4-1-1987

The Feasibility Of The Materials Requirement Planning Software For The Microcomputer In Small Business

Neil E. Sheehan

Recommended Citation

THE FEASIBILITY OF THE

MATERIALS REQUIREMENT PLANNING

SOFTWARE FOR THE MICROCOMPUTER

IN SMALL BUSINESS

by

Neil E. Sheehan

Bachelor Of Liberal Arts,

United States Air Force Academy, 1983

An Independent Study

Submitted To The Graduate Faculity

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Master of Business Administration

University of North Dakota Graduate Center
April
1987

This independent study submitted by Neil E. Sheehan in partial fulfillment of the requirements for the Degree of Masters of Business Administration from the University of North Dakota is hereby approved by the Faculty Advisor under whom the work has been done. This independent study meets the standards for appearance and conforms to the style and format requirements of the Graduate School of the University of North Dakota.

_____
Faculty Advisor

ii

PERMISSION

Title   THE FEASIBILITY OF THE MATERIALS REQUIREMENT PLANNING

         SOFTWARE FOR THE MICROCOMPUTER

Department   School of Business and Public Administration

Degree   Master of Business Administration

        In presenting this independent study in partial
fulfillment of the requirements for a graduate degree from the
University of North Dakota, I agree that the Library of this
University shall make it freely available for inspection.   I
further agree that permission for extensive copying for scholarly
purposes may be granted by the professor who supervised my work
or, in his absence, by the Chairman of the Department.   It is
understood that any copying or publication or other use of this
independent study or part thereof for financial gain shall not be
allowed without my written permission.   It is also understood
that due recognition shall be given to me and to the University
of North Dakota in any scholarly use which may be made of any
material in my independeny study.

                Signature _____

                Date   26 APRIL 87_____

iii

TABLE OF CONTENTS

LIST OF TABLES
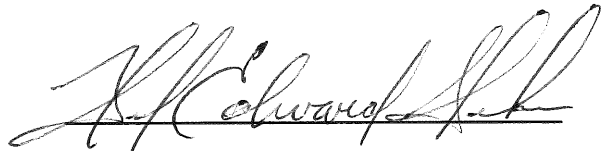
ACKNOWLEDGEMENTS

All too often when people try to list those deserving of thanks, someone is mistakenly left out. To avoid such a mistake, I would like to thank all the faculty and staff of the University of North Dakota at Minot Air Force Base, the Air Force Institute of Technology detachment commanders and my fellow students of whom I had the privilege to associate with.

Above all I thank my loving wife Laurieanne, for without her long devoted hours of assistance and patience none of this would have been possible.

Neil Edward Sheehan

ABSTRACT

In today's competitive world, small businesses need all the help they can afford. Mainframe Material Requirements Planning (MRP) programs once thought only affordable by large companies are now available for the "little guys". This paper shows that the microcomputer MRP software on the market today is both a feasible and attractive option for small business.

Chapter I

PURPOSE

During the time that this paper was composed economic indicators were not falling, headlines were not proclaiming record high interest rates and credit makers were not depressed. However, for a small business even prosperous times require tight controls over resources, time and money. This is especially true with the competition by low-cost Japanese and other Asian producers. This paper will address an isssue that impacts the small business.

In today's competitive environment it becomes even tougher for the small business to compete and survive. All aspects of the operations must run at maximum effectiveness and efficiency, and only then can a company operate at its lowest operating cost. Along these same lines, the customer's good will must be maintained. This includes customer's service levels, quality products, and competitive pricing.

In a world where the manager of any business is bombarded with more information than he or she could ever handle or need, there is a need to filter out that which is important from, what is not. This will not guaranty correct decisions but it will improve their quality and this becomes even more important in todays environment. One tool that can help the business manager

is a Materials Requirement Planning (MRP) system.

Materials Requirement Planning is a computerized information system that integrates the scheduling and control of materials for manufacturing. The MRP system shows what materials procurement actions are needed and when, so that the desired quantities of end products are completed as needed during the planning horizon.

For today's small businesses the Materials Requirement Planning (MRP) systems once found only on large mainframe computers are now available in software packages designed to operate on microcomputers. The same general benefits associated with these large computer driven programs now appear available on the microcomputer. These benefits include: more efficiently run operations, higher levels of customer service, and overall tighter control on information and operations.

It is this paper's position that the microcomputer MRP software on the market today is both a feasible and attractive option for small businesses. There is such software available and that there is no so called "economic threshold" for the benefits afforded by the purchase of this software.

Chapter II

SCOPE

Materials Requirement Planning means many different things to many people. In this paper the term is a concept embracing all facets of the manufacturing process, to include and not limited to; basic manufacturing, master scheduling and forecasting, capacity planning, materials requirement planning, and a host of others. It is not the intent of this paper to concentrate on any one individual area. References, however will be made to these areas when the capabilities of the different packages are examined.

This paper lends itself to examining the different microsoftware packages that are available on the market today, their capabilities, limitations, and benefits. The depth of this analysis will be suited for a person who has a working knowledge of the manufacturing process. This is to include a college student with classes in the production or business fields. It will also be assumed that the reader has some knowledge of the MRP systems used on mainframe computers. Only a quick overveiw of its history and benefits will be supplied. This paper is written for a middle manager of a small business in search of an MRP software program that will reap the benefits associated with

the larger more expensive programs. The Small Business Admin-
istration defines a small business as "one which is independently
owned and operated and not a leader in its field of operations."[1]

It is also assumed that the company this manager works
for does not wish to invest large sums of money on such a
package. It is assumed that the term large is relative to the
cost of a mainframe program. This paper will side-step the issue
of hardware requirements to the extent that it will be assumed
that relative to the purchase or rent of mainframe time, the
purchase of a personal computer or a multi user system is
inexpensive. The paper will only address the relative dif-
ferences between the two systems, personal computer and multi
users. It will also address the memory capacity requirements.
This paper will not assume the small businesses have just
dependent-demand inventory, as was the case when MRP first
started out.[2] A list of the different areas of applications will
be given later.

The conclusion drawn will be based on the information in
magazine articles, books, speeches, newspaper articles and
personal interviews. The personal interviews are with those that
either make, sell, or make and sell the different software
packages. To this extent the paper may be somewhat bias. It was
assumed that the interviewees gave candid, honest answers and

---

[1]Hal B. Pickle and Royce L. Abrahamson, Small Business
Management(New York: John Wiley Sons, 1981), p. 10.

[2]Joseph Orlicky, Materials Requirements Planning(New York:
McGraw-Hill, 1975).

were not trying to sell their product. Any such interviews where the selling of ones product may have prejudice the facts were ommitted from the paper and were not used in determining any conclusions. This was seldom the case. The conclusions about whether or not the available microcomputer software for MRP system is worth the investment and for what types of small business and other questions will be made.

Chapter III

METHODOLOGY

With the assumptions made in the scope of this paper it was not necessary to do a complete history analysis on Materials Requirement Planning (MRP). What was needed was a quick reveiw of the "buzzwords", tools and language of the trade. At the same time it was necessssry to investigate the state of the technology and the future paths of MRP in regards to its applications on the microcomputers. The approach was broken into two phases: a literature review and personal interveiws.

Literature Review

The approach that was taken was to look up Material Requirement Planning and other words used to describe the process, in the Readers Guide To Periodical Literature, Wall Street Journal Index and the Business Indexes. MRP was listed seperately in the later volumes of the Business Indexes. Inventory control was used in the earlier volumes to represent MRP.

In light of the purpose of the paper, no reference books dated earlier then 1980 were used. Those books and articles dated earlier were used to get the familarity described in the scope. These books were found using the bibliography of an

independent study written on small business applications of MRP.

There were very few listings of MRP or inventory control in the Readers Guide. The articles were obtained by looking up the general category of computers. From there it was narrowed down to "business uses." Here many articles were found that addressed the use of computer in business in general. Many of the technical articles were found using the sources in the Business Indexes. No articles at all were found in the Wall Street Journal Index that were helpful.

Overall some 150 magazine articles were found. At first many of them were not located. This was due to the limit of the libraries and the limited number of libaries used. Those were the: Minot State College Library, Minot City Library and the Air Force Institute of Technology Library at Minot Air Force Base.

To prevent the paper from coming to a stand still the author used the aid of a computer search, The Dialog Databases at the Minot State College Library. The author chose two databases from Dialog's Business, Industry, Corporate Databases. They were ABI/INFORM and Management Contents. They provided a list of over 30 magazine articles from which to choose. Again many were not found in the immediate area. With the help of the University of North Dakota's interlibrary loan request program all but one of the magazine articles were found.

In the late seventies and early eighties many of the articles written on MRP were asking why were companies not getting better results. Articles like, "Should You Pull The Plug

On MRP II" found in Infosystems is an example.[3] Later articles began praising MRP again. It was determined that the blame for bad results rested on the companies. Many began writing articles on what it takes to make MRP programs work. An example of this is "Is Your Organization Ready For MRP?".[4]

There was no literature found during the survey conducted for this paper with regards to the actual capabilities, limitations and benefits of microcomputer software applications of MRP systems. All the literature came from pamplets and brochures from the actual vendors themselves. A listing of the vendors was obtained from magazines such as Infosytems, Data Pro and Data Source.

Interviews

The second part of the research was to contact makers and vendors of the software. The initial call was to obtain information on their different packages. After contacting the different vendors and requesting descriptions of their systems, calls were made asking for greater detail. The questions were usually general in nature. Then questions concentrated on trends in the industry, use of personal computers to multi-terminals, the separation of software and training packages, and the future of the industry as a whole. The most fascinating interview took place with a Mr. Dave Monroe, Profit Key International, Salem

---

[3]Oliver Wright, "Should You Pull The Plug On MRP II?" Infosystems, December 1981, p. 86.

[4]Charles J. Teplitz, "Is Your Organization Ready For MRP, A Case Study," Interfaces 10 (June 1980): 103.

N.H. This man was a source of a wealth of information that allowed this author to ask more pertinent questions. He also gave this paper a better sense of direction.

Chapter IV

FINDINGS

It is this paper's position that the microcomputer Materials Requirement Planning software on the market today is a feasible option for small businesses. That statement implies that not all small businesses should turn to MRP systems using the microcomputer. The obvious question then becomes, "what small businesses are ready or even need the help afforded by MRP?"

What Businesses?

As Dave Monroe of Profit Key pointed out in his interview, many small companies perform a "ballet" in which a carefully orchestrated balance is struck.[5] This "ballet" has grown through the years as the company has developed. It possesses a delicate operating machine that facilitates the flow of information. This enables a firm to stay alive. These companies may have up to 10 to twelve employees. These are the companies that do not need MRP to stay alive. There are no hard and fast rules for the determining the need to implement an MRP program. As many have said "If It Is Not Broken, Don't Fix It." These were

---

[5]Dave Monroe, telephone interview, Salem, New Hampshire, August 1986.

the same words echoed by Darryl Landvater, President of Oliver Wright Video Productions, Inc., when writing about companies adopting MRP programs.[6]

It is when these companies become too big, the channels of information become to small, and jobs become too specialized, that companies need a MRP type program.[7] MRP systems allow access to all function and elements of the business. MRP systems aid in the flow of information. This is accomplished by the programs ability to provide a "snapshot" of the firms position.[8] An American Production Inventory Control Society (APICS) Study revealed that MRP growth is characterized as "exponential" with the heaviest users found in electronics, fabricated metals and machinery makers.[9] This is not to say that these are the only companies that can benefit from MRP.

Throughout all the readings and interviews, there seemed to be no economic threshold level for purchasing such programs. During interviews when questions were asked about economic thresholds, the topic quickly narrowed down to the areas pre-viously mentioned. These include employee size. Discussions here focused on the flow of information or lack of it when

[6]Darryl Landvater, Technology. A Catalyst For Human Change," Infosystems, May 1984, p.81.

[7]Darryl Landvater, "Why Isn't Everyone Getting Class A Results?" Infosystems, May 1985, p.76.

[8]Haig M. Bazoian, "How New Software Makes Management Easier," Nations Business, October 1983, pp. 66-68.

[9]John Courtas, "The Challenge To Marketing Of Intergrated Manufacturing Databases," Business Marketing, March 1985, p. 67.

companies began expanding. Some contested that it depended on the number of significant machines. The term significant was used in reference to: expensive machines, machines that are utilized all the time or computers. Here the range was from 4 to 8 machines. Mr. Monroe feels that companies that do jobs in which total cost are hard to determine, can also benefit from MRP microsoftware.[10] This is a far cry from what the MRP system was first designed to work on.[11]

Table 1 depicts what vendors, felt were the average sales or unit volumes of their customers. Here again, there was a dichotomy between what should be used. Some preferred using dollar sales, others preferred units sold. This made comparisons very difficult.

In 1984 only a small percentage of U.S. small businesses were using MRP, but the number is growing.[12] In the May/June 1984 issue of Business Horizons a chart of the percentage of MRP system elements that were computerized is shown in Table 2.[13]

Capabilities and Limitations

As the previous charts depicted, MRP microcomputer sotware are modular designed software programs that perform the different elements of the manufacturing process. These programs

[10]Monroe, Interview.

[11]Orlicky, Materials Requirement Planning, p. 75.

[12]"Small Business Stumbles Into Computer Age," Business Week, February 1984, pp. 118-122.

[13]John C. Anderson and Roger G. Schroeder, "Getting Results From Your MRP System," Business Horizons, May/June 1984, p. 59.

TABLE 1

VOLUME AND DOLLAR CAPACITIES

OF PROGRAMS EXAMINED

	VOLUME(UNITS)	DOLLARS($)
M PAC		$80 MILLION (MAX) $5000,000 (MIN)
PROFIT KEY	NO MAX OR MIN	
MC SOFT	32,000 (MAX) 100 (MIN)	
MCBA		$100 MILLION $10-25 MILLION (AVE)
COMPUMAX	1-5000	
MAC PAC/PC (NOT A TRUE MRP)		$7 MILLION (AVE)

BLUEBIRD $10 MILLION (AVE)

NOTE: These figures were taken from the brochers sent by the
respective dealers or from telephone interviews.

TABLE 2

PERCENTAGE OF MRP SYSTEM ELEMENTS COMPUTERIZED

	MRP Companies	Non MRP Companies
Forecasting End Items	42	15
Bill Of Materials	86	48
Inventory Stock System	84	54
Master Production Schedule	52	15
Parts Explosion	86	40
Order Release	49	17
Purchasing	43	8
Capacity Planning	37	6
Operations Scheduling	35	8
Shop Floor Control	30	9

SOURCE: May/June issue of Business Horizons.

Definitions:

BOMP - Bill Of Materials Processor

CRP - Cost Requirement Planning

J/C - Job Cost

Definitions: (continued)

L/P - Ledger/Payroll

M/S - Master Schedule

SFC - Shop Floor Controls

SPC - Shop Purchasing Controls

SPR - Shop Purchasing Reports

INTER - Interactive (with other modules)

can stand alone or work interactively with other modulars. These modulars. These modulars can be installed in virtually any sequence or combination. One complaint often heard about mainframe and minicomputer MRP systems is that they are too tightly integrated. It is all or nothing.[14] C.R. Smolin feels that any company considering a move to MRP should start out small. This allows them to basically try the waters before diving in head first.[15] Many companies also claim that their products need very little tailoring. This again keeps cost down and allows companies to shop around and find that product that best serves their needs. Table 3 lists the different programs

---

[14]Donald Cox, telephone interview, Davis, California, March 1987.

[15]C.R. Smolin, telephone interview, San Diego, California, March 1987.

for some of the companies that were interviewed.

TABLE 3

MICROCOMPUTER SOFTWARE OPTIONS (MODULES)

Company	Function								
	BOMP	CRP	J/C	L/P	M/S	SFC	SPC	SPR	INTER
M PAC	X				X				X
PROFIT KEY	X	X	X	X	X	X	X	X	X
MC SOFT	X	X				X			X
MCBA	X	X	X	X	X	X	X	X	X
COMPUMAX	X		X		X				X
MAC PAC/PC	X		X		X	X			X
BLUEBIRD	X		X		X	X		X	X

Training

Another aspect of microcomputer software is the training that is required to implement these programs. The industry appears to be at a turning point in this respect. As table 4 depicts, there is a tendency of the training and consulting to be separated from the price of the software.

As Mr Landvater has pointed out the industry is entering its third stage of development. The first stage belonged to the pioneers. Those like Olicky who dared to try something new. The second stage involved working the bugs out and greater industry

for some of the companies that were interviewed.

TABLE 3

MICROCOMPUTER SOFTWARE OPTIONS (MODULES)

Company	Function								
	BOMP	CRP	J/C	L/P	M/S	SFC	SPC	SPR	INTER
M PAC	X				X				X
PROFIT KEY	X	X	X	X	X	X	X	X	X
MC SOFT	X	X				X			X
MCBA	X	X	X	X	X	X	X	X	X
COMPUMAX	X		X		X				X
MAC PAC/PC	X		X		X	X			X
BLUEBIRD	X		X		X	X		X	X

Training

Another aspect of microcomputer software is the training that is required to implement these programs. The industry appears to be at a turning point in this respect. As table 4 depicts, there is a tendency of the training and consulting to be separated from the price of the software.

As Mr Landvater has pointed out the industry is entering its third stage of development. The first stage belonged to the pioneers. Those like Olicky who dared to try something new. The second stage involved working the bugs out and greater industry

TABLE 4

MICROCOMPUTER TRAINING COST

	USE OF DEALERS	FREE HRS OF TRNG	COST OF ADDITIONAL HOURS OR DAYS
M PAC	X	8	$55/HR
PROFIT KEY			$400-800/DAY
MC SOFT	X	8	VARIES WITH PACKAGE
MCBA	X	0	$500/DAY
COMPUMAX	NO	FREE SEMINARS	$75/HR
MAC PAC/PC	NO	-	-
BLUEBIRD	X	VARIES WITH PACKAGE	$150/DAY

use. The third stage is wide spread use and acceptance through many industries.[16] As Mr. Monroe points out there is a parallel trend in training. During this first stage, it was new and

---

[16]Darryl Landvater, "Technology - A Catalyst For Human Change," Infosystems, May 1984, p. 84.

training was needed by these pioneers. They were excited and eager to make the system work. During the second stage, many firms were not as eager to accept this new idea. Therefore training cost began increasing, requiring more hours to implement programs. This created a disparity between selling to different companies and as the industry entered the third stage vendors sought a solution to this problem. With such a diverse background for those requesting MRP programs, training cost are beginning to separate from the price of the software.[17] For those firms that are not indoctrinating the whole firm into the process, to include structuring the firm to facilitate and aid in the transmitting of information, they will require the highest training cost.

Hardware Requirements

The memory requirements run along the same lines as the programs themselves. It all depends on the capabilities of the packages. Table 5 lists the acceptable and recommended requirements for the vendors that were surveyed.

There is also a division between multi user systems and personal computers use as shown on Table 6. The trend was for smaller programs to use the P.C. while more advanced software programs used the multisystem approach. Those vendors using multi-user systems felt that their system offered a much greater cost savings.

---

[17]Monroe, August 1986.

TABLE 5

SOFTWARE MEMORY REQUIREMENT: REQUIRED AND RECOMMENDED

	REQUIRED	RECOMMENDED
M PAC	64K	
PROFIT KEY	256K	20mg HARD DISC
MC SOFT	256K	20mg HARD DISC
MCBA	256K	10mg HARD DISC
COMPUMAX	64K	64K
MAC PAC/PC	64K	256K
BLUEBIRD		

The benefits received far exceeded the cost associated with the purchase of both the hardware and software. The following is a list of the specific measurable benefits associated with the using these microcomputer programs.[18]

    a)   Raw Materials 20% - 40%

    b)   Purchased & Mfg'd Items 20% - 40%

    c)   Work In Progress 25% - 40%

[18]Production And Inventory Applications, MC Software, Excelsor, Missouri, 1986.

d) Finished Goods 10% - 40%

e) Obsolete Items 50% - 90%

f) Safety Stock 50% - 95%

g) Storage, Taxes Insurance 20% - 40%

RESULT: More Available Capital

(How Much???)

TABLE 6

PERSONAL COMPUTER VS. MULTI-USER SET UPS

	PC	MULTI
M PAC		X
PROFIT KEY	X	X
MC SOFT	X	X
MCBA		X
COMPUMAX	X	
MAC PAC/PC	X	
BLUEBIRD		X

In the June 1982 issue of <u>Management Accounting</u>, Fredrick Davenport, quoted similiar savings.[19] Other benefits sighted include: reduced production lead and delivery lead time to customers, realistic delivery commitments, increased operating efficiency and better information control.[20] Still others rave of the ability to trim middle management and allow for development of their managers as benefits associated with MRP systems.[21] A little "gee whiz" item that highlights the attractiveness of microcomputer MRP software is a comparison of cost between the micro and mainframe packages. The highest estimated cost of any one of the packages examined in this paper is 20 thousand dollars. In the April 1984 of Distribution, IBM and Xerox were heralding a new low cost MRP system that sold for $250,000. Both systems were designed to handle between five to 80 million dollars in revenue. This is not to say that the microcomputer can do all of what the mainframe systems can do, but for a small business the micro is attractive and feasible.

<div align="center">

<u>Cautions</u>

</div>

MRP is not the instant cure all. There are some areas the buyer of these programs must be aware of. The first is that programs like Lotus 1,2,3 or large data bases are not the same as a MRP system. A second problem is the attitude of those who will

---

[19]Fredrick J. Davenport, "Finacial Management Through MRP," <u>Management Accounting</u>, June 1982, pp. 27 - 29.

[20]Satish Mehra and M. Jerry Ried, "MRP Implementating An Action Plan," <u>Interfaces</u> 12 (February 1982): 69.

[21]Bazoian, "Software Makes Management Easier," p. 68.

be using the new system. Their attitude must be positive and they must be willing to accept it.[22] The implementation of these programs can cause unrest and failure to those companies that are not prepared for MRP.

Scores of literature have been written on the importance of upper-level management support and in a small business this can play an even greater role. Long Range Planning, December 1984, lists a host of ways to make the system work.[23] This and other such readings are essential to making and preparing your company for the MRP wave. On a personal note one must be careful of the vendors from whom they purchase. Companies to careful of are those that only produce one product. Several of the vendors in the November 1985 issue of Datapro no longer exist today. Questions must be asked not only of the capabilities of the software but the future of the company. Getting stuck with a MRP system that cannot be supported could cost more than it could save.[24]

---

[22]Nancy Entwisle, "Xerox, IBM Put Their Wares Together," Distribution, April, 1984, pp. 87 - 89.

[23]Kevin Cross, "Manufacturing Planning With Computers At Honeywell," Long Range Planning 17 (December 1984): 66.

[24]DataPro Research Corporation, McGraw - Hill, New Jersey, November 1985.

Chapter V

CONCLUSIONS

This paper started out purposing that the MRP software that can be run on the microcomputer is an attractive option for the small business person in managing their business. The paper then went on to define which small business men could benefit from such a set up. It was decided due to the inexpensiveness of such set ups that there was no real entry level or economic threshold for the purchase of such software and hardware. It depends more on the employee size, number of different jobs and the flow of information or lack of it. The magic number of employees appeared to be 10 to 12. A company with 5 or 6 significant machines were also identified as candidates. Some even suggested that those companies who performed made to order jobs where total costs were tough to estimate were the final choice.

In the same statement of purpose the assumption was made that there was indeed microsoftware available. This was quickly confirmed with a viewing on Datapro, November 1985 which listed over 15 companies selling MRP systems for use on the micro-computer.

The examination of this software revealed modular type

programs. These programs provided many of the same functions mainframe computers perform in the manufacturing process. These modulars can stand alone or can be combined in any size number of combinations. This format allows for individual tailoring. It also provides the flexibility to grow with the company. This can reduce the initial investment and the initial risk of purchasing.

The training associated with these programs is in between phases. Many vendors offer a limited number of hours of counseling with the initial purchasing with following hours at a flat rate. Others have completely separated the two.

Hardware requirements were limited to the size of the memory. The only other issue was whether or not the system was multi user or straight personal computer. Here the industry is split. The trend however was toward the multi user system due to the cost benefits associated with it. The smaller programs however still use straight personal computers.

Cost relative to the mainframe did not even compare. The modular format allows for even the cautious investor to experiment with MRP programs. Cost should be limited to the purchase of a small personal computer and one or two modules. The benefits are the same as those associated with the mainframe. Added benefits are the previously mentioned tailoring to meet the firms individual needs, and the ability to grow with the company.

As with any other investment one needs to watch for the hidden pitfalls. The implememtation of such programs require a committment from the top. This is especially true for small

business. The firm must be ready to accept the program and those directly involved must be willing to make it work. Finally, when deciding on what vendor, one needs to do some checking on the company itself. Many companies that existed last year are not around today.

   With some solid investigating and knowing the needs of the firm the available MRP software run on the the microcomputer are indeed an attractive option for the management of small business.

BIBLIOGRAPHY

Books

Orlicky, Joseph. <u>Materials Requirements Planning</u>, New York: McGraw-Hill, 1975.

pickle, Hal B., and Royce L. Abrahamson. <u>Small Business Management</u>. New York: John Wiley & Sons, 1981.

Articles

Amer, Dean "Materials Management: Where It Stands Today." <u>Purchasing Magazine</u>, 70 (January 7, 1971), 44-47.

Anderson, John C. and Roger G. Schroeder. "Getting Results From Your MRP System." <u>Business Horizons</u>, May/June 1984, pp. 57-64.

Bazoian, Haig M. "How New Software Makes Management Easier." <u>Nations business</u>, October 1983, pp. 66-68.

Beman, Lewis. "A Big Payoff From Inventory Controls." <u>Fortune</u>, 104 (July 27,1981), 76-80.

Benton, F. Warren. <u>Execucomp: Maximum Management With The New Computers</u>. New York: Wiley & Sons, Inc, 1983.

Besbard, J.F. "MRP: Getting From Here To There." <u>Infosystems</u>, October 1982, pp. 72-80.

Chase, Richard B., and Nicholas J. Aquilano. <u>Production and Operations Management</u>. Homewood, Ill.: Richard D. Irwin, 1981.

Clark, Steven J., James F. Cox, and Robert W. Zmud. "Auditing An MRP System." <u>Academy Of Management Journal</u>, 24 (1981) 386-401.

Courtas, John. "THe Challenge To Marketing of Integrated Manufacturing Databases." <u>Business Marketing</u>, March 1985, pp. 40-51.

Cross, Kevin. "Manufacturing Planning With Computers At Honeywell." <u>Long Range Planning</u>, 17 (December 1984), 66-75.

Davenport, Frederick J. "Finacial Management Through MRP." <u>Management Accounting</u>, June 1982, pp. 26-29.

Donovan, R. Michael, and Steve King. "Are You Ready For MRP?" <u>Management Review</u>, 66 (October 1977), 47-50.

Entwisle, Nancy. "Xerox, IBM Put Their Wares Together."
    Distribution, April 1984, pp. 79-81.

Field, Anne R., and Catherine L. Harris. "Software: The Growing
    Gets Rough." Business Week, 24 March 1986, pp. 69-81.

Higgins, Mike. "You Can Go To MRP Step By Step." Distribution,
    79 (November 1980), 33.

Horovitz, Bruce. "MRP: Is It Worth A CEO's Time?" Industry
    Week, 13 October, 1980, pp. 86-90.

Huther, William H. "A Management Guide To MRP 11: Manufacturing
    Resource Planning." Management Review, June 1983, pp.
    43-48.

Johnson, Michael L. "Paring The Myth From MRP." Industry Week,
    197 (3 April 1978), 77-80.

Landvater, Darryl. "An Hour In The Sun." Infosystems, November
    1983, p. 69.

Landvater, Darryl. "Technology - A Catalyst For Human Change."
    Infosystems, May 1984, p. 84.

Landvater, Darryl. "Why Isn't Everyone Getting Class A Results?"
    Infosystems, May 1985, p. 76.

Mehra, Satish and M. Jerry Reid. "MRP Implementation Using An
    Action Plan." Interfaces, 12 (February 1982), 69.

Rosen, Nancy J., and Jacob B. Paperman. "How To Use Materials
    Requirements Planning." Management Review, 67 (August
    1978), 17-23.

Sander, Rufus C. "MRP...Mirage Or Miracle." Infosystems, 24
    (December 1977), 62-65.

Schonberger, Richard T. Operations Management, 1981, Georgetown,
    Ontario.

Shull, Joseph S., and George E. Palmatter. "Computerized
    Planning Systems Links Marketing, Production, other
    Functions" Marketing News, 17 March 1985, pp. 19-20.

Special Report, "New Software Takes Drudgery Out." Business
    Week, (13 December 1982) 73-76.

Special Report "How Computers Remake The Manager's Job."
    Business Week, (25 April 1983), 68-86.

Special Report, "How Personal Computers Can Backfire." Business

Week, (12 July 1982) 56.

Special Report, MRP 11: A Framework For Factory Management."
     Business Month, (February 1984) 58-68.

Special Report, "Small Business Stumbles Into Computer Age."
     Business Week, (8 October 1984), 118-142.

Teplitz, Charles I. "Is Your Organization Ready For MRP, A Case
     Study." Interfaces, 10 (June 1980), 103.

Thiel, Carol Tomme. "Manufacturing Resource Planning: Go For
     It!" Infosystems, October 1982, pp. 70-80.

Wright, Oliver. "Should You Pull The PLug On MRP 11?"
     Infosystems, December 1981, p. 86.

Wright, Oliver. "Beyond Independent/Dependent Demand."
     Infosystems, November 1982, p. 84.

                         Interviews

Brown, Camron, Field Representative, MCBA, Glendale California,
     September 1986.

Bun, Thomas P., President, Compumax, Menlo Park, California 19
     September 1986.

Chrisope, Wanye, Customer Service, MC Software, Inc, Davis,
     California 3 September 1986.

Fuller, John, Field Representative, Bluebird Systems Carlsbad,
     California, 1 September 1986.

Monroe, Dave, Field Representative, Profitkey International,
     Salem, N.H., 26 August 1986.

McCullough, Linda, Owner, Solid State Software, Inc., Excelsior
     Springs, Missouri, 23 August 1986.

Riedel, Ralph A, Field Representative, Arthur Anderson & CO.,
     Houston Texas, 30 August 1986.

                      Other References

Arthur Anderson & CO, MAC PAC/PC PAMPLET, Houston, Texas, Sept.
     86.

Christen, William Mark. "Materials Requirement Planning As

Applied To Small Business." An Independent Study, University of North Dakota, November 1981.

Compumax, Pamplet, Menlo Park, California, Summer 1986.

Datapro Research Corporation, Pamplet, McGraw-Hill Company, Delran, New Jersey, November 1985.

MCBA, Pamplet, Glendale, California, Summer, 1986.

MC Software, Pamplet, Davis, California, Summer, 1986.

Production And Inventory Applications, Pamplet, MC Software, Excelsior, Missouri, 1986.

Profitkey International, Inc Pamplet, Salem, N.H., Summer, 1986.

Solid State Software Inc., MPAC Pamplet, Excelsior Springs, Missouri, Summer, 1986.