

# IBM Research Report

## Using an Expert System on the Web to Recommend Solutions and Services

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**Abstract:** *We summarize the current state of web-based expert systems. We argue that at the current juncture expert systems are not commonly used for e-commerce, and moreover their current use in e-commerce is limited primarily to consumer commodities such as computers and shoes. Although the sales process for solutions and services accurately matches the classical paradigm of an advice-giving expert system, little has been done to automate this process. To blaze this trail we describe a working expert system prototype called BNAT (Business Needs Analysis Tool) that is designed for this purpose. Insights that we obtained by testing our prototype with actual business executives are summarized,*

**Keywords:** *artificial intelligence, expert systems, electronic commerce, sales automation*

## 1 Expert Systems on the Web

Expert systems have been successful in providing automated advice in many domains. With the proliferation of the Internet over the past few years, a large number of advice-giving expert systems are now available on the Web [4,5]. Domains covered by Web-based expert systems include industry, medicine, science, and government.

For web users frustrated by the limitations of search engines and hot spots, expert systems have the potential to provide a much more satisfying web experience. For example, the Occupational Safety and Health Administration has developed a number of expert advisors that ask the user questions to narrow down their specific requirements for regulatory information [2]. Expert advisors can probe into topics like asbestos handling, confined spaces, and fire safety.

The classical paradigm for an advice-giving expert system is [3]:

1. Find the symptoms (e.g. of a computer network problem or a disease);
2. Detect the problems causing these symptoms;
3. Give recommendations to solve these problems.

For example, the Web-based expert system Toxonet [6] helps a physician diagnose the disease Toxoplasmosis and offers therapy recommendations.

## 2 Application to E-Commerce

At the vast majority of e-commerce websites, potential customers plod through a series of hotspots and search engines, hoping to find something interesting. One step up from this paradigm is software offered by the Ask Jeeves company, which matches free-form customer questions to canned questions which have canned answers. However this is still basically a search engine.

Some effort has been made to provide expert system-based help desk support. According to a 1996 report, there were at least 175 vendors of expert help desk systems [7]. In general, these programs attempt to resolve complaints such as "it doesn't print".

Ask Jeeves also offers a tool called Ask Jeeves Advisor that lets shoppers respond to multiple choice questions to narrow down their product search [8]. This technology is in use at Nike.com.

Startup company Soliloquy offers a tool called Notebook Expert which allows customers to type free-form questions like "Find me the lightest laptop that plays DVDs". It returns a list of relevant products offered by the website.

Reportedly, in a five-month trial of this program, notebook sales went up 21% on Acer America's Shopacer.com [8].

### 3 Application to Solutions and Services

Our research indicates that expert systems for e-commerce are not in widespread use yet. Moreover, use appears to be limited primarily to consumer commodities such as computers and shoes.

Solutions and services are a different story. A solution normally consists of a number of off-the-shelf and customized deliverables that in combination solve a specific customer problem. For example, a solution may combine an off-the-shelf supply chain or CRM software package with custom middleware (e.g. to bridge to existing IT infrastructure), off-the-shelf hardware, and custom services (e.g. process reengineering). Often, purchase of a solution is preceded by a consulting service which attempts to determine the root cause of a set of business symptoms followed by the recommendation of a solution. Although this sounds a lot like the classical symptom-problem-recommendation paradigm of expert systems, little has been done to automate this process.

How do humans sell solutions and services? When a company seeks help in addressing complex business symptoms, they may be approached by a number of people who play several different roles. For example:

- A *general salesperson* represents a variety of diverse solutions. After listening to a potential client describe their business symptoms, a general salesperson tries to match the business symptoms to his/her knowledge of solution areas. They do not actually try to solve the problem. Instead, they arrange for experts from the best-fitting solution areas to meet with the client. Often, such experts are consultants.

- A *solution consultant* is like a general contractor for a solution area. They have a number of different software, hardware, and service offerings at their disposal. Within their solution area they execute the classical symptom-problem-recommendation paradigm. The first phase of this cycle is often performed quickly for free or for a minimal fee, setting the stage for a more detailed and costly second phase.

Why have solutions and services evaded the expert systems machinery? Cresswell [1] states that "expert systems have been successful in domains where the problems are routine and there is considerable factual information that can be readily codified." Although business climates are changing much more rapidly these days, for a given 6-12 month period we believe that business problems become relatively routine and considerable factual information can be codified. For a general salesperson, this means that the mapping from business symptoms to solution areas can be codified. For a solution consultant, this means that within a solution area the mapping from symptoms to problems and their specific solutions can be codified. Of course, the codified information must be continuously maintained due to the rapid pace of business change and the advancement of technology.

Obviously, an expert system will never be as knowledgeable as a consultant. However, we believe that in many cases an expert system can make initial contact with a potential customer and perform the first phase of the sales process, thereby screening the customer for potential business opportunities. After the automated screening process, a salesperson or consultant can take over. Automation of the up-front sales process represents a tremendous opportunity for cost savings.

One potential issue in selling solutions and services on the Web is that solutions and services are much more expensive than computers and shoes, hence people expect personalized sales attention when spending that kind of money. However, several years of e-commerce has taught us that there are new customer segments that can only be reached via the web. And reaching a customer segment via the Web is generally much cheaper than traditional channels due to reductions in overhead. For example, a solution provider may not be able to afford to send a sales representative to all the Mom-and-Pop stores in the world, but it should be able to reach many of them via the Web.

If you don't have an expert system available, you can still sell a lot of shoes and computers on the web, because consumers have a pretty good feel for the types of shoes and computers that they need. On the other hand, without an expert system to help you, selling solutions and services

on the web is almost impossible because it is difficult for consumers to perform the symptom-problem-solution mapping. We believe that an expert system can bridge this educational gap. In this sense there is a stronger case to use an expert system for solutions and services than for shoes and computers.

#### 4 A Prototype Expert System For Solutions and Services

We have developed a prototype expert system called BNAT (Business Needs Analysis Tool) that helps to automate the process of selling solutions and services on the Web. The automated approach taken by the BNAT prototype is as follows:

- The user is assumed to be an executive. We try to entice the user by asking about their company's financial issues. Benchmark metrics and competitive analyses are made available.
- We then relate the financial issues to process and IT issues.
- We identify any potential process and IT problems found, and relate these problems to the solution areas offered by today's solution providers.
- We provide relevant case studies for each potential problem.
- We list some representative vendors in the indicated solution areas.

The basic idea is that corporate executives control spending but focus on financial measurements, not IT and process issues. Therefore the sales process starts by identifying the financial areas that need improvement. After that the expert system drills down into IT and process issues that have the potential to improve the financial measurements.

The concept of enticing a user by asking about financial issues is touted by the Finlistics company [9]. Finlistics provides a tool called the *Finlistics Value Manager* [www.finlistics.com] which helps to identify weak financial areas based on competitive benchmark information. Finlistics does not provide any automated tools for drilling down into IT and process issues. That is the role that we hope to play.

To better understand our approach, consider a simple example involving a General Merchandise retailer. BNAT begins by asking them about their financial performance in seven different areas: inventory turns, revenue growth, COGS (cost of goods sold), SG&A (sales, general, and administrative), asset turnover, accounts receivable, and accounts payable. It is revealed that this company has had flat revenue growth while their competition is averaging 11% revenue growth over the past 12 months (see Fig. 1).

Note that help text (shown in Fig. 1 as a pop-up window) is available in BNAT by clicking on the question mark icon. In this case the help text provides competitive benchmark information (obtained from the *Finlistics Value Manager*) to help the user assess their performance in each financial category.

After the financial assessments have been entered, BNAT drills down into the weaker financial areas. Note that most surveys drill down into *every* area, which makes them extremely tedious to complete. In this case, only the revenue growth area is investigated. Fig. 2 shows a representative set of business metrics for revenue growth in the retail industry. Note the hierarchical organization which allows lower level questions to be skipped if their parent question does not indicate any weakness. In this case, the metrics that appear to be weak are store forecasting accuracy, new customers, and new stores. For each weak metric, a BNAT report lists some solution areas that may be able to improve the metric (see Table 1). Another BNAT report lists some commercial vendors that provide solutions in the recommended solution areas (see Table 2). The vendors in this list are sorted decreasingly by the number of weak metrics that referenced each vendor. BNAT filters out commercial solutions that are not applicable to the customer's industry, subindustry, annual revenue, or hardware platform. Usually the commercial solutions in the final list overlap in functionality. On the other hand, a combination of the solutions is often possible. At present, BNAT does not attempt to resolve this ambiguity, nor does it evaluate the quality of the vendor solutions; these tasks are left for humans to sort out. This is a potential area for future research.

A third BNAT report lists some case studies in which other companies had similar weak metrics and were able to improve their performance by adopting a relevant solution or

service. Additional BNAT reports provide competitive benchmark information, which we obtained from the *Finlistics Value Manager*.

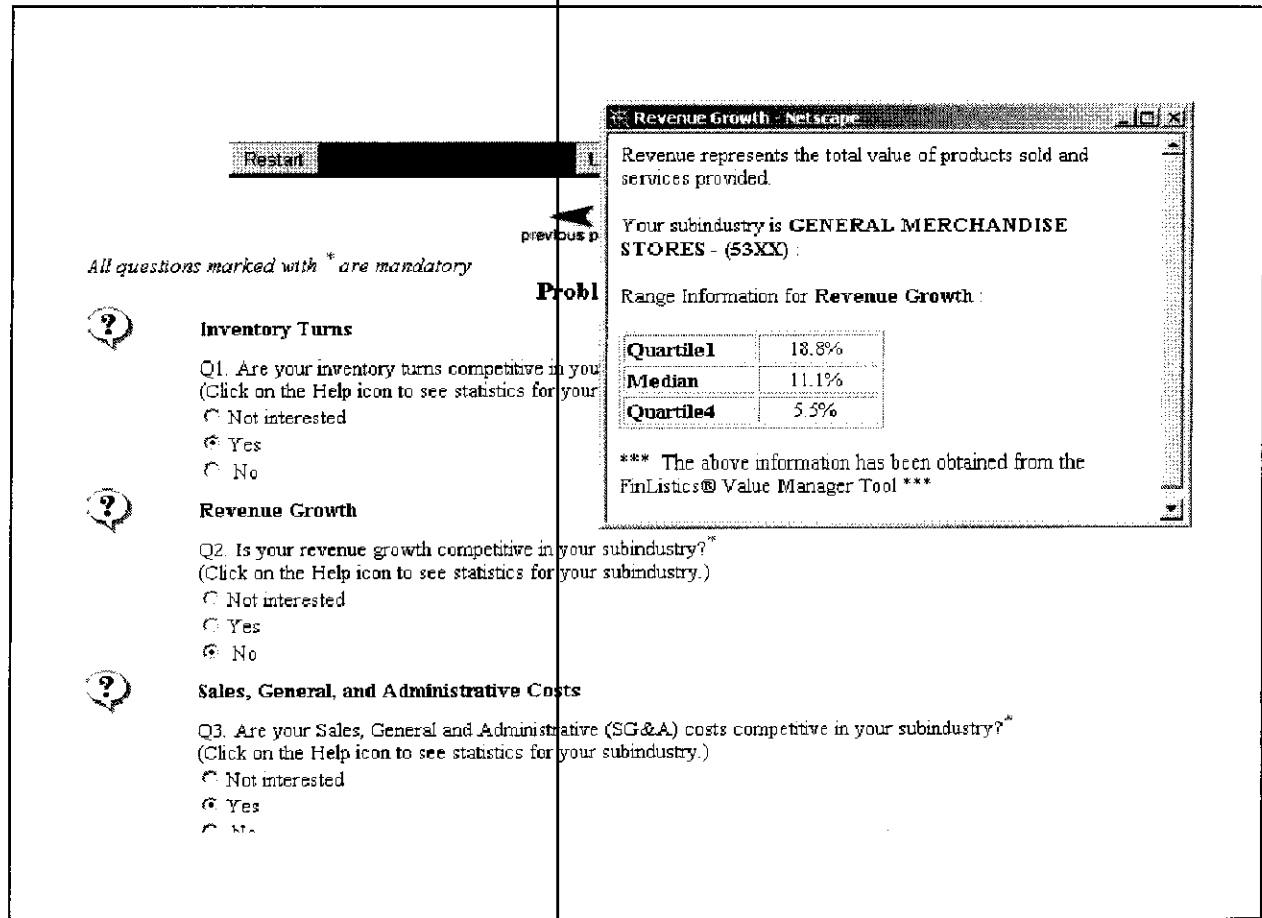


Figure 1. Some financial questions asked by the BNAT prototype.

## 5 Feedback From Initial Users

The BNAT prototype was tested in several ways. In the first test at a large solutions and services trade show hosted by IBM, BNAT was used as part of the show's Information Center to help business executives navigate the vendor exhibits. The BNAT questions helped the executives identify their business needs. BNAT mapped each customer's business needs to the solution areas on display at the trade show. A printout of the vendors providing relevant solutions was provided to each customer. Competitive benchmark information was provided for each user's subindustry. At the end, we asked each customer if this service had

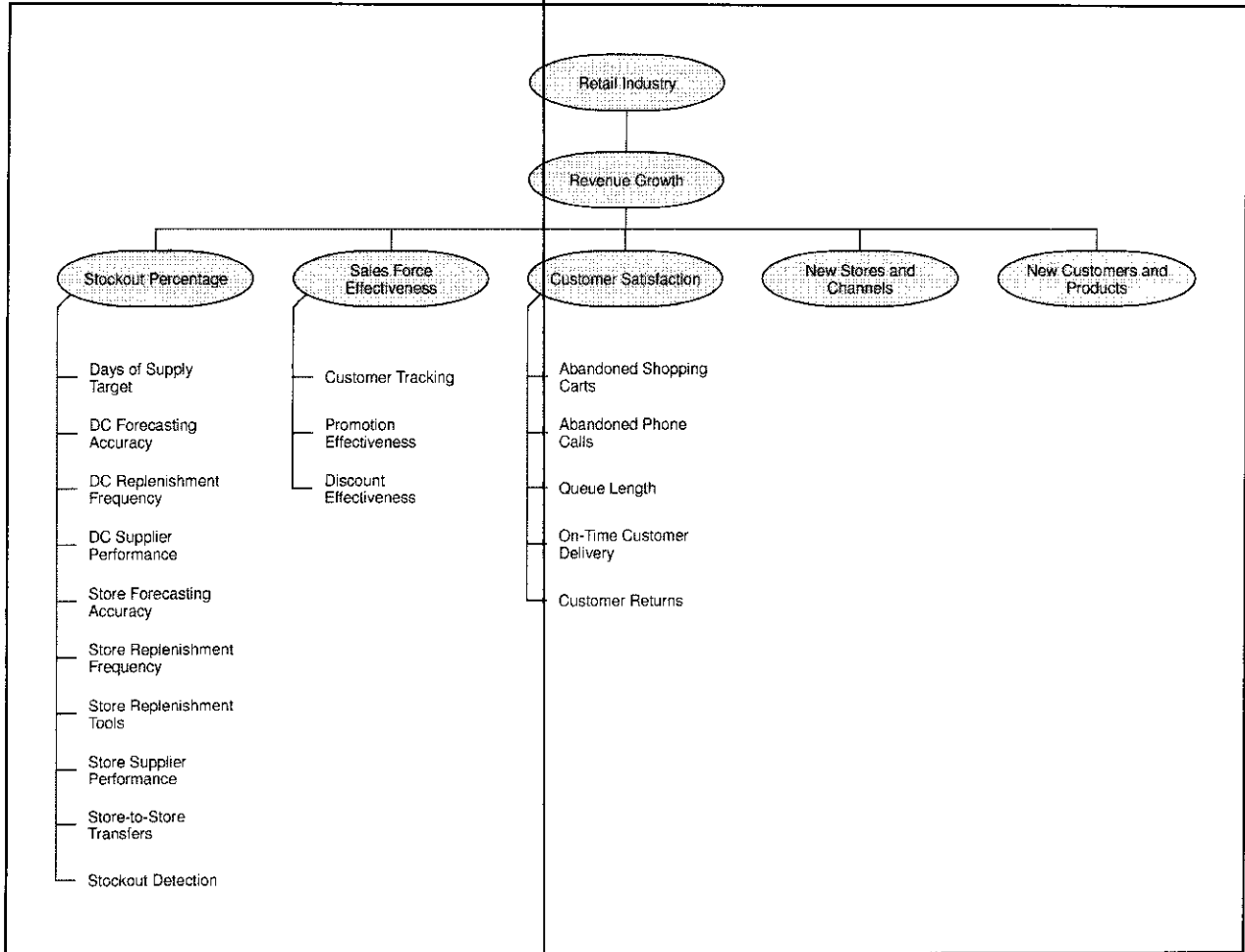
been useful. The feedback was overwhelmingly positive. The customers found most of the questions to be easy to answer, indicating that our approach was on target for business executives. They appreciated the mapping of business problems to solution areas. For many attendees we had demystified the maze of acronyms on display at the show, such as B2B, B2C, and CRM. And finally, they liked the competitive benchmark information.

The reaction was equally positive from the vendors at the trade show. One vendor said that BNAT was the focal point of the trade show and that it filled a void that had existed for three years.

We also met one-on-one with selected IBM customers to get their feedback on the value of the tool. Once again, the response was extremely positive. We also received valuable

feedback to improve the usability and content of the tool.

Having validated our concept, our next task is to deploy the tool on the web.



**Figure 2.** A representative set of hierarchical business metrics for revenue growth in the retail industry.

### Acknowledgments

This work would not have been possible without advice and assistance from many people in IBM. We would like to offer special acknowledgments to Desiree Briceno, Tom Burnett, Harriet Cao, Jean Ellis, Gino Gaensler, Prof. Guillermo Gallego (also of Columbia University), Vembu Harish, Shekhar Mishra, Mary Orr, Ed Park, and Kathy Steiger.

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Problem	Solution Area
New Stores	Network Optimization
New Customers	e-Marketplaces
New Customers	Internet
New Customers	Technology Assisted Selling
New Customers	Business Intelligence
New Customers	Content Management
New Customers	Customer Support
New Customers	Marketing Automation
New Customers	B2C
New Customers	Personalization
Store Forecasting Accuracy	Forecasting, Demand Planning, Inventory Management
Store Forecasting Accuracy	Business Intelligence
Store Forecasting Accuracy	B2C
Store Forecasting Accuracy	B2B
Store Forecasting Accuracy	Collaboration Tools
Store Forecasting Accuracy	Network Management Tools
Store Forecasting Accuracy	Development Tools

Table 1. Report of solution areas that may be able to improve weak metrics.

Vendor	Votes	Solution Area	Votes
Vendor 1	16	B2C	2
		Business Intelligence	2
		Customer Support	1
		e-Marketplaces	1
		Technology Assisted Selling	1
Vendor 2	15	B2C	2
		Business Intelligence	2
		e-Marketplaces	1
		Personalization	1
		Internet	1
Vendor 3	14	B2C	2
		Business Intelligence	2
		Internet	1
		Customer Support	1
		Marketing Automation	1
Vendor 4	14	B2C	2
		Business Intelligence	2
		Internet	1
		Customer Support	1
		Marketing Automation	1
Vendor 5	13	Business Intelligence	2
		Customer Support	1
		e-Marketplaces	1
		Internet	1
		Technology Assisted Selling	1
Vendor 6	13	B2C	2
		Business Intelligence	2
		Marketing Automation	1
		Internet	1
		Forecasting, Demand Planning, Inventory Management	1
Vendor 7	13	B2C	2
		Business Intelligence	2
		Customer Support	1
		Technology Assisted Selling	1
		Internet	1

Table 2. Report of commercial vendors who provide potential solutions for this set of business problems (actual vendor names not revealed). Each business problem casts one vote for each relevant solution area. Total votes for each vendor are tallied in column 2. Total votes for each solution area are tallied in column 4. To conserve space, only the top five solution areas per vendor are listed in column 3.