An Evaluation of Expert Systems for Personal Financial Planning[1]

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A comprehensive personal financial plan prepared by a professional planner costs from $2,000 to $20,000 even when conventional computer software is used. A plan prepared by an expert system costs from $200 to $500 if no professional planner is involved. Because these systems can produce many plans at substantially reduced prices, personal financial planners may need to consider using an expert system operators' services to remain competitive and to extend their practices.

This article describes the use of expert systems in personal financial planning and the research approach used to evaluate the expert systems. For four of the six expert systems that have been developed, it compares the data-collection forms and information used in preparing personal financial plans. Then, it discusses environmental and system assumptions. Lastly, the article analyzes the impact of the variations observed in information requested, system parameters, and system assumptions, and, when possible, compares the recommendations of the plans.
KEY WORDS: *expert systems, personal financial planning, validation*

Comprehensive personal financial planning is a complex service provided by a variety of professionals.[1] Expert systems have reduced the cost of personal financial plans to one tenth or less the cost of those prepared by professional planners. Employers, who once provided this fringe benefit only to top executives, have provided or are considering providing financial planning to

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more if not to all their employees (Nielson et al. 1992; Nielson et al. 1991; Phillips et al. 1990).

Personal Financial Planning Expert Systems

An expert system is a special type of computer program that uses artificial intelligence to solve problems that have either multiple acceptable solutions or no prescribed procedures that assure a solution. Personal financial planning uses many assumptions and items of information to recommend one of several acceptable solutions to financial planning problems. Trebby (1987), Brandi (1988), and Humpert and Holly (1988) were among the first to discuss applications of expert systems to personal financial planning.

Expert system prepared plans can be completed without the services of a professional planner while conventional software programs to prepare plans require substantial input from the planner. For an expert system prepared plan, a professional planner may gather the family's information, edit the plans' written explanations, interpret the plan, or counsel the family in carrying out the plan's recommendations charging a professional fee.

Comprehensive Personal Financial Planning

A comprehensive personal financial plan has eight planning areas (Figure 1). Because no two families have the same personal and financial information, goals and desires, inflation expectations, and risk attitudes, personal financial plans are specific to each family. As shown in Figure 1, comprehensive personal financial planning requires many information items: Family Facts, Assumptions, and many types of Experts' Knowledge. A comprehensive plan includes suggestions for cash and debt management, income tax minimization, estate maximization, investment portfolios, insurance coverage, retirement plan decisions, and personal savings needed to meet the family's personal financial goals.

Expert system operators use preprinted data-collection forms for families to provide their personal and financial information for use by the expert system. Then the expert system, using the family's specific information, the environmental assumptions, the planning parameters, and the experts' knowledge stored in the expert system, prepares the personal financial plan. The accuracy and completeness of the family's information, as well as the skill and knowledge the experts used in preparing and updating the system's knowledge base are critical to the quality of the personal financial plans.

Figure 1
The Personal Financial Planning Process

Family Facts

Assets
Liabilities
Current Revenue Sources
Future Revenue Sources
Current Expenditures
Anticipated Future Expenditures
Retirement Benefits
Insurance Coverage
Family's Goals and Desires
Family's Expectations
- Inflation
- Investment Returns

Attitudes Toward Risk

Assumptions

Environmental
Inflation Rates
Investment Returns
Life Expectancy

System
Beneficiaries
Property Ownership
Citizenship
Health Status

Experts' Knowledge

Accounting: Asset and Liability Valuations, Cash Flows, Debt Management
Taxation: Income, Estate, and Gift
Laws: Divorce, Will, Estate and Trust, Property
Investment Products and Opportunities
Insurance
Employee Benefits

Financial Plan's Planning Areas

Cash Management	Investment Planning
Debt Management	Insurance Planning
Income Tax Planning	Retirement Planning
Specific Personal Financial Goals	Estate Planning

Operational Personal Financial Planning Expert Systems

Because a comprehensive personal financial planning expert system can take as many as eighty person-years to create, only six systems have been developed. Brown et al. (1990), Phillips et al. (1990), and Nielson et al. (1991) describe all of these systems. McKell and Jenkins (1988), Kindle et al. (1989) discuss a single system in greater depth.

Four systems were used for this research (Figure 2). Arthur Andersen's system is a modified version of Sterling Wentworth's system so Arthur Andersen's system was used to evaluate both expert systems. Because this research was designed to test only system-prepared plans, Ayco Corporation's system was omitted as its plans all have input from a professional planner. Because the plan names are very similar and the operators' names are long, this article will use abbreviations to identify the systems: AA (Arthur Andersen & Co.), APEX, Chase (Chase Lincoln First Bank), PW (Price Waterhouse). All four expert system operators agreed to prepare plans without a professional planner reviewing or altering the data-collection forms (forms) or their planners changing the resulting plans.

Figure 2
Personal Financial Planning Expert Systems Tested

Expert System	**Operator**	**Income Range**
AAFINPLAN a modification of Sterling Wentworth's PLANMAN	Arthur Andersen & Co. - **AA**	All incomes
Client Profiling System	**APEX**	$25,000 - $200,000
Personal Financial Planning System	Chase Lincoln First Bank - **Chase**	$25,000 - $500,000
Personal Financial Analysis	Price Waterhouse - **PW**	All incomes

Objectives of This Research

This research was designed to evaluate the data-collection forms, to compare the environmental and system assumptions used, to evaluate the plans for coverage, and to compare the financial plans' recommendations. An area's planning recommendations can be logically compared if the following are true:

- the information entered in the systems is the same
- the systems' assumptions are the same
- the systems' knowledge bases and assumptions have no material errors or omissions
- the depth of coverage is the same among the systems.

This article compares individual plan's recommendations if all four factors are true.

Profile Development

Three family profiles were prepared in three steps to test the expert systems and to control the families' information entering the systems. To avoid bias, the authors did not see any operator's forms until the profiles were complete.
First, a detailed outline of all the personal and financial information needed to prepare a family's plan was prepared.[2] Second, this outline was used to write detailed family profiles including as many alternatives from the outline as possible, yet retaining a realistic family profile. At least one example of every item of personal and financial information on the outline is in at least one profile, except for rental property and stock options. This methodology produced three families' personal and financial information to test the information items that might be needed to prepare a personal financial plan.
The third step was to validate the profiles for internal consistency so a system would not reject them. Income taxes, debt relationships, and present values were analyzed to ensure internal consistency. The profiles also were reviewed for logical relationships between demographics and financial information. For example, the assets in a person's retirement fund must consider that person's current salary, person's length of employment, and the maximum contributions permitted by the retirement plan.

Because each family's profile contains all the information the authors determined necessary, they readily knew when the forms did not ask for needed information. To complete the forms, some minor details were added to the profiles, but nothing was deleted or modified. For example, the original profiles did not identify specific stocks in an investment portfolio, but did present the dollar value and a description of the investment rating of the portfolio.

The Family Profiles

The first family is a couple in their early thirties with two preschool children living in a state with low income taxes. The husband is a public employee with nonvested retirement benefits in a defined benefit pension plan. The wife is a part-time professional, the recipient of her mother's gifting program, and the remainder person beneficiary of her father's testamentary trust.

The second family is a divorced woman in her forties with a 12-year-old son living in a high income tax state. She is a commission salesperson who received substantial pension benefits in a divorce settlement.

The third family is a middle-aged couple. The spouses were previously married and each has two children from those marriages. This couple resides in a community property state that has no income taxes. The husband, age 55, is retired due to disability, collecting disability and retirement benefits, the income beneficiary of a trust, and a passive shareholder of an S corporation. His wife, age 45 and a resident alien, manages their family business and has vested retirement benefits in a defined contribution pension plan.

Comparison of the Data-collection Forms

The systems' differing information requirements are crucial to understanding the relative strengths and weaknesses of each system. Although the forms differ in organization, length, and writing style, most information items requested are either identical or comparable. The forms occasionally use different terminology to ask for comparable information and in a few cases the forms have internally inconsistent terminology (Table 1).

For retirement, survivor, and disability income, the authors assumed household spending, after-tax expenditures, and after-tax income net of savings were the same value. AA's, APEX's and PW's systems include debt payments in household spending while Chase's system excludes debt payments. For needed estimates, the forms have suggested values to help the family. Table 2 shows the values provided on the current forms.[3]

Evaluation of the Information Requested and Its Effect On Plans' Recommendations

Most of the information requested by all operators' forms was comparable and handled identically by each system. Table 3 lists the major profile information omitted by at least one operator's forms.

Citizenship

Since 1988, the Internal Revenue Code has not allowed an estate tax marital deduction for property left to a resident alien spouse unless that property is in a qualified domestic trust (Nelson 1989). The profile with a resident alien spouse had sufficient assets for a marital deduction trust to be a correct estate planning recommendation only if the spouse is a U. S. citizen.

Table 1
Information Requested for Projections (In Today's Dollars)

Income to Be Projected	AA	APEX	Chase	PW
Disability	Annual After-tax Income (Spending)	Not Requested (Monthly Expenses Discussed)	% of Current Living Expenses (Annual Spending)	Annual Before-tax Income
Survivor	Annual After-tax Income (Spending)	Monthly Expenses	% of Current Living Expenses (Annual Spending)	Annual Before-tax Income
Retirement	Annual Spending Level (After-tax)	Annual After-tax Income	% of Current Living Expenses (Annual Spending)	Annual Before-tax Income

All systems' plans computed the estate tax marital deduction and recommended a marital exemption trust for the resident alien without stating it was appropriate only for a U.S. citizen. Thus, all the systems assume all the adults in the family are U.S. citizens. Since these tests were run, AA has added citizenship status to its forms and considers citizenship in its plans.

Community Property

In a community property state, assets acquired and income earned during a marriage belong one half to each spouse, regardless of which spouse is the recorded owner of the asset or which spouse earned the income. Unless community property and community income are handled according to the division provided by state laws, many of the computations and recommendations in the plans are incorrect. AA's and PW's systems handle community property and sharing of community income correctly. APEX's and Chase's systems did not treat either community property or community income correctly. As a result of our findings, Chase's system was modified to correctly handle community property and income. The profile was rerun to test the revision and the system performed correctly.

Remainder Interest in a Trust
AA's and Chase's systems consider a trust's remainder interests that a beneficiary will receive upon the death of the income beneficiary while APEX's and PW's forms did not have a place to enter the information. As all four systems' plans recommend establishing marital exemption trusts when a person's taxable estate exceeded $600,000, it seems incongruous that the forms do not provide for an individual to be the remainder person beneficiary of a testamentary trust or any other trust.

Table 2
Suggested Values Provided on Current Data-collection Forms

Income or Cost Factor Valued	AA	APEX	Chase	PW
Income if Disabled	60-90% of Current Annual Expenses	Not Provided	60-80% of Current Living Expenses	60-80% of Before-tax Income
Income of Spouse (Survivor Income)	60-80% of Current Annual Expenses	Not Provided	60-80% of Current Living Expenses	50-80% of Before-tax Income
Retirement Income	60-80% of Current Annual Expenses	80-100% of Current Annual Expenses	60-90% of Current Living Expenses	60-80% of Before-tax Income
Cost of College				
Public	$3,500 to $7,000	$4,000	$4,500 to $10,800	$6,000
Private	$10,000 to $20,000	$14,000	$10,100 to $19,900	$12,000 to $17,000

Table 3
Major Profile Information Omitted

Information Item Tested	AA	APEX	Chase	PW
Citizenship	No	No	No	No
Community Property	Yes	No	No[1]	Yes
Remainder Trust Interest	Yes	No	Yes	No[2]
Fluctuating Earned Income	No	No	Yes	No[2]
Increasing Earned Income	Yes	No	Yes	No[2]
Future Gifts	Yes	No	Yes	No[2]
Pension Benefits Received in a Divorce	No	No	No	No
Spouse or Estate not Beneficiary of Retirement Benefits	No	No	No[3]	No
Spouse Not Beneficiary of Life Insurance	Yes	No	No[3]	No
Death and Disability Benefits of Defined Benefit Pension Plan	Yes	No	No[3]	Yes
Potential Changes in Working Spouse's Earned Income				
- Not Currently Working	Yes	No	Yes	Yes
- Already Working	Yes	No	No	Yes
Other Spending Goals Excluding Education	Yes	Yes	Yes	Yes[4]

1 The system has been modified to treat jointly owned property as community property when individuals are residents of a community property state.
2 The information could have been reported in a section labelled cash flows.
3 The operator has supplemental forms to report this item, but the basic forms do not provide a place to enter this information.
4 Included only if within two years and only if used existing assets.

Changes in Earned Income
If a plan is for a family with fluctuating earned income, anticipated changes in future income need to be included in the plan's computations. Because Chase's system includes this factor, it was the only one to correctly predict the

commission salesperson's current year's cash flows and income tax liability. AA's and Chase's systems incorporate expected increases in earned income if it is different from the system's assumption of increases equal to inflation. APEX's and PW's systems assumes income and expenditures will rise at the rate of inflation.

Future Gifts
AA's and Chase's forms provide for reporting gifts that a person was reasonably certain to receive over the next five years. APEX's and PW's forms do not specifically provide for reporting these gifts. All systems' plans recommend gifting to reduce a taxable estate, yet only AA's and Chase's forms specifically provide for either these gifts or other gifts.

Retirement Benefits Received in a Divorce
Because divorce is such a common occurrence in our society and because it has a major impact on a family's financial life, two of the profiles included people who had been divorced (DeJesus 1989). No forms provide for entering retirement benefits transferred in a divorce and the benefits were reported as if they were from a former employer.

Beneficiaries of Retirement Benefits and Life Insurance
All systems assume the spouse or the person's estate is the beneficiary of retirement benefits. Only AA's forms allow reporting the beneficiary of life insurance and the other three expert systems assume the spouse is the beneficiary. These assumptions resulted in incorrect recommendations for estate planning and insurance planning for survivor income protection.

Death and Disability Benefits of Retirement Plans
APEX's and Chase's forms do not ask for the death or disability provisions of retirement plans. As a result, APEX's and Chase's plans for one family understated the husband's estate in death and overstated the need for additional life insurance to protect his survivors because they omitted the pension plan's death benefit. Both systems' plans omitted the pension plan's disability benefit, thus overstating the amount of disability insurance needed to protect the family.

Changes in Working Spouse's Income When Spouse is Disabled or Dies
Only AA's and PW's forms ask if a spouse's income would change if a mate were disabled or died, and the systems include the income changes in their disability and survivor income calculations. Chase's forms included changes in income if not currently working but not changes if already employed. As a result of this research, Chase's current forms now include changes in income for an employed spouse.

Other Spending Goals Excluding Education
Every family has future goals that include one-time expenditures or large expenditures over time. For many families, college education is one of these goals. All systems' plans cover funding the cost of college educations. PW's forms only include other future goals if they will be purchased within two years with existing assets. Chase's plans include financing future goals. APEX's plans discuss the impact of financing future goals, but their financing is not in the family's cash flow projections.

Environmental Assumptions Used By the Expert Systems

Future income, investment earnings, and costs must be predicted to estimate a family's income needs if a spouse should die or become disabled; the savings needed to provide the desired income at retirement; and the amount of cash needed in the future to educate children, to purchase a home, or to meet any other large, one-time purchase. These predictions require estimates of inflation rates, investment returns, life expectancy, and health status. These predictions also are affected by property ownership laws -- community property versus head of household -- and by designated beneficiaries of life insurance and retirement benefits. All systems include parameters for these assumptions (Table 4).

Because remaining life spans are so long (almost sixty years for a thirty year old), even a small difference in other environmental assumptions can produce substantial differences in a plan's recommendations. No two systems use the same values for inflation rates, investment returns, or life expectancy. Nevertheless, all are within acceptable ranges if compared to medium and long-term inflation rates and investment returns, and current mortality tables (Table 5).

Organization of the Plans and Their Summary Information

Because personal financial planning is so complex, the easier the plans are to use, the more valuable they are to the family. Table 6 shows the explanatory and summary information included in the plans.

Computations
To understand completely the conclusions and recommendations presented in its financial plan, the family needs to understand how values were derived and to understand the computations used to make the recommendations. A plan containing schedules of these computations is easier to understand and interpret. If computations are included in their related section, a plan is easier to use and follow. AA's plans include all derived value schedules in the appropriate

section. Chase's plans include all schedules in an appendix and provide an index to the appendix and the schedules. The other two systems' plans only include some schedules showing computations. All except APEX's plans include all the schedules of computations for the recommendations made; APEX's plans provide only some computations.

Table 4
The Systems' Environmental Assumptions When Profiles Were Run

Environmental Assumption	AA	APEX	Chase	PW
Inflation Rates - General - Real Estate - Education	Client's Expected Rate	5.0% 8.5% 7.0%	5.4% 5.6% 6.1%	4.0% 4.0% 4.0%
Investment Returns	Actual Returns	8.5%	Actual After Suggested Changes	8.0%
Life Expectancy	Average Plus Five Years	Men 82 Women 85	Top 5%	Average [1]
Health Status Considered	No	No	Average	No
Community Property and Income Considered	Yes	No	No[2]	Yes
Beneficiaries - Retirement Benefits	Spouse or Estate	Spouse or Estate	Spouse or Estate[3]	Spouse or Estate
- Life Insurance	Designated Beneficiary	Spouse	Spouse[3]	Spouse

1 Changed to 90 years.
2 System revised and now correctly treats community property and community income.
3 Can specify beneficiary if optional forms used.

Recommendations

All plans provided a summary of the recommendations made in the plan. All except PW's plans include an analysis of specific financial goals other than financing a college education. APEX's and Chase's plans have a summary of these specific goals. Chase's plans also include the percentage of each specific goal the system determined is achievable.

Table 5
Environmental Assumptions Reported In the Plans

Environmental Assumption	AA	APEX	Chase	PW
Inflation Rates				
Presented Rates	Yes	Yes	Yes	Yes
Discussed Potential Differences	Yes	Yes	Yes	Yes
Illustrated Potential Differences	Yes	No	Yes	No
Investment Returns				
Presented Return	Yes	Yes	Yes	Yes
Discussed Potential Differences	Yes	Yes	Yes	Yes
Illustrated Potential Differences	Yes	No	Yes	Yes
Life Expectancy				
Presented	No	No	Yes	Yes
Client	No[1]	No[1]	Yes	Yes
Spouse	No[1]	No	Yes	No
Discussed Potential Differences	No	No	Yes	No

[1] These could be calculated from information presented.

Glossary

Comprehensive personal financial plans include many financial, accounting, tax, legal, and insurance terms. Because plans often are prepared for families without an extensive business background, the inclusion of a glossary of terms is very helpful, even though all the plans are written in lay language. Chase's plans contain a glossary of terms and PW's plans have a glossary in the supplemental reference manual.

Table 6
Explanatory and Summary Information Included in the Plans

Explanatory and Summary Information	AA	APEX	Chase	PW
Schedules of Computations	Yes	Some	Yes	Partial
Detailed Computations	Yes	Some	Yes	Yes
Summary of Recommendations	Yes	Yes	Yes	Yes
Summary of Clients' Specific Goal Achievement	No	Yes	Yes	Not in Plan
Glossary of Terms	No	No	Yes	Yes[1]

[1] The glossary is in the reference manual and not the plan.

Specific Supporting Information in the Plans

Table 7 summarizes the specific supporting information provided in the plans. All plans include some cash planning ideas, yet only AA's and Chase's plans include current cash flow statements. All systems' plans provide a statement of financial condition (balance sheet), but they differ widely in the terminology used and the items included.

Income Taxes
All systems' plans include the amount of the current year's federal income tax and Social Security tax liability. All systems' plans except APEX's plans include all the supporting computations. AA's, APEX's, and Chase's plans include the state income tax liability. PW's plans excluded the computation of the state income tax liability. Omitting state income taxes substantially underestimated the income tax liability of the family in Profile Two.

Marginal Income Tax Rates
Because income tax planning strategies are designed to increase after-tax dollars based on marginal tax rates, an accurate computation of a family's marginal income tax rate is critical to good personal financial planning. All systems' plans present a marginal tax rate. However, APEX's and PW's plans do not include state income taxes in that marginal income tax rate. The second profile

is an Oregon family with a combined federal and state marginal income tax rate of 34.48% and federal marginal income tax rate of 28% -- a 6.48% difference. APEX's plan for the Oregon family stated "Your marginal tax bracket (the highest rate at which any of your income is taxed) is projected to be 28%." The plan did not identify the rate as the federal marginal income tax rate and did not included the impact of state income taxes. PW's plan stated "We estimate that you are in the 28% marginal tax bracket. This means that for each additional dollar you earn this year, you will pay 28 cents of it in federal income taxes." Preceding the computations of federal income taxes, the plan stated "Please note that the discussion in this section concerns federal taxes only. You should consider the impact of local income taxes when making your final financial plans."

Table 7
Specific Supporting Information In the Plans

Supporting Information	AA	APEX	Chase	PW
Cash Flow Statement	Yes	No[1]	Yes	No[2]
Statement of Financial Condition (Balance Sheet)	Yes	Yes	Yes	Yes
Current Year's Income Taxes Shown	Yes	Yes	Yes	Yes
Computations Provided	Yes	No	Yes	Yes
Marginal Tax Rate	Combined Federal and State	Only Federal	Combined Federal and State	Only Federal
Current Annual Living Expenditures	Yes	Yes	Yes	No
- Compared to Average Household Spending	No	Yes	Yes	Provides Norm

1 Plans include an Income and Expense Summary.
2 Forms only ask for federal income tax related cash outflow items.

Personal Expenditures

AA's, APEX's, and Chase's forms request information regarding personal annual expenditures. APEX's and Chase's plans provide a comparison of the family's personal expenditures to "norm" expenditures for a similar family. AA's plans provide the family's current expenditures in dollars and as a percentage of total living expenses. PW's plans only provide the norm expenditures.

Specific Planning Areas and Recommendations

All systems' plans include all the planning areas, but the depth of coverage of the eight planning areas varies substantially among the systems. Depth of analysis varies from detailed analyses based on the family's facts provided to provision of a general boiler plate discussion of the topic. A comprehensive personal financial plan should have general and specific recommendations in all planning areas. Table 8 summarizes the plans' coverage -- income tax planning, cash flow planning, debt management, savings and investment planning, financing future goals, retirement planning, insurance coverage, and estate planning. Because the depth of coverage was different among the systems' plans, specific recommendations were not made by all systems' plans for all planning areas. Sometimes, the differences among the plans' recommendations for the same profile were greater than anticipated. These differences were partially caused by

- systems including different information because of the differences in the operators' forms,
- systems using different assumptions for environmental factors, and
- the "expert's rules" and other individual features of the systems.

If the differences in recommendations were caused by differences in data input, comparisons are not made. If the differences are due to environmental factors or system rules, comparisons are presented.

Income Tax Planning

AA's, Chase's and PW's plans have a section covering income tax planning. APEX's plans do not cover this area, although the plans discuss some tax strategies within other sections. AA's plans have some specific recommendations regarding common tax strategies, as do Chase's plans. PW's plans are general, although they have some discussions specific to the particular profile. PW's reference manual contains a short section on basic tax matters. Only Chase's plans present a detailed schedule of the effect of the tax strategies recommended in the plans.

Recommended tax planning strategies differed for each profile. All systems' plans recommended the use of IRAs in all profiles and stated the contributions would not be tax deductible for the family. All plans recommended the public employee take advantage of a tax-deferred annuity when funds were available. All plans explained that the contributions are made with before-tax dollars and

Table 8
Coverage of Planning Areas

Planning Areas	AA	APEX	Chase	PW
Income Tax Planning	Specific	Some Specific	Specific	Specific
- Separate Section	Yes	No	Yes	Yes
- Some Discussion With Other Planning Areas	Yes	Yes	Yes	Yes
Cash Flow Planning	General	Specific	Specific	Occasional Comment
Debt Management	Specific	Specific	Specific	General[1]
- Future Borrowing in Projections	No	No	Yes	No
Savings and Investment Planning	Specific	Specific	Specific	Specific
Financing Future Goals	Specific	Specific	Specific	Specific
- College Education	Yes	Yes	Yes	Yes
- Other Funds for Children	Yes	No	Yes	No
- Other Major Goals	No	Yes	Yes	No
Retirement Planning	Specific	Specific	Specific	Specific
Insurance Coverage				
- Life	Specific	Specific	Specific	Specific
- Disability	Specific	Specific	Specific	Specific
- Medical	Specific	No	General	General[1]
- Property and Casualty	Specific	General	General	General[1]
- Auto	Specific	General	General	General[1]
- Umbrella Liability	Specific	General	General	General[1]
Estate Planning	General	General	General	General

[1] All general comments are in the separate reference manual that accompanies the plan.

showed the potential retirement funds that could be accumulated through this retirement annuity. APEX's plans lack current tax planning because they do not present the computation of current tax liability that the other three systems' plans present. AA's plans, although they presented the computation of the income taxes, did not discuss the under- or over-payment of current year's income taxes.

Cash Flow Planning and Debt Management
All plans have a section on cash flow planning, although PW's plans deal only with cash inflows as PW's forms ask for only tax-deductible cash outflows. AA's plans make a few general recommendations regarding cash planning and PW's plans make a few comments. APEX's and Chase's plans provide detailed recommendations for the management of cash.

APEX's and Chase's plans make recommendations regarding cash to the nearest dollar, giving the impression that these amounts are precise, when in reality they are based on recommended percentages built into the expert systems. Although APEX's and Chase's plans recommended redeeming certificates of deposit, none of the plans discussed the interest penalty for early withdrawal of cash from a certificate of deposit. In addition, Chase's recommendation for one family to redeem a certificate of deposit ignored the fact that the certificate was a separate asset of a community property state resident and the resulting recommendation would have converted the separate property into community property. For one family, APEX's plan recommendation to move cash between accounts was followed by a recommendation of borrowing to pay current debts. This recommendation was made even though available cash was more than adequate to pay the debts.

Cash Flow Planning
All plans recommended a level of cash reserves each family should maintain for emergencies. For two families, the plans' recommendations were approximately the same and, for the third family, wide discrepancies exist in the recommended cash reserves. These differences indicate that the levels set by the systems vary.

Investment Planning
All plans, except PW's plan for one family, recommended a percentage of investable assets in various categories of investments. To create comparability among the recommendations, the categories used are cash and fixed income investments, equity securities, and real estate. Table 9 includes the target recommendations of the plans. All plans included recommendations for the division of current investment assets among various categories based on level

of risk. AA's and Chase's plans did not recommend real estate investments, while Apex's and PW's plans did recommend real estate.

The plans' recommendations for diversification of investments reflect the amount of invested assets as well as a family's risk tolerance. Although the profile of one family had a moderate risk level, APEX recommended a considerably more risky investment -- real estate. For all profiles, Chase's plans' recommendations were the most conservative excluding equity investments for two families and not recommending real estate investments for any family.

Table 9
Investment Asset Allocation Recommendations

Profile	AA	APEX	Chase	PW
Profile One				
- Cash and Fixed Income Securities	56%	50%	100%	Not Presented
- Equity Securities	44%	33%		
- Real Estate		17%		
Profile Two				
- Cash and Fixed Income Securities	54%	49%	100%	37%
- Equity Securities	46%	34%		45%
- Real Estate		17%		18%
Profile Three				
- Cash and Fixed Income Securities	55%	40%	89%	40%
- Equity Securities	45%	40%	11%	45%
- Real Estate		20%		15%

Financing Future Goals
All families have future goals for infrequent or once-in-a-lifetime expenditures. These goals may include financing a college education; paying for a wedding; purchasing a home, a car, a vacation home, a boat, or airplane; and buying rental property or a business. All systems' plans include the financing of college educations.

AA's plans incorporate other future goals into the cash flow projections, but did not specifically discuss the goals or the funding of those goals. APEX's plans discuss each goal specified on the forms. Because APEX's plans do not incorporate borrowing to finance future goals, its plans frequently recommend the family rethink its goal because it was not achievable with present assets.

Chase's plans include borrowing to reach the family's goals. Chase's plans discuss each goal specified, the percentage attainable, and methods of achieving that goal. PW's plans only cover funding college educations and do not include funding personal future goals beyond those covered in the specific planning areas.

All profiles had children whose parents anticipated providing support for college educations. Table 10 summarizes the inflation factors used, the after-tax earnings rate used, the estimated cost provided on the forms, the plans' estimated cost indexed for inflation, and the cash needed today to financial the cost. All plans also provided alternative financing methods.

Table 10 clearly shows that the systems' environmental assumptions of inflation rates and investment earnings have a substantial impact on the projected future costs of providing a college education, particularly if the costs are far in the future. The impact is marginal when the costs are in the near term.

Retirement Planning

All systems' plans include a section on retirement planning. Differences in the information requested by the forms and differences in the definitions for values requested resulted in plan recommendations that are not based on the same information. One APEX plan omitted the remainder interest in a trust, thus understating future receipts of assets and producing a projection of needed retirement funds higher than the other systems' plans. For all families, the authors' assumption that current living expenses were equivalent to after-tax income resulted in all Chase's plans projecting a lower amount of income desired in retirement than the other three systems' plans. For one family, the authors followed the instructions on PW's forms and did not report the retirement assets that had not been withdrawn upon retirement and, thus, understated the assets of the family. For one family, APEX's plan omitted the lifetime income being received from a trust and, thus, overestimated the amount of future income needed to meet the family's retirement goals.

Insurance Coverage

All systems' plans include a section covering life insurance for survivor income protection and disability insurance for income protection. Only AA's plans provide specific recommendations for medical, property, auto insurance, and umbrella liability coverage. APEX's and Chase's plans provide a general discussion of property and liability insurance coverage including homeowners insurance, auto insurance, and umbrella liability coverage. Chase's plans discuss medical insurance in general, while APEX's and PW's plans do not cover medical insurance. PW's reference manual discusses medical, property and casualty, auto, and umbrella liability insurance.

Table 10
Financing College Educations

System's Assumptions	AA	APEX	Chase	PW
Inflation Factor	5.00%[1]	7.00%	6.10%	4.00%
After-Tax Earnings Rate	6.12%	6.10%	5.40%	5.75%
Age 2 and Age 5				
Cost Estimate	$120,000	$120,000	$120,000	$120,000
Cost Indexed for Inflation	$270,700	$357,106	$275,091	$225,360
Fund Now With Cash	$100,700	$137,382	$125,224	$58,100
Child Age 12				
Cost Estimate	$ 19,200	$19,200	$19,200	$19,200
Cost Indexed for Inflation	$31,000	$34,648	$32,160	$29,056
Fund Now With Cash	$19,900	$22,161	$19,691	$13,600
Child Age 17				
Cost Estimate	$ 21,600	$21,600	$21,600	$21,600
Cost Indexed for Inflation	$23,500	$27,450	$26,309	$23,848
Fund Now With Cash	$20,233[2]	$22,249	$21,600	$18,000

[1] AA's system uses the inflation rate specified by the client. The researchers specified the recommended rate of 5%.

[2] AA's plan duplicated income causing the system to compute the family's marginal tax rate at 33% rather than 28%. If the correct marginal tax rate had been used, the after-tax return would have been 6.12% and the required payment now would have been lower.

Because of the differences in the descriptions used by each operator's forms to request the family's desired after-tax income for the surviving spouse, the values used by the systems varied substantially and the relevant profile information was not reportable on all forms. APEX's and Chase's forms do not include a way to enter a defined benefit pension plan's death benefit. Both

AA's and PW's projections excluded passive income from an S Corporation. Thus, these systems' plans underestimated the assets available for the survivors. AA's system omitted the disability and trust income when projecting a surviving spouse's future income.

Chase's and PW's forms do not have a way to enter a beneficiary other than a spouse for retirement benefits. Only Chase's plans consider the possibility that a spouse is disabled and probably not insurable. All except AA's plans discuss the potential elimination of disability income insurance once the recipient becomes eligible for Social Security. AA's and APEX's plans discuss the taxability of disability insurance payments, while the other two systems' plans do not cover this topic.

All plans recommended additional long-term disability insurance for the primary family wage earner. Only Chase-Lincoln First Bank's plans recommended short-term disability coverage for the primary family wage earner for all profiles. All but PW's plan recommended disability coverage for the spouse in Profile One. AA's plan for Profile Three recommended the purchase of disability insurance for a person already disabled and collecting on a disability insurance policy: clearly, an impossible recommendation. In Profile One, PW's plan assumed that the annual payment amount from the husband's defined benefit plan would be available to the wife while the other firms' systems did not make that assumption. Most retirement benefits become vested upon disability, so PW system's assumption is the most logical one.

Estate Planning

All systems' plans' estate planning sections are general. The lack of specific recommendations was expected, as any detailed estate plan could be considered the practice of law and none of the system operators are legal firms. All plans computed the gross taxable estates of the families' adults, estimated potential estate expenses, and computed potential estate tax liability. The computations of estimated estate expenses varied slightly depending on the system parameter, percentage of gross estate, used to estimate these expenses. Only AA's and PW's plans allow for a specific bequest to either a charity, a non-spousal family member, or a non-family member in a will when computing estate taxes.

In one family, the spouses each had outdated wills prepared in a former state of residence that did not provide for their children. All systems' plans except AA's plan recommended updating their wills. In another family, the adult had no will and all systems' plans recommended immediate preparation of a will. AA's, APEX's, and Chase's plans discuss executors and guardians for minor children while the PW's plans do not discuss these concerns. AA's and PW's plans discuss trusts for minor children and for spouses. Chase's plans discuss the safekeeping of wills and PW's plans discuss the transfer of estate assets, while the other systems' plans did not discuss these items.

One family is a married couple, both had been previously married, and both had provided for children from their first marriages through the assignment of retirement benefits. The husband had assigned a portion of his life insurance to his former wife as protection for unpaid alimony payments. No system allowed for these facts to be included in the computation of their taxable estates.

Conclusions

All the expert systems reviewed can provide useful and comprehensive personal financial plans. The key element is the data-collection forms. If the information gathered on the forms is both correct and complete, all the relevant information that is needed for a quality plan will enter the expert system. The difficulties of developing pre-printed forms that cover the many financial and personal family situations are apparent. This study found that some changes would improve the forms being used. Some of these recommendations, which have all been shared with the system operators, have already resulted in changes.

Not all the data-collection forms allow for reporting anticipated changes in the family's primary sources of earned income. A minor change to the forms could add information that for some families should be included. Some of the forms did not provide for the reporting of gifts and the income and beneficial interests in estates and trusts. Two systems' data-collection forms did not allow for the reporting of death and disability benefits from defined contribution plans, and thus overstated the need for life and disability insurance.

Changes in family situations deriving from changing demographics could be added to the data-collection forms. For example, financial planning should include changes in assets and their ownership, income, or child support resulting from divorce or remarriage. While a family's financial planning usually does not anticipate divorce, the forms did not always allow for reporting existing obligations or benefits relating to a prior divorce.

The systems' plans differed in the depth of coverage of the various areas encompassed by personal financial planning. The emphasis and depth of coverage of the systems' plans has been demonstrated by the analysis. The importance of this emphasis and depth of coverage can only be judged in light of the uses anticipated for these comprehensive financial plans and the preferences of the planner or corporate selector of the system.

The assumptions regarding inflation rates, investment rates of return, and life expectancies differed among the systems, according to the philosophy of the system operators. However, because their impact on the recommendations in personal financial plans is substantial and can have a long-term effect on the financial well-being of the client, the recommendation is that all the plans should provide extensive discussion of their assumptions and should give illustrations of financial outcomes resulting from differences in these assumptions.

Endnotes

1. These professionals include Certified Financial Planners (CFPs), Chartered Financial Consultants (ChFCs), attorneys (LLBs, JDs), Chartered Life Underwriters (CLUs), Certified Public Accountants (CPAs), and CPAs who are Accredited Personal Financial Specialists (APFSs).

2. This outline is eleven pages of very detailed information. For example, the outline had the following information items for automobiles -- year, make, model, purchase price, down payment, debt amount, debt interest rate, monthly payment, balance of contract, and normal replacement cycle.

3. Since the profiles were run, AA has added the cost of education to their forms and Chase has updated its costs of college education. These changes are included in Table 2.

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