Silicon Valley
WORLD INTERNET CENTER

THINK TANK SESSION

ARTIFICIAL INTELLIGENCE (AI): IS IT REAL?
AI & SUPPLY CHAIN MANAGEMENT
Tuesday, November 13, 2001

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SUMMARY

On Tuesday, November 13, 2001, twenty-four invitation-only participants attended a Think Tank Session to investigate the possible ways artificial intelligence can be applied to assist in Supply Chain Management (SCM). The definition of artificial intelligence for the purpose of the Think Tank Session follows:

"Software that automates tasks that require human intelligence, specifically, for the area of Supply Chain Management."

Participants were given the opportunity to brainstorm and discuss the following questions:
- How can AI be used to automate or semi-automate SCM processes, like inter-company collaboration, for instance, to address questions regarding increasing responsiveness and information sharing?
- Speed may require that decisions be made locally rather than globally. How can AI help?
- In a cross-company situation, there are security and data sharing concerns. How can AI address these?
- How can AI be applied to automating the procurement process?

DO NOT SEND SOFTWARE TO DO A MAN'S JOB

Adam Cheyer of VerticalNet, a company that manages vertical supply chains, presented an overview of SCM environment to orient the discussion, cautioning that, although the technology may be available to apply AI to SCM, it will only be adopted as fast as human beings will accept it. The factor of human attitudes in advancing and hindering the use of technology was widely discussed throughout the day. The theme climaxed with the concurrence that people will not promote technology that puts them out of a job, and most importantly, technology cannot replace human cultural and social skills in bargaining, gifting, cajoling, trading favors and having personal knowledge of the customer or supplier. In many areas, the group concluded, AI cannot be pushed to replace humans, but it can, instead, be used to assist human networks in doing what, to date, only they do best.

STANDARDS, AGENTS AND THE SEMANTIC WEB

The group also held some debate on intelligent agent technology as tied in with standards and the emergence of the Semantic Web, a version of the Web that allows more natural exchange of information between human beings than is now possible. It was agreed that standards, which can be used as collaborative tools to merge and rationalize existing systems, will take longer to put in place than the Web is evolving to where it will need those standards. Participants agreed that a "de facto" standard will not be developed for what they referred to as "the big picture," but that lesser standards such as SOAP will emerge to reduce complexity and provide connecting technologies. Participants also agreed that some set of standards will be required to allow a small, manageable space against which to perform semantic mapping. Agents, which they said are defined by the problem needing to be solved, can help with deal making in that Semantic Web space. One question that needs further attention lies in how human agents talk to artificial agents.

Other challenges offered by the participants in discussion included:
- What happens when there is a serious disruption in the supply chain?
- How can business bridge the gap between researchers and business users?
- How can business handle massive data from diverse inputs?
- How can business develop metrics that will optimize for all parts of the value chain?
- How is data integrated and rationalized?
- How does software or AI accurately capture human considerations and preferences?
- How can business understand the complexity of the tools?
- What is the required depth of integration?

Participants were asked to identify ways in which AI is currently employed in SCM, as well as the opportunities for AI in the next 12 to 18 month market and the next 18 to 36 month market. The following are the results. Participants, as a group, then voted for the top three areas they considered the most viable to get to market.

OPPORTUNITIES: 12-18 MONTH MARKET

- Data (8 votes)
  - Data and process integration and management (e.g. EAI, BPM, Web services)
    Better tools for collaborative, iterative standards development to help move forward the data problem which underlies everything else
  - Enabling true integration through a) access to data and b) turning data into information
  - Content integration in SCM
- Human (5 votes)
  - Work with the humans who make the process work to define the process in a way that is usable by machines while rewarding the human sufficiently to compensate for their intellectual capital
  - Human-facing agents for reducing complexity (incremental improvement)
  - Opportunities exist to aid, manage and track the following "human" activities
    - Problem resolution, e.g. incorrect goods received
    - Exception situations, e.g. excessive returns
    - Decision making, e.g. selection of a candidate
- Measurement (4 votes)
  - AI will help create better quality demand forecasts based on historical trends. Neural nets are a possibility
  - Measuring and managing end-to-end supply chain operations for optimal customer value

OPPORTUNITIES: 18-36 MONTH MARKET

- Human-machine Interface (9 votes)
  - Human/computer interface
    - How to present information to users in an easy-to-use, "brain dead simple" way
  - Knowledge transfer from human agent to intelligent agent
  - Knowledge distribution from human agent to software agent in terms of knowledge schema
  - Human/computer interfaces for AI-based agents
  - Coexistence of agent- and human-experts
- Decision Support (13 votes)
  - Preference and business rules for a variety of complex SCM decisions; need to be easy and accurate
  - Strategic business decision support e.g. "What should we do?"
  - Usability for decision makers throughout the process
  - Distributed decision making
- Business Rules (6 votes)
  - Integrating manufacturing execution system with planning system for supply chain; re-plan after machine breakdowns or parts shortages
  - On demand side – propose timely optimized response to dangerously disruptive events
- Inventory Management (0 votes)
  - A large factor in today's economic downturn has been an excess of manufacturing inventory due to unreasonable long-term demand forecasts. Inventory is expensive (20% to 40% of unit value when annualized)
- Human (4 votes)
  - (5-10 years) Employing Semantic Web technologies to dramatically increase supplier to manufacturer efficiencies.
    - Revolutionary technology will come from Semantic Web and intelligent agents
  - Create systems supportive of existing human networks – e.g. automating the task of data gathering for traders
  - Alignment of economic outcomes
  - Create intelligent system to keep track of
    - Vendor offerings
    - Favors / discounts
    - Emulate relationships and favors – "give and take"
- Data (6 votes)
  - Real time SCM data

- Automatic information extraction, normalization and aggregation from disparate data sources (e.g. different databases, dynamically changing Web sites, free text information sources, etc.)
- Data access – answers all important characteristics of a winning opportunity –
  - It solves a true problem visible to the company's management team
  - Not a threat to players within the organization
  - Modest complexity

The group contributed their ideas of where else AI can be applied in three time frames, the next 12 to 18 months, the next 18 to 36 months and the next 3 years and beyond. The results are listed below.

OTHER IDEAS: 12-18 MONTH MARKET

- Accepting heterogeneous environments (applications, platforms, data formats, etc.)
  - Data extraction from known sources
  - Normalization etc. of known formats
  - Application of known rules to data
- SCM performance metrics
- Facilitate value chain optimization supplier/partner/customer
- Simplify access
  - Bridge the gap between human agents and artificial agents (representing back-end applications or mediating between apps)
- Information extraction from disparate sources to a common representation
- Automate strategic sourcing with agents to analyze spend and optimize supplier RFP (request for proposal) award decisions
- Human interface with intelligent agents / wizards will become more common, with knowledge models improving in the longer term
- Automatic ontology mapping
  - Agent scans databases and Web pages and makes best guess of matching data schemas
- Collaborative, iterative standards and data modeling tools
- Advanced data aggregation / analysis tools
- Integration technologies
  - Data collection
  - Data understanding / translation
  - Data synchronization / normalization / reconciliation
  - Data to information transformation
- Increased cross-functional decision support
- Data agents and patterns
- Standards for inter-agent communication
- Agents
  - Level playing field
  - Lower barriers to entry
  - BP = IP (business process becomes intellectual property)
- Tools to make data capture painless and accurate
- Data integration agent
- N-tier integration and tools
- Intelligent personal agents e.g. "commute advisor"

OTHER IDEAS: 18-36 MONTH MARKET

- Distributed decision support agents
- Modules for 80% of the scenarios available by industry
- Auto-configuration agents for building sourcing relationships
- Time compression
- Hedge becomes normal way of conducting business
- Profiles
- "Evolvable" software integration providing version control and data normalization for EAI that's robust over time
- Automatically create knowledge management system from existing operational data
- Connect production control software to ERP (enterprise resource planning), SCM and CRM (customer relationship management) systems
- Opportunity cost calculator – "If you had done "B" instead of "A" your company would now be worth 10X"

- Packaged data modules of successful companies experience i.e.; Bill Gates simulation model
    - What we did and why
    - Integrated with software – not text
- Integration technologies
- Adaptability – learn from data and user interaction to speed up decision making
- Managing heterogeneous environments (applications, platforms, data formats…)
    - Adaptive technologies to handle unknown sources, unknown formats, etc.
    - Pattern recognition
- Realtime adaptive strategic planning for collaborative commerce
- Instrumenting low level business software and processes with data gatherers (automatic) or sensors to feed data/statistics into a repository (that can be used later for inference)
- Content management and agents supporting SCM
- Elevate Business Process Integration and Management (BPM) across ERP systems to new, easy-to-use level via agents with a Web services architecture
    - Helps tame business complexity
- Agent-based decision support systems
- "Always on" context aware information assistant agents
- Agent-Semantic Web integration
- Knowledge management tools
    - Allow knowledge workers to track their are learning
    - Compare to actual performance to confirm actual learning
- Multi-enterprise transaction processing
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OTHER IDEAS: 36+ MONTH MARKET

Adaptive supply chain

- Mobile connectivity to decision support
- Central control agent architecture for automatically optimizing operational decisions across the entire supply chain
- Intelligent user interaction support agents
- Dynamic sourcing for optimal supply/demand matching
- Automatic tool that allows an executive to play "what-if" games with comp plans to determine impact and interactions
- Voice, video and electronic data agents
- Crisis / exception re-planning
- Semantic / context / systemic knowledge capable agents for decision support
- Location / transparency
- Decision analysis software that provides the information that humans need in a flexible enough way to be useful
- Demand-driven manufacturing
- Supply chain software that automatically detects and notifies of changes, disruptions to the chain, and recommends alternate actions based on optimality criteria
- Optimization
    - Decrease role or sophistication of human agents
    - Optimize across systems and processes

FOR FURTHER INFORMATION

The full proceedings from this Think Tank Session will be available within 3-4 weeks. The proceedings will be posted on the Center's Web site. For further information please contact:

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