An intelligent agent-assisted decision support system for family financial planning ☆

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Abstract

The demand for family financial planning (FFP) services is growing dramatically as the financial market grows more complex and people become more aware of the importance of qualified financial guidance. To provide decision support for FFP-related decisions, we formulate a conceptual model for FFP by following Simon's decision-making process model and map our model to the generic FFP process. The design, development, and empirical investigation of an intelligent FFP system for supporting FFP decisions by utilizing intelligent agents and Web-services technology are presented.
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Keywords: Family financial planning; Decision support systems; Conceptual model; Intelligent agents

1. Introduction

In September 2003, the Bank of Communications (Hong Kong Branch) (BCOM) and the City University of Hong Kong commenced a joint development project. By May 2004, the prototype, called "Financial Planner," had been completed, launched, and utilized by all BCOM investment managers. Financial Planner, by its nature, is a computer-based system that provides investment-related advisory services to help high net worth individuals to manage their portfolios.

This project initiates our research in financial planning (FP), more specifically, in the family financial

planning (FFP) area. Today, more people than ever recognize the importance of managing and controlling their family finances. Furthermore, the complex financial marketplace, changing tax laws, and other social and economic changes make it difficult for people to both keep up with all the changes and understand how these changes may affect them. As a result, the need for, and the complexity of, FFP has tremendously increased.

Our first attempt in the FFP research domain is the design and development of a Web-services, multi-agent-based system providing family wealth management advisory services to high-net wealth individuals [16,17]. This initial research is an extension of the BCOM development project. The objective is to improve the system developed for BCOM in terms of applying more innovative technology and integrating more family wealth management services.

However, FFP is not only for the wealthy. In contrast, everyone needs FFP. Thus, in this research, we extended FFP to the general public. FFP is a complex, dynamic,

and distributed process, which requires the system to have a high degree of cooperative problem-solving capability [7]. It is very important to start from a decision-making/problem-solving perspective when analyzing and representing FFP domain knowledge [18]. In this study, we have adopted Simon's [41] well-known model of the decision-making process as a framework for a decision-based FFP model. Based on this conceptual model, we examined the various available resources and practices that assist families with FFP decisions, including printed materials, courses, financial institutions, the Internet, computer software, and FFP specialists [28]. We found that the current available resources and practices have limitations:

- Printed materials, courses and seminars, and the Internet may not be good options for many people, especially the elderly and the undereducated, who tend to seek quick and professional advice rather than attempting FFP themselves;
- Although the financial institutions and FFP specialists may provide seemingly effortless professional FFP-related services, these professionals may be specialists in one specific field and may not be qualified to provide the full range of advice required to develop a thorough financial plan. Those who can provide complete FFP advisory services typically first meet with individual customers one-on-one and determine the status, goals, and resources of the customer. They may then meet with the client's other advisors such as attorneys and bankers to obtain a complete understanding of the client's finances. After analyzing the information, planners may write a report detailing their recommendations. This approach is time-consuming, expensive, and inefficient. In addition, these resources are only for families with high incomes and large property or business interests, and not for the general public, especially those with low incomes;
- Over the last few years, there has been an increasing interest in developing FFP software or online program applications. Although contemporary FFP software or online programs help to improve the efficiency of the FFP decision-making process in some ways and are relatively inexpensive, they still have some of the following drawbacks: (i) Narrow focus. Current software/programs mainly provide one or two types of FFP-related services, such as investment strategy or risk management. The majority provide personal financial planning without taking other family members' finances into account. An ideal FFP system would include the aggregation

of various FFP-related services while providing family-based FP services; (ii) Lack of autonomous and flexible problem-solving behavior. These applications are not capable of customer profiling so they cannot provide tailor-made services. Additionally, the software/programs always require user intervention to proceed; (iii) insufficient interaction and negotiation. Each existing software/program specializes in a certain FFP area; however they don't look at FFP as a whole, with few if any interactions among them. Separating these pieces of advice in each area from each other may result in conflicting information or important omissions that could lead to users suffering financial loss. Our proposed model requires different parties to evaluate the partial solution and to negotiate with each other; (iv) lack of proactive and reactive features. Our proposed model suggests the FFP solution needs to be revised when the situation changes or to react even before the change occurs. The existing software/programs neither respond to changes that occur nor exhibit goal-directed behaviors by taking initiative.

From the discussion above, it is evident that current FFP resources and practices suffer from a lack of popular use, flexibility, adaptability, and collaboration. Therefore, a new intelligent agent-assisted decision-support approach is proposed to achieve better FFP. FFP is a complex process involving many entities, where activities are delegated to a number of both autonomous and collaborative problem-solving agents. Each agent manages its FFP-related activities based on situational awareness and real-time decisions. From a holistic perspective, such agents have specific goals to achieve and interact with one another to manage their interdependencies. They work both autonomously and collaboratively to achieve the user's FFP goals — agents will collaborate in evaluating others' partial solutions, detecting conflicts and reconciling, in order to achieve the maximization of families' financial well-being.

The rest of this paper is organized as follows: Section 2, Background, briefly reviews the relevant literature on family financial planning, Simon's decision-making process model, intelligent agent theory and Web-services. Section 3 presents our proposed decision-making process model of FFP. Section 4 presents the system design architecture, prototype development, and operation of the proposed Intelligent family financial planning Decision Support System (IFFPS). In order to evaluate the prototype system, an empirical experiment is conducted to test the system's effectiveness in Section