Your business decision to buy a microcomputer system

do—*not* in terms of their technical hardware characteristics. Fundamentally, computers should supply valuable management information.

Before deciding to purchase a computer system, you must ask some basic questions, like: What information do I really need? When is computerized information valuable?

Additional management information always sounds good, but can you as manager use it? The answer lies in determining if the information's value exceeds its cost.

We recommend this decision framework, and we have organized this publication accordingly:

1. Identify real decision problems or potentials.
2. List information you'll need for each decision problem and determine if that information is best developed by a computer.
3. Determine the economic benefits and costs of a computer system that will address the problem or potential.
4. Make a computer decision.
5. Be aware of common traps along the way so that you can avoid them.

Identify problems and potentials

The first step in deciding whether a computer is worthwhile is to list decisions or actions where you want to see improvement. These could include such things as control of cash flow, marketing and inventory, facility utilization schedules, land or equipment purchases (sales), input acquisition, government program participation, financial requirements, communications, etc.

Develop a list and prioritize your information needs. Here is one approach.

A computer system is worth adding to your business when its benefits outweigh its costs. You'll need to estimate these in terms of specific tasks or decisions where you want the computer to help you. You'll need to identify these decisions carefully—and to list in detail the kinds of information you'll need to make those decisions.

While our perspective is agricultural business management, the *principles* we outline here and the *approach* we recommend apply just as well to *any* kind of business—a commercial fishing operation, a gear or machinery shop, forest management, or whatever.

In every case, the manager faces these decisions: How can I use a microcomputer? Do I buy a microcomputer, or not?

Computers should be justified and purchased on the basis of what they can

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First, list decisions or improvements where *one decision is critical:* for example, the purchase of another business, the sale of a major tract of land, or the purchase of new equipment.

These decisions may include opportunities that your business currently does not consider because of lack of information or managerial time.

Second, list recurring situations where information may not have a high economic impact with one decision but may have a *substantial cumulative economic impact* over time.

Examples include purchasing feed or formulating livestock rations. In the latter case, feeding a suboptimal ration may not make the firm go broke the first day—but if continued over time, it could have a major impact.

Third, list data and record management areas where you wish to improve or reduce the amount of time you spend. In this category, you may not necessarily anticipate a major economic impact—rather, *you're looking for a different approach* that may produce reports on a timely basis, generate better reports, make the process less boring, or release employee time for other activities.

Managing herd records and many accounting functions are examples in this third category.

Information needs and computer capability

Those three lists represent decision areas where you as manager may need more or better information. At this point, it is important to list the *specific* information needs for each decision and ask if a computerized system satisfies these information needs.

For example, a fertilizer co-op may want to monitor fertilizer sales because profits have been falling—this is the problem. Minimum information needed would include volume and turnover data, prices, and overhead costs over time.

In this case, volume may have decreased. On the other hand, perhaps overhead costs have increased, and even (with increased turnover) profits have decreased.

The information would identify critical areas requiring corrective action. In turn, you must know the capabilities of a computer system to determine if it can be programmed to generate the information.

Basically, a computer system has five functions:

1. arithmetic manipulation using predetermined procedures;
2. simulation modeling using alternative assumptions regarding the business;
3. storage and retrieval of information— data base management;

4. word processing;
5. communications.

(Education and entertainment may also be functions, although they are generally more prominent in home situations. Thus we do not discuss them here.)

You'll need to understand each of these functions in some detail before you can evaluate how well a computer system would help in your decision.

Arithmetic manipulations

Computers work with data in the form of numbers and very easily add, multiply, subtract, divide, and otherwise deal with large quantities of data rapidly.

Virtually every computer on the market today is capable of doing thousands of arithmetic manipulations at very high speed. However, since the arithmetic manipulations must be controlled by a set of instructions, programming is necessary.

Generally, this is provided by the operator and professionally prepared programs such as the use of spreadsheets. An example would be break-even analysis, using one of a number of popular spreadsheets like VisiCalc, SuperCalc, or Lotus 1-2-3.

Simulation

The second function of a computer is its ease in creating simulations. For example, suppose you wanted to study the effect of a change in the crop price on profitability.

A program that multiplied the crop yield times price, subtracted the costs per acre for the acres devoted to each crop on the farm, then subtracted the fixed costs, would develop an annual income statement.

With this program, you could easily go back and change the prices to simulate the effect on final profitability. Thus, computers are excellent for testing out situations before taking action or trying various assumptions about consequences and degrees of risk.

Data storage and retrieval

All computers have memory, either internal (directly accessible within the computer) or external (cassette tapes, disks, or other electronic media).

The computer stores and codes data on these media and then is capable of retrieving these data for sorting, reformatting, mathematic calculations, summarization into reports, etc.

Given the speed of the computer, large quantities of data may be manipulated. For example, most computer disks will hold at least a 50-page report and can recall it within seconds.

Word processing

In our modern businesses, computers are taking on a large and important role as word processors. Documents are stored on electronic media, after which they can be reviewed and edited faster and more easily than ever before.

Words or whole sections can easily be deleted, added, moved, or changed. Many programs can also check spelling.

Communication

Computers may be connected, through an "interface," to other computers or other electronic devices. Thus, you can gather and pool data, transmit data to other sites, or communicate interactively with other users. One common use is tracking current market prices. Computer communications have also made electronic mail a reality.

Benefits and costs of a microcomputing system

If a computer system will address your management concerns, it is important to determine whether the benefits from the additional information exceed the costs you encounter in owning and operating the system.

In general, it is easier to estimate costs than benefits, so we will first deal with costs.

Costs

The costs of the computer system may be divided into six components: ownership, operation and maintenance, personnel, management, obsolescence, and risk.

Ownership, operation, and maintenance. These costs are fairly straightforward. The initial outlay for hardware may range between $2,000 and $6,000; the initial outlay for software, between $500 and $4,000.

Using the figures in table 1, the annual cost of ownership for both hardware and software would range between $1,113 and $3,858 a year.

Anyone who buys and operates a computer pays these direct costs, yet you must consider other costs as well. Some will be obvious, others may be harder to spot.

Personnel. It is possible that you will encounter personnel costs for training. Some examples:

• replacement of time spent on the computer that ordinarily would have been devoted to work on other items within the business (that is, opportunity costs),
• displaced personnel who require readjustment or settlement,

• personnel who resist the computer and cause inefficient operations or disruptions in your normal business schedule.

In transforming your staff to a computer oriented group, you may have to hire new personnel and consultants.

Management. There is the cost of training, which involves time with the computer, instruction in how best to use a computer, and possible computer operation or programming itself. There is opportunity cost of lost management time, which ordinarily would be spent on other tasks.

Obsolescence and risk. Finally, these two costs are interrelated. There are risk costs associated with buying equipment that becomes technologically obsolete and therefore depreciates faster than you originally anticipated.

Similarly, there is the risk of buying a computer that is not useful for the tasks for which you intended the system.

There is the risk of making wrong decisions based upon faulty software or misuse of some program.

In general, there is risk of overrunning cost projections when you incorporate a computer into your business, simply because it affects more people, programs, and buildings than you generally expect.

Benefits

Estimating the benefits arising from the acquisition of a computer is usually more difficult than estimating the costs. The benefits depend upon the difference in your profits because of decisions you made with and without the computer.

This includes decisions you made with the computer and decisions that you made differently because of the influence of the computer. Management should make better decisions with a computer because of a more systematic analysis process that is usually followed.

You might consider a larger number of alternatives systematically, use more data with more accuracy. Thus, direct benefits would result from improved decisions using computer systems to explore opportunities that normally you would have overlooked.

There may be indirect benefits, when you analyze situations you didn't foresee when you bought your computer—or when you use a more systematic approach to problems as a result of your computer experience.

The use of a computer can also have implications for a number of other items. It can be an excellent training device to educate personnel in decision analysis, which results in their doing a better job. This particular benefit may extend above and beyond those decisions directly supported by computers—it may extend to *all* their decisionmaking activities.

Similarly, adopting a computer may reduce staff or allow you to reduce the number of employees doing routine tasks, freeing them for other production activities.

A computer system can have a marked impact on your recordkeeping activities and monitoring capabilities. Computerized data acquisition and storage can allow a business to continually monitor performance of planned actions. It can reduce the cost of maintaining records and make it easier to access records.

A computer system can provide rapid communication within your firm and prevent duplication of effort in terms of data-development activities.

Finally, computerized communication allows direct computer access to external data in a rapid and efficient manner.

Economic analysis

Again, it's advantageous to adopt a computer system when its benefits exceed the costs. This sounds straightforward enough, but in practice it may be difficult.

We suggest listing the benefits and costs, beginning with those that are easy to express in dollars and moving to those that are not so easy to value.

This exercise may prove useful, especially when you can estimate most of your major

Table 1.—*Estimated computer costs*

Cost category	Cost	
	Low	High
Hardware		
Computer (64K–128K RAM)	$1,600[a]	$3,500
Includes: CPU, keyboard, monitor, and two disk drives.		
Printer	350	2,000
Modem	125	500
Total purchase cost	$2,075	$6,000
Depreciation (5-yr. straight line, 0 salvage)	415	1,200
Interest (½ purchase cost × 12%)	125	360
Repairs (5% of purchase price)	104	300
Annual cost	$ 644	$1,860
Software		
Word processing	$ 100[a]	$ 500
Data base management	350[a]	750
Accounting (general ledger)	250[a]	2,000
Electronic spreadsheet	250[a]	800
Total purchase cost	$ 950	$4,050
Depreciation (3-yr. straight line, 0 salvage)	317	1,350
Interest (½ purchase cost × 12%)	57	243
Updates and replacement (10% of purchase cost)	95	405
Annual cost	$ 469	$1,998
Total system annual cost (Annual cost hardware + annual cost software)	$1,113	$3,858

[a] Software may be included and packaged with the original equipment purchase.

Table 2.—*Preparing a benefit-cost analysis*

Action	Year					
	0	1	2	3	4	5
A. Benefits	$ 0	500	1,200	1,200	1,200	1,200
B. Costs	1,950	725	200	200	200	200
C. Net cash flow (A – B)	–1950	–225	1,000	1,000	1,000	1,000
D. Present value factor	1.00	.877	.769	.675	.592	.519
E. Present value (C × D)	–1,950	–197	769	675	592	519
F. Net present value	$ 408					

Table 3.—*Present value factors useful in making a benefit-cost analysis*

Yr	==========Interest				Rate	===============				
	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10
1	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909
2	.980	.961	.943	.925	.907	.890	.873	.857	.842	.826
3	.971	.942	.915	.889	.864	.840	.816	.794	.772	.751
4	.961	.924	.888	.855	.823	.792	.763	.735	.708	.683
5	.951	.906	.863	.822	.784	.747	.713	.681	.650	.621
6	.942	.888	.837	.790	.746	.705	.666	.630	.596	.564
7	.933	.871	.813	.760	.711	.665	.623	.583	.547	.513
8	.923	.853	.789	.731	.677	.627	.582	.540	.502	.467
9	.914	.837	.766	.703	.645	.592	.544	.500	.460	.424
10	.905	.820	.744	.676	.614	.558	.508	.463	.422	.386
11	.896	.804	.722	.650	.585	.527	.475	.429	.388	.350
12	.887	.788	.701	.625	.557	.497	.444	.397	.356	.319
13	.879	.773	.681	.601	.530	.469	.415	.368	.326	.290
14	.870	.758	.661	.577	.505	.442	.388	.340	.299	.263
15	.861	.743	.642	.555	.481	.417	.362	.315	.275	.239
16	.853	.728	.623	.534	.458	.394	.339	.292	.252	.218
17	.844	.714	.605	.513	.436	.371	.317	.270	.231	.198
18	.836	.700	.587	.494	.416	.350	.296	.250	.212	.180
19	.828	.686	.570	.475	.396	.331	.277	.232	.194	.164
20	.820	.673	.554	.456	.377	.312	.258	.215	.178	.149
25	.780	.610	.478	.375	.295	.233	.184	.146	.116	.092
30	.742	.552	.412	.308	.231	.174	.131	.099	.075	.057
40	.672	.453	.307	.208	.142	.097	.067	.046	.032	.022

	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20
1	.901	.893	.885	.877	.870	.862	.855	.847	.840	.833
2	.812	.797	.783	.769	.756	.743	.731	.718	.706	.694
3	.731	.712	.693	.675	.658	.641	.624	.609	.593	.579
4	.659	.636	.613	.592	.572	.552	.534	.516	.499	.482
5	.593	.567	.543	.519	.497	.476	.456	.437	.419	.402
6	.535	.507	.480	.456	.432	.410	.390	.370	.352	.335
7	.482	.452	.425	.400	.376	.354	.333	.314	.296	.279
8	.434	.404	.376	.351	.327	.305	.285	.266	.249	.233
9	.391	.361	.333	.308	.284	.263	.243	.225	.209	.194
10	.352	.322	.295	.270	.247	.227	.208	.191	.176	.162
11	.317	.287	.261	.237	.215	.195	.178	.162	.148	.135
12	.286	.257	.231	.208	.187	.168	.152	.137	.124	.112
13	.258	.229	.204	.182	.163	.145	.130	.116	.104	.093
14	.232	.205	.181	.160	.141	.125	.111	.099	.088	.078
15	.209	.183	.160	.140	.123	.108	.095	.084	.074	.065
16	.188	.163	.141	.123	.107	.093	.081	.071	.062	.054
17	.170	.146	.125	.108	.093	.080	.069	.060	.052	.045
18	.153	.130	.111	.095	.081	.069	.059	.051	.044	.038
19	.138	.116	.098	.083	.070	.060	.051	.043	.037	.031
20	.124	.104	.087	.073	.061	.051	.043	.037	.031	.026
25	.074	.059	.047	.038	.030	.024	.020	.016	.013	.010
30	.044	.033	.026	.020	.015	.012	.009	.007	.005	.004
40	.015	.011	.008	.005	.004	.003	.002	.001	.001	.001

costs and benefits. The magnitude and number of the benefits and costs will affect the reliability of the analysis. If there are several that you can't estimate and that may also be large, then your analysis has less merit.

There are four specific requirements to undertake a benefit-cost analysis. We

illustrate these with a simple example (see table 2).

Step 1. Estimate benefits and costs by year. In our example, you could invest in a computer and some software now ($1,950 in Year 0) and anticipate adding a printer,

modem, and more software next year ($725, Year 1).

You could anticipate miscellaneous expenses for repairs, etc., of approximately $200/year thereafter.

At first, while you are learning, you may anticipate benefits from using the system for one action, such as a least-cost feeding system. Then you might anticipate benefits in future years as you make other management decisions (record management or accounting).

Including inflation, you might conclude that there would be a $500 benefit in Year 1 and $1,200 in Years 2 through 5.

Benefits and costs are shown on lines A and B of table 2.

Step 2. Subtract costs (B) from benefits (A) in each year. This difference is the net cash flow in each year (C).

Step 3. Discount the net flows in Years 1 through 5, using the present value factor (D). This factor connects a specific future year to an interest rate that will discount *expected* net cash flows back to the present. Table 3 provides a range of useful discount factors.

Our example (table 2) uses a 14% interest rate, which represents the lowest rate of return that you will accept on your investment. (This is an assumption, of course—when you do your own benefit-cost analysis, use the current loan rate.)

In table 3, use the factors under 14% for each year in your analysis. For example, find Year 1 (lefthand column) under 14% interest and note that the present value factor is .877 (the amount on line D, Year 1, in table 2).

Stay with the Year 1 column in table 2. Multiply your present value factor (.877) by the net cash flow (–$225), and you have present value, –$197 on line E. Then follow this same procedure for Years 2 through 5 in our example.

Step 4. Add up the present values across line E. The result is the net present value (NPV) of the computer system (F).

When this NPV is zero or greater, the benefits outweigh the costs, and the decision is economically sound. If the net present value (E) in our example had been zero, this would have indicated that we were getting a 14% return on our investment.

However, the return on the investment here is greater than 14% because the NPV is greater than zero.

Planning a successful purchase

How sophisticated a system?

If a computer system looks advantageous, planning is necessary to move it into your operation. You don't need to purchase the most sophisticated system on the market.

Rather, it is important to start with a smaller and simpler system and move into the computerized information arena carefully. Race car drivers don't start at the Indy 500—they start on a dirt track and gradually increase their skill over time!

You must learn about computer systems before committing yourself to expensive, complicated systems. Expectations often exceed what managers can really accomplish, at least at first.

Time is required

One feedlot operator took 1½ years to develop the software needed to aid in managing his feedlot and an additional 3 years to gain the experience and a sufficient data base to have an effective management system.

Typically, it takes 12 to 18 months after installation for users to feel comfortable with their systems. So you must be committed to slowly evolve into computer-assisted management.

Managers must realize the time commitment it takes to computerize, set out a reasonable time frame, and reserve judgment for a reasonable adjustment period. Further, some computer systems require a data base that may not exist or will require considerable time to develop.

Only after you realize the time and commitment needed to plan and operate a successful computer informational system, does it make sense to turn to hardware and software selection.

Software and hardware

Software selection is more important than hardware—software selection should "drive" hardware selection.

While computer companies are spending millions of dollars trying to sell hardware, it is software that makes the machines function, and it is the *quality* of software that helps managers make sound decisions.

You'll have to determine the tasks you want to do, then determine the kinds of software you want to purchase or develop. You may find some clues if you return to the three lists of information needs (pages 1-2).

The software you choose should support the greatest number of high priority tasks as possible. However, don't try to develop your own software!

There are over 5,000 entrepreneurs developing software—in the agricultural field alone, it is estimated that there are between 220 and 250 firms developing agricultural software.

Further, it is important to realize that much of the software on the market has been recently developed. In choosing software, it is important to compare alternatives, read magazines and newsletter reviews, and test the specific software before purchasing it. (We have included a short reading list on page 6 to get you started.)

When you do this, bear in mind the informational and decision needs of your firm, so that they dominate your software decision. In too many cases, managers have ended up purchasing software because a salesperson convinced them they needed it—not the other way around.

Consider service

In agriculture, managers often purchase equipment and supplies from local dealers because they expect service after the sale; the same holds for computers. Discount houses often advertise lower prices than local dealers—but they may become extremely elusive when a problem arises.

It is a sound management decision to purchase both software and hardware from the same dealer. This makes one dealer responsible for making the whole system run, not just a part of it. Dealers can also be very helpful when you learn how to set up and use a computer system. This is important to remember, even if your system never requires service.

Plan

We suggest that you outline your tasks and required capabilities first, then choose software, then a dealer, and then hardware: hardware should be your *last* decision.

The hardware should run the software and be reliable over time. The system should be able to expand in the future because your perceived needs and uses at the time of purchase often differ substantially 1 to 2 years later.

Avoiding the common traps

Finally, we have outlined 12 "traps" in which managers often find themselves. As we enter the computer information revolution, it is our hope that you can avoid these traps and that this information will provide useful reminders for managerial action.

Trap No. 1

Businesses create and collect large quantities of data, and managers are trapped into too much raw and unorganized data with little useful summary information. Computers simply make the problem worse.

Management action. Differentiate between *data* and *information*. Define carefully how you should combine and formulate data so that you can *use* the information. Ask yourself what questions you are trying to answer *before* you start.

Trap No. 2

Some people may think that information from a computer system constitutes a decision. But *people* make decisions, and the world is too complicated to simulate on a computer.

Management action. Adopt the viewpoint that computers do not make decisions; rather, they provide information in support of decisions. Managers must be responsible for decisions.

Trap No. 3

Managers think computers can immediately support all decisions in the firm. In fact, trying to do every possible computerized task immediately will lead to extreme frustration.

Management action. Get the computer system moving on a few specific decisions and tasks. Develop a broader implementation over time. Also realize that there are some decisions for which the computer just won't be practical.

Trap No. 4

Computers may be used for tasks when there is a more efficient alternative. This is dangerous if these tasks are the primary reason why the manager justified the computer in the first place.

Management action. Even if the computer system capabilities are consistent with the data needs, it is important to ask if the computer is, in fact, the best tool to do it. For example, working in a dairy herd or hog operation, a breeding board may be more effective and useful than a computer for managing that aspect of the livestock operation. Testing or viewing another system in operation before making the initial investment can help the manager avoid computer "tunnel vision."

Trap No. 5

The computer system designed and developed today does not meet tomorrow's needs, either because the world changes or because you really hadn't anticipated what you were going to use the system for when you started.

Management action. Make the system flexible at the outset—that is, able to expand and run other software. Also, don't let the system dominate your business—switch if you outgrow it. Computers are cheap today and will probably become cheaper.

Trap No. 6

The computer becomes a useless machine to management. It may be fancy and fast, but it will not run the programs management wants to use. Often management gets caught up in megabytes, RAM, ROM, 128K, before asking what the system is really designed for.

Management action. Design task requirements *first*—*then* choose applicable software. Make sure software selection dictates the hardware purchase, not the other way around.

Trap No. 7

Computer systems scare employees if they view the computer as a substitute for them and not as an aid. In turn, they can cause the system to run inefficiently.

Management action. Management must educate support personnel before, during, and after the computer system is installed. Begin by covering the *purpose* of the computer (show how it will aid your employees in more ways than just the technical features of computers and computing).

Trap No. 8

The computer installation gets out of managerial control: You don't end up with what you thought you were going to get because computer specialists (not managers) designed it.

Management action. Keep involved in the design and installation of your system. Develop your skills to the point where you feel comfortable with the computer system. Develop an understanding of computers in the management team before installing the computer!

Trap No. 9

Computer systems become so difficult or cumbersome to use the management becomes frustrated.

Management action. Test all software for its ease-of-use qualities. Be sure a novice can be trained to use it easily and successfully. See if the system can be streamlined for the experienced user.

Trap No. 10

Different users of a software program get different results because the program is not error-free. An example would be where a blank is read as a 0 or where large numbers (that aren't logical) cause logical results.

Management action. Buy reliable software and test it before you buy. Try to "bomb" the program when you test it. Read reviews, buy established programs (ones on the market more than 1 year), and buy from reliable dealers.

Trap No. 11

Managers underestimate the time and effort it takes to master a computer system.

Management action. Allow adequate time for training both managers and other personnel. Estimate the time *and triple it*.

Trap No. 12

People often think that they need to be programmers to use a computer.

Management action. Introduce practical computer training, using already developed software. Make sure the software is easy to use and reliable. Discover that many computer applications are preprogrammed and communicate this.

For further reading

Books and articles

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Newsletters and magazines

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Doane-Western, Inc.
8900 Manchester Road
St. Louis, MO 63144
    phone 314-968-1000

Farm Computer News
Successful Farming
1716 Locust Street
Des Moines, IA 50336
    phone 515-284-2127

Infoworld
530 Lytton Avenue
Palto Alto, CA 94301
    phone 415-328-4602

Personal Computing
Hayden Publishing Company
50 Essex Street
Rochester, NJ 07662
    phone 313-761-7490