best product offering to the Teletex market changed from being that of offering a Teletex-connected text-processing terminal (which would compete in a very crowded market with other non-Teletex-connected text processing terminals) to that of offering a Teletex "brown box" which would provide the interface to the Teletex network, and which could be used with virtually any manufacturer's word processor, local area network, minicomputer, mainframe computer, PABX etc. By this method, the organisation hoped to take advantage of the potentially large existing base of text processing devices of American-designed PABX, local area networks, and mini and mainframe computers.

Thus the organisation could hope for a share of the whole Teletex attached market rather than that part of it based on individual terminals. The likely size of this market is shown in Figure 7.4 by converting the installed base figures of Figure 7.3 into annual sales.

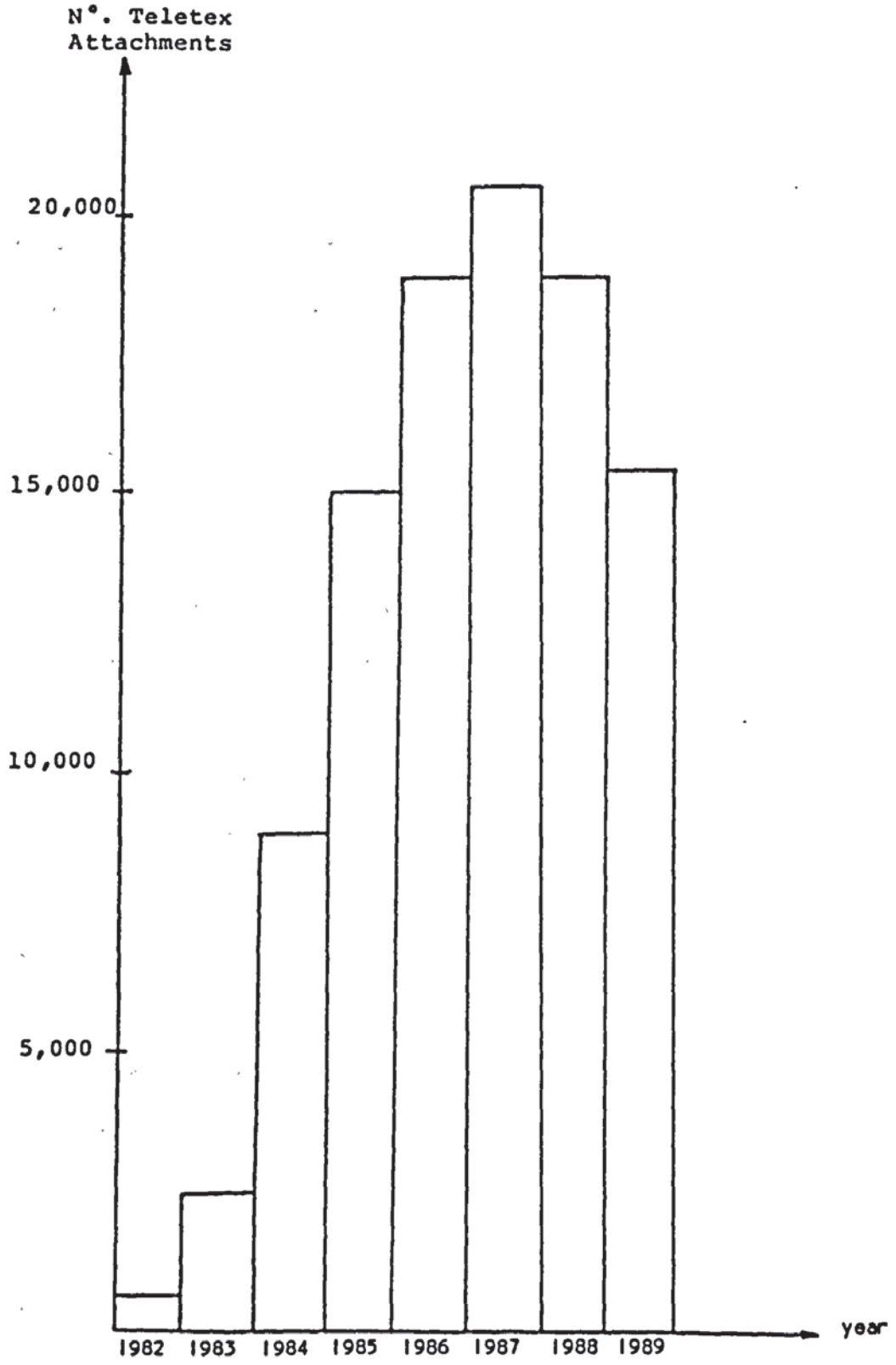

FIGURE 7.4 The Market For Teletex Attachments (Units p.a)

7.3.3 Reassessment

A design study was then performed into the likely cost of a Teletex Interface, either packaged as a separate device or as part of another device such as a Word Processor. The results of this study indicated that the Teletex interface was a complex device and hence would not be cheap. Indications were that the selling price of such a device might be in the region of £2000 to £2500 (this was confirmed by other industry sources).

At the same time as this became clear, initial indications were obtained from British Telecom as to the likely tarrifs of the Teletex service. With these two pieces of information, the author was able to further assist in the refinement of the Teletex product strategy by considering the financial attractions for users to adopt the Teletex service in preference to Telex or conventional mail. This is shown in Appendix J. As can be seen, the work was done against a rapidly changing background of tarrif information.

The main contribution of this work was to identify more closely, potential early users of the Teletex service. These were likely to be users with large amounts of intra-company but inter-site mail or telex traffic. From the organisation's own experience with its Telex Manager product, these were likely to be organisations in the banking, finance and commodity

trading business, amongst others. This work also enabled advertising to be formulated and targeted so as to emphasise the attractions of the Teletex Service, and to reinforce the organisation's desired image of providing "Cost Justified Office Products".

7.4 CHAPTER SUMMARY

The three instances given in this chapter illustrate how the influences of the work done as part of this project were able to go beyond the strict confines of the project brief (Appendix A). The fact that the work done as one feasibility study was able to contibute constructively to other product developments, and also to the identification of a second product opportunity in its own right (Chapter 6), illustrates the importance of considering such exercises not as isolated tasks, but as contributing to the "Dominating Ideas" of the organisation (Normann, 1977) and also that benefits can accrue to the organisation if horizontal and vertical information flow is permitted and encouraged by the action of management and/or professional staff. This information flow can be beneficial in both formal and informal types of information exchange.

CHAPTER EIGHT

CONCLUSIONS

8.1 THE CUSTOMER ACTIVE PARADIGM.

8.2 METHODS OF MARKET RESEARCH

8.3 THE IMPORTANCE OF FREE INFORMATION FLOW

8.4 ELEMENTS OF THE OFFICE PRODUCTS STRATEGY

8.5 AREAS FOR FURTHER WORK

Being an interdisciplinary thesis, it is not surprising that the conclusions arising from this work cover a number of different areas. A major part of the work reported here extends the previously published work of von Hippel concerning the Customer Active Paradigm. Another significant area contrasts the Customer Active Paradigm with the more conventionally encountered Manufacturer Active Paradigm.

In another area, the thesis draws a number of conclusions relating to methods of market research, confirming existing observations on the suitability of postal, telephone and personal interview strategies in certain circumstances.

The thesis goes on to demonstrate the importance of free information flow within an organisation in the pursuit of new product opportunities, the free flow making it more likely (as shown here) that both sought and unsought opportunities can be exploited. These findings refer to the earlier work of Normann who has shown that an organisation is strongly influenced by the "dominating ideas" which are formulated by the "principal actors". It is shown here that formal information flows and documents are a necessary but not sufficient method of influencing the formation of the "dominant ideas" on new product areas. These findings also link the work of Tushman and Katz on "Gatekeepers" with the work of von Hippel by showing that the role of a gatekeeper is

particularly appropriate and useful in an organisation moving from Customer Active to Manufacturer Active methods of idea generation.

Finally, the thesis provides conclusions relating to the specifics of the exploitation of the product opportunities facing the sponsoring organisation, in the form of two New Product Proposals.

The conclusions in these areas are described in more detail below.

8.1 THE CUSTOMER ACTIVE PARADIGM

Chapter 3 describes the work of von Hippel in identifying the Customer Active Paradigm for new product idea generation. Von Hippel has studied the industries of scientific instrument manufacture, electronic subassembly process machinery manufacture, and semiconductor process machinery manufacture and shown that a significant number of new product ideas originated with users rather than suppliers. These users took the large steps of writing a specification for the new product, or even sometimes developing a prototype, before approaching a manufacturer to provide the product in the required volume and to production standards. Von Hippel has also observed this mechanism to a lesser degree in the custom automobile, bakery and packaged software industries, and has shown how the mechanism has been encouraged in the latter two areas. He claims that the Customer Active Paradigm operates counter to the Manufacturer Active mechanisms normally recommended in the literature.

Chapter 3 shows how this mechanism was observed in the Computer Systems Business by an analysis of the origins of the organisation's new, independent business segments developed since the late 1960's. The chapter shows that the nature of the technology (rapidly advancing and highly adaptable) and the history of the organisation (in producing custom systems to individual

specifications) contributed to the manifestation of this mechanism.

It is shown that the customer organisation benefits from the mechanism by being first to receive the benefits of the new product without having to acquire the new skills and facilities necessary for its development. The supplier organisation benefits from the mechanism since its development costs are subsidized, its development risks are lessened, and it is provided with a very useful reference installation for its new product to show to potential customers.

One potential drawback of the mechanism is identified in that although, from the contract-based nature of the original development, customer contact is dispersed throughout the organisation (a good thing) it is quite likely that the product could be produced too close to the requirements of the original customer, in prejudice to the wider opportunity. Furthermore, because the original customer takes responsibility for the overall specification and the manufacturer is chosen for his technical expertise, it is possible that any manufacturer seeking repeated operation of this mechanism might develop a balance of skills too close to the technology and not sufficiently close to the application for a successful wider product. The manufacturing organisation must take active steps to ensure it has the necessary skills and experience to exploit the wider market opportunity by obtaining application-related expertise to

balance the technology-related skills for which it was chosen. This leads on to the appropriateness of the concept of the gatekeeper (see 8.3 below).

The chapter goes on to identify how the organisation attempted to nurture its customer-based idea sources by the development of close relationships with opinion leaders and advanced technology users; by performing well in existing contracts; by employing a technologically skilled sales force; and by promoting its total range of skills.

Finally, a limitation of the Customer Active Paradigm was noted, in that it was found to be inappropriate to the study described here which involved the identification (against identified time constraints) of the requirements for a product redesign. The Customer Active Paradigm is unreliable against these constraints, and a more conventional Manufactuer Active search was pursued.

8.2 METHODS OF MARKET RESEARCH

Chapter 4 describes the methods used to obtain information from the potential users of the recommended products, and in doing so reinforces the recommendations found in the literature regarding postal, telephone and personal interview strategies. In the work described here, it was required that an understanding be developed of the opinions and preoccupations of Data Processing Managers regarding products which did not yet exist and that the various points arising be discussed and probed. Postal and telephone methods were tried and rejected as being unsuitable, although it was felt that they would have been suitable for statistics-generating exercises in which the questions to be asked could remain the same across a wide range of respondents.

Instead, a personal interviewing strategy was employed which involved face-to-face interviewing on the respondent's premises. Not only did this permit much more subsidiary visual information to be obtained about the respondent and his organisation, but also it permitted the development of a flexible interviewing strategy in which the responses of earlier interviewees deliberately influenced the questions asked in subsequent interviews so as to develop and refine the ideas which emerged.

This flexible interviewing strategy was further refined in the second Information Gathering Exercise in which it was acknowledged that respondents would be better able discuss certain areas, and not able to contribute in others. In this case, a thumb-indexed questionnaire was used which allowed the respondent to develop his own lines of argument, largely free from conceptual or philosophical constraints imposed by the questionnaire. The interviewer could then switch between the relevant sections as required.

8.3 THE IMPORTANCE OF FREE INFORMATION FLOW

The work described here demostrates the importance of free information flow in an organisation (between levels in the organisation's hierarchy, along levels in the hierarchy, and into and out of the organisation) which can result in enhanced exploitation of product opportunities. Chapter 6 illustrates the importance of free flow down the hierarchy, allowing a previously abandoned product idea to be resurrected and developed. Chapter 7 illustrates the importance of free flow across the hierarchy by describing how the author was able to usefully contribute to developments outside his main area of responsibility. Chapter 5 and 6 illustrate the importance of free flow up the hierarchy by showing how the author (developing from Normann's idea of "principal actors" and" dominating ideas") used informal information flows to complement formal, written reports to reduce the "culture shock" of his new product proposals and to identify potential areas of opposition.

The recognition of the importance of free information flow allowed Tushman and Katz's work on the role of "gatekeepers" to be linked with von Hippel's work on the "Customer Active Paradigm". This work shows how important the role of gatekeeper is to an organisation which was changing from a CAP-type operation to a more Manufacture Active method. It is important that someone in the organisation performs the role of gatekeeper in

channelling information inwards so as to replace the previously active customer in producing external contact and (more importantly) application specification. The role of gatekeeper is also important in CAP mode to ensure the original product design is broad enough to address the wider market need, rather than the immediate customer specification.

The thesis points to the author's adoption of the role of gatekeeper in furtherance of his product proposals, and the organisation's appointment of Product Managers, whose role encompassed elements of the role of gatekeeper as defined by Tushman and Katz.

8.4 ELEMENTS OF THE OFFICE PRODUCTS STRATEGY

The conclusions in this area concern the recommendations given in Chapter 5 and Appendix I specific to the organisation's current position and future aspirations, and as such are necessarily not as easy to generalise as the conclusions described above. Nevertheless, these were the conclusions which were most important to the industrial (complementing the academic) aspects of the work and the more important of these are mentioned here for completeness.

It was recommended that the organisation broaden its terminal business to address the opportunities presented by the developing Office Products or Information Technology market. In order to do this, it was recommended that the organisation develop products which could be accorded a Cost-Justified image, since these were likely to be more easily adopted by the market and hence achieve a wider degree of success. It was recommended that the organisation acknowledge the user requirement to pursue an evolutionary and marginal costing strategy in the implementation of future office systems, and that the products contained upgradeable design features to permit this. It was proposed that the organisation was not likely to dominate the office products market and that as a result of this, the

products be designed so as to make a virtue out of their coexistence with alien products, and hence increase customer appeal. Furthermore, it was proposed that the organisation pursue an innovatory rather than emulatory policy in connecting to alien products.

8.5 AREAS FOR FURTHER WORK

The work described in this thesis has covered a number of different academic areas. This broad span coupled with the industrial requirement to produce detailed product strategy documents has meant that it has not proved possible to fully pursue all the academically interesting lines which have emerged from this work. Two areas in particular have, reluctantly, not been pursued and are mentioned here as suggestions for further work for future researchers in the same area.

The first area concerns the incidence of the Customer Active Paradigm. In considering the areas in which the CAP has now been observed to operate (such as Computer Systems, Semiconductor Process Machinery, Scientific Instruments, Electronic Subassembly Process, Packaged Software), it would appear that the CAP might be associated with industries which are in an early, growth phase. Certainly, the areas mentioned above would appear to correspond with this definition. It would appear to be interesting to consider other industries at similar early, growth phases (possibly linked to the high adaptability and rapid advance exhibited by the Computer System, Electronics, Semiconductor and Packaged Software areas) in order to identify other possible manifestations of the Customer Active Paradigm.

The second area concerns the linking of the Customer Active Paradigm with the importance of the role of gatekeeper. It has been shown here that in the Computer Systems business, the transition between Customer Active and Manufacturer Active methods of product idea generation, results in the role of gatekeeper becoming vitally important. It is further shown that in CAP mode, the role of gatekeeper is important in maintaining a balance in the product design between the requirements of the original customer and the possibilities of the wider market. It would appear worthwhile to consider whether a similarly important gatekeeping role can be observed in other incidences of the Customer Active Paradigm.