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USING THE CASE STUDY APPROACH TO DEVELOP A MICROCOMPUTER BASED, FULLY INTEGRATED, DATA BASE DRIVEN, MANAGEMENT INFORMATION SYSTEM

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ABSTRACT

The project objective was to develop a microcomputer based, fully integrated data base driven, management information system for a small wholesale business. To accomplish this survey data was collected from a number of wholesalers and a composite model company developed. The model company was expanded into a full case study so that a full management information system could be developed around the parameters.

INTRODUCTION

Recent developments in technology have removed many of the barriers to the development of full information- systems on microcomputers. The relatively low cost and high dependability of this technology have made inevitable deployment of such systems into the commercial world a possibility. However, up to this point, the complementary development of satisfactory software has lagged behind the hardware technology. This paper addresses that need; it discusses a model for an information system which could be used in the intermediate distribution industry; (e.g., wholesaling) and incorporates much of the current "state-of-the-art" techniques traditionally reserved for large main-frame computer systems.

Actual firms were used as the basis for the model developed for this discussion. The entire work was based upon a single case study of a wholesale sporting goods distributor. Within that case study, sample databases were developed to drive the functional modules described in the text. As a result, the case study provides a frame work on umbrella-like reference for all of the normal MIS functions.

TECHNOLOGICAL CHANCES

The last few years have seen the development of whole industry based upon the microprocessor - a computer on a chip. As each generation of these devices is announced, greater performance, higher throughput and improved reliability are reported. Today, the computing power available for a few dollars could only have been purchased for hundreds of thousands a decade or so ago. Concomitant with the development of the microprocessor chip has been the development of dependable, low cost memory devices. These devices, also in chip form, complement the microprocessor or chips, in terms of physical volume, energy requirements, and cost. The result is the two essential ingredients of a computer, processor and memory, available in a low cost, moderate power, small size configuration.

At the same time, random access mass storage devices have been developed which permit high volume mass storage of information in a non-volatile manner. These devices, primarily floppy disks (and of late, small fixed disks), are on a scale compatible with the new breed of microcomputers.

With the advent of the need for CRT's and print devices on this large scale, industry has responded with a wide variety of compatible devices.

TECHNOLOGICAL LIMITATIONS

The microcomputer industry has enormous potential, and a wide variety of companies, from the IBM's and the Exxon's of the world to the two-men-in-a-garage types, have jumped upon the opportunity. The result has been rapid development at the expense of standardization. Thus little plug-compatibility exists and interfacing is often too technical for most end-users to accomplish.

Because many of the premier competitors in the industry are very small, resources have been focused upon hardware and too little upon such key requirements as comprehensive software and operating systems. This result is not unanticipated since hardware features are easily quantified and "sold" or marketed, but software features are more "artistic", less quantifiable and less easily sold. The result is that software development is more difficult to make into comprehensive systems.

OVERVIEW OF THE MODEL

The author developed the model in conjunction with the production of a textbook ("Business Systems for Microcomputers", Prentice-Hall, 1981). The objective was to develop a fully integrated, database driven, management information system on a microcomputer. The system would be fully menu driven and friendly to the user; that is, affording full information and assistance to the operator via CRT. The intent was to incorporate all of the subsystems and operating system utility requirements within the umbrella of a single program. The intended result was to reduce operator error, system failure, and expedite user learning/adaptation.

The model industry selected was intermediate distribution since it presented potentially the widest range of system requirements. All of the general financial systems (accounts payable, accounts receivable, general ledger, payroll), full inventory management and warehousing (buying, forecasting, stocking, pricing) and the general merchandising requirements (merchandise management, directional analysis, purchase order tracking, etc.) were required. The authors feel that if all of these needs could be satisfied, most other systems applications would constitute a subset of these.

THE MODEL COMPANY IDEA

Since a text was planned for small businesses, it was decided early in the conceptualization process that a major case study should form a significant focus for the effort. This approach would serve two purposes - cast a frame of credibility and practicality around the theoretical and secondly, to form a reference for the authors to assume a clear focus in the writing process.

Developing the case study proved to be a substantial challenge. A number of in-depth executive interviews were conducted with a group of wholesalers in different lines of trade which uncovered widely different operating requirements. For example, in building products, delivery scheduling frequently was key; in plumbing and heating, it was not. The automation after market serial number cross indexing was the sine qua non requirement

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but it did not exist in hardware. In lumber, commodity pricing was a major issue while in office supplies, a two-tier (wholesale and retail) operation was normal, and so forth.

The goal was to develop a genius system capable of supporting all of these requirements. Early on it became apparent this was an unrealistic objective. It was decided to focus on sporting goods since it seemed to be "representative" of many industries but free of idiosyncratic features germane to only one or two specific lines of trade.

The interview process uncovered many operating variances within lines of trade - various forms of accounting, differences in statements, and inventory valuation methods, to name a few. A survey was conducted of many wholesalers to determine the scope of the options and the degree of acceptance.

The result of the effort was the development of a model company; Bunyan Sporting Goods which represented most of the trends in the industry and most of the composite features. This model company was refined by an expert panel using a Delphi-like approach.

MODEL COMPANY FEATURES

Via the survey, the authors were able to determine the "worst case" for each operating parameter. Worst case means that version which imposed the greatest design demands upon the system. For example, some wholesalers use balance forward statements, others use open item statements. Open-item requires more design thus was adopted for the model.

The model required much detail since the information system would touch virtually all operating areas of the company. A physical layout for the warehouse was made since picking tickets would be generated in "warehouse sequence. Model inventory stocks were developed and integrated with both a vendor file and an open purchase order file. A customer list was created and integrated with an accounts receivable file (the item quantities of which were integrated to the sales history file). The accounts payables file was integrated into both the vendor file and the item file. An employee file was created which "fit" the level of activity in the company.

All of the systems were integrated into a general ledger system which summarized the transactions.

A report stream (more than 50 reports in all, are created by the system) was developed which displayed the data in the file and conceptualized in the model company in such a way that one report made mathematical and logical sense with the others. (There were of necessity a few exceptions).

A major challenge was to then develop a systems flow which properly accounted for five key constraints.

- microcomputer technological limitations systems integration at an appropriate scale
- logical integration
- chronological coordination current (and business practices

Microcomputers impose certain technological constraints - limited main memory, speed of data transfer, file size and file access, among others. The system as developed had to

design around these constraints.

Small wholesalers could be operating with a staff of fewer than seven people. Thus the system had to reflect this scale and not impose heavy data processing requirements which the logical user could not afford. Thus certain features were simplified; many desirable features eliminated to assure reasonable scale.

If a wholesaler paid bills twice a month the system had to permit him to continue to pay twice a month -frequently industries have norms which have been established over time but have real significance attached - such as discounts or rebates. Thus the system had to be flexible to accommodate 52 periods per year, 13 periods per year and 12 periods per year, for example.

Chronological coordination is key to business operation - period beginning and ending dates, service charge calculation dates, discount dates, and the like. The system needs to be tied to a calendar (Julian dates, In this case) and flexible in design to permit varying operational parameters or drives.

Finally, the loop from manual systems to automation suggests some changes in day to day operating procedures which facilitate more timely, accurate or efficient information management. The system had to be designed to avail itself of the best of these improvements without imposing major disruptions on the "user". Further, it was necessary to sort out normal (but unacceptable) business practices. Small firms frequently do not have as good operating procedures as larger ones for all the logical reasons. Our objective in the book was to balance sound business practices with common sense and scale to make the model company a model of good business practices as well.

OPERATIONAL OVERVIEW

The prospective basic systems design was to create three levels of files:

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|------------------|--|
| Database files - | used as major data repositories in an ongoing way. |
| Workfiles - | used as intermediate files to feed database. These files expand and contract with the level of activity. |
| Taskfiles - | Transitory files used to develop and format data to drive work- files and databases. |

The programs were written as modules all called by the menu-modules and sized so that data manipulation can usually be done in core to expedite processing. Database, file and program storage is balanced (in the floppy disk based system) on a number of diskettes to minimize diskette changes and provide maximum growth capability of databases. Diskette changes are specified via menu and verified before continuation.

Processing regimen is based on the "form follows function" philosophy. For example, file maintenance may be performed whenever daily activity provides an Opportunity.

Programs are linked by an umbrella of chained programs including:

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Start-up

EOD - (End of day)

EON - (End of month)

EOY - (End of year)

Start-up is required to load programs and cannot be called again until EOD has been run, etc.

The result of the systems work has been the development of a fully integrated, menu-based, database driven, distribution management information system. Industry reaction and beta site performance are suggestive of good user acceptance, and adequate design. Together they predict the advent of microcomputer systems for commercial use.

Because of the detailed case study approach, the authors and editors conclude that the use of the textbook which describes this system is four fold:

- as a text for use in an advanced course in small business management or distribution
- as a supplementary text for a course in systems design
- as a resource for the small businessman who intends to purchase and install a system
- as a pragmatic guide to the system designer developing a general business integrated systems software package.

While these audiences seem to be widely divergent, they have a general framework of need in common. With the advent of the business microcomputer they all have the same set of challenges. Because of the cost scale of microcomputer technology, the small business- man will not only be the owner of the business but probably the data processing manager too (as well as the head buyer, merchandiser and sales manager); consequently he will need wide expertise. The case study approach synthesizes the key disciplines under a single business management approach in all key decision areas and the new technology. This approach bridges many of the old academic discipline-imposed artificial barriers and fosters integration through experiential simulation.

SUMMARY

The exigencies of the conceptual idea for a book on microcomputer based information systems led the authors eventually to a case study approach. The development of the case study proved to be a formidable task because of the requirements for detail, completeness and internal integration.

The resulting 'model company' formed the integrating and modeling factor for the development of an integrated management information system for small companies engaged in intermediate distribution.

Use of the model or case study provides a focus or frame of reference for the reader. As each system is developed, its inputs and outputs are defined conceptually, technically and finally in terms of the model company.

The results, via manuscript review, from academicians, data processing experts and the owner/operators of small distribution firms have been encouraging and suggest that the approach taken has relevance for multiple audiences.