Chapter IX

Agent- and Web-Based Employment Marketspaces in the U.S. Department of Defense

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Two modes of matching people with jobs prevail at present: hierarchical planning and distributed markets. Each has strengths and limitations, but few systems have been designed to exploit strengths corresponding to both. With evolving information technology, the job-matching process could be accomplished far more equitably and efficiently using Web-based markets within the firm. Intelligent agents offer excellent potential to help both potential employees and employers find one another in a distributed, electronic marketplace. But realizing this potential goes well beyond simply changing the rules of internal job matching or making agent technology available to job searchers. Rather, the corresponding markets and technologies must be designed, together, to mutually accomplish the desired results (e.g., efficient and effective matching) and conform to necessary properties (e.g., market clearing). In this chapter, we draw from Game Theory results to assess the feasibility of using two-sided matching algorithms to address this market-design problem. We also draw from current agent research to address the information technology dimension of the problem by implementing a proof-of-concept multi-agent system to enact, automate and support the corresponding market solution. This chapter integrates the key economic and technological elements required to design robust electronic employment markets. This chapter also presents preliminary results from a pilot experiment comparing performance for a human-based job assignment process to alternative market designs. These alternative designs can potentially reduce cycle-time and better match employees to job vacancies. However, the human-based process currently provides better rule conformance. Future research into Web-based internal job markets should address this shortcoming, among others.

AGENT TECHNOLOGY IN THE PUBLIC SECTOR

In most developed countries, the public sector seems to lag behind private-sector firms and organizations, particularly in terms of adopting advanced technology. Bureaucracy, absence of competitive pressures and other reasons are often cited for this disparity between public- and private-sector organizations, but the novel technology associated with software agents appears to be deviating from this trend; that is, we find evidence of this advanced information technology being developed and applied to military and governmental enterprises at the same rate as—and in some cases ahead of—corporations, businesses and firms.

For example, software agents are being applied to enable electronic commerce systems for supply chain automation and support in a business-to-government (B2G) context (Nissen, 2001), and agents are also being employed to help improve electricity allocation and pricing decisions (Yan et al., 2000). And these applications are well ahead of agent systems in use today in industry, for instance. Other applications (e.g., to facilitate citizen/government interactions) are being conceptualized and developed in advance of private-sector counterparts as well. How far can agent technology go toward automation and support of the public sector? Literally, any public-sector process that involves knowledge and information work (esp. paper-based workflows) offers potential for agent-based performance improvements.

Yet agent technology is not a cure-all for public-sector performance ills. As we describe in greater detail below, agent technology remains relatively immature. And as with leading adoptions of any new or emerging technology, caution must be exercised to avoid over-reliance on technology before it has suitably matured into what can be referred to as "industrial strength" applications (cf. Nissen, 1998). In the case of software agents, to be more specific, although they can be developed using artificial-intelligence techniques to exhibit "intelligent" behavior, for many tasks (e.g., those involving creativity, judgment, novel-problem-solving behavior), their performance is often inferior to that of people assigned to do the same tasks. Alternatively, for tasks that can be specified well, requiring only modest levels of "intelligence" to perform effectively, agent performance can surpass that of people, particularly in terms of accuracy, speed and cost.

Further, not all agent designs and designers are equivalent. For instance, some agents developed for a specific set of tasks may greatly exceed the capability and performance of others developed for even these same, specific tasks. Which specific tasks and agent designs are most appropriate in any given circumstance remains a matter for empirical investigation. This chapter presents one of the very first such empirical investigations of human versus agent performance, and we address the specific problems associated with matching employees with jobs in labor markets.

PROBLEMS WITH CURRENT EMPLOYMENT APPROACHES

Two modes of matching people with jobs prevail at present: 1) hierarchical planning and 2) distributed markets. Patterned after centrally planned (e.g., former Soviet-style) economies and command-and-control (e.g., the military) organizations, the former approach remains prevalent for matching job candidates to jobs within the current enterprise. As an example from the U.S. military, the Navy currently matches sailors to jobs using a

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