

DISS 890 Project Report:
A Strategic Plan for the Implementation of Electronic Commerce
at American Axle and Manufacturing

by

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A paper submitted in partial fulfillment of the requirements
for DISS 890

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Business-to-business electronic commerce is projected to grow at an annual rate of forty-one percent during the next five years. The automotive industry, recognizing this fact, is making significant progress in the deployment of electronic commerce technologies. Unlike its Big 3 customers, American Axle and Manufacturing (AAM), a tier one supplier of automotive driveline systems, is taking a "wait and see" approach to electronic commerce. In response to AAM's lack of an electronic commerce strategy, this project report was submitted. The goal of the project was to provide an executive summary that outlined the most effective business-to-business electronic commerce strategy for AAM to deploy over the next eighteen months. In the following pages, this project report included five chapters. The first chapter covered topics: problem statement and goal, relevance, barriers and issues, plan and approach, and milestones and expectations. The second chapter provided a detailed review of the literature relevant to future business-to-business electronic commerce initiatives at AAM. Technologies discussed were extranets and the ANX, business-to-business portals, supply chain integration, and e-commerce enabled procurement systems. The third chapter described the research methods and online tools and resources that were employed during the completion of the project report. The fourth chapter included an analysis of the literature and a discussion of the project's findings. The fifth chapter provided an executive summary that outlined a strategic plan for the implementation of electronic commerce at AAM. In conclusion, a recommendation for a future project in electronic commerce initiatives was given.

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Chapter I Introduction

This project report is submitted to fulfill the requirements for DISS 890. The following introductory sections describe the problem to be investigated, goal to be achieved, and barriers and issues encountered during the completion of the project paper. The introduction also provides the plan and approach of the project along with a timeline of milestones.

Problem Statement and Goal

Electronic commerce (e-commerce) is the process of using digital technology as the medium for transmitting information between organizations (Editor, 1999). For most companies, it refers to the processes of buying and selling goods and services and the associated methods of electronic payment for those transactions. E-commerce is generally divided into two types: business-to-consumer and business-to-business. Although the business-to-consumer market has received the most publicity, the business-to-business market has a larger dollar volume and is growing faster.

The automotive industry, recognizing this fact, is making significant progress in the area of business-to-business e-commerce. Examples include the Automotive Industry Action Group's (AIAG) Automotive Network Exchange (ANX) and Manufacturing Assembly Pilot (MAP) (AIAG, 1999). Other examples are General Motors', Ford's, and DaimlerChrysler's use of trading partner Web sites. Using secured access over the Internet, these sites provide automotive suppliers with business information that ranges from production schedules to quality statistics.

American Axle and Manufacturing (AAM), a tier one supplier of automotive driveline systems, is an integral link in the automotive supply chain (AAM, 1999). AAM is headquartered in Detroit, Michigan and has five North American manufacturing facilities. The company's near-term plans include expansion in Europe, Asia, and South America. AAM employs more than 8,500 associates.

AAM's information technology (IT) infrastructure consists of more than 2,100 desktops (i.e. Windows NT workstations running MS Office and MS Exchange). In spite of its "e-commerce ready" infrastructure, the company's IT Plan is very traditional and calls for only limited e-commerce initiatives. AAM is taking a "wait and see" approach to e-commerce. This approach runs contrary to the fact that business-to-business

e-commerce is projected to grow at an annual rate of 41 percent during the next five years according to the Yankee Group (Editor, 1999). AAM must begin implementing e-commerce technologies now or find itself at a disadvantage as the rest of the automotive supply chain embraces business-to-business e-commerce.

This project report is written in response to AAM's lack of an e-commerce strategy and a clearly defined implementation plan. The company has failed to identify e-commerce as a high-priority business initiative and this oversight will place it at a competitive disadvantage in the future. Furthermore, the goal of this report is to provide a brief executive summary. This summary describes the benefits of expanding e-commerce at AAM. It also outlines the most effective business-to-business e-commerce strategy for AAM to deploy over the next eighteen months. Implementation of this strategy will allow AAM to leverage "best of breed" e-commerce technologies to gain a competitive edge as a tier one automotive supplier.

Relevance

This project report is relevant to the study of e-commerce and the future of AAM. This is because its successful completion was dependent upon the exploration and understanding of select areas of business-to-business e-commerce that would benefit the company. Those areas included:

- Extranets and the ANX
- Business-to-business Portals
- Supply Chain Integration
- E-commerce Enabled Procurement Systems

These specific topics were chosen because they represented the most promising business-to-business e-commerce technologies in use today. In addition, they appeared mature enough to be deployed successfully within the given period at AAM.

Barriers and Issues

The primary barrier to the successful completion of this project was the vast quantity of research material related to business-to-business e-commerce. This material needed to be gathered, compiled, filtered, and evaluated to determine its appropriateness to the project.

Successful project completion was also complicated by the many changes that occurred in the area of business-to-business e-commerce applications during the course of the study. The long-term success of numerous emerging e-commerce technologies had to be judged. Those deemed viable and ready for deployment were then integrated into an effective

business-to-business e-commerce strategy for AAM to deploy over the next eighteen months.

Plan and Approach

The project report is a descriptive study formatted in five chapters. The first chapter covers the project's problem statement and goal, relevance, barriers and issues, plan and approach, and milestones and expectations. The second chapter provides a detailed review of the literature relevant to future business-to-business electronic commerce initiatives at AAM. The third chapter describes the research methods and online tools and resources that will be employed in completing the project report.

The fourth chapter of the project report analyzes the available business-to-business e-commerce technologies with regard to their application at AAM. This analysis is then consolidated in chapter five into an executive summary that outlines a strategic plan for the implementation of business-to-business e-commerce technology at AAM. Included is a brief description of the e-commerce technologies to be deployed along with a timetable for their completion. Also included is a discussion of the integration required for these technologies to function with AAM's current applications.

Excluded from the executive summary are details of the eighteen-month implementation effort (e.g. cost justification, resource allocation, and detailed project planning). The scope of the summary was limited for two reasons. The first was the limited time available to produce the project report, and the second was the amount of detail considered appropriate for AAM executive review.

Milestones

The scope of the project report was manageable and lent itself to investigation within the given time period. The following is a summary of the milestones for the project along with significant dates. The first milestone, writing and submitting the idea paper, was completed on April 5, 1999. This paper was approved with comments by Dr. Abate on April 14, 1999.

The next milestone was the approval of the project proposal. The proposal was an expanded version of the idea paper and consisted of the first three of the five chapters that comprise the project report. The introduction, chapter one, was completed on May 2, 1999. This was followed by completion of the review of literature, chapter two, on May 29, 1999. Methodology, chapter three, was completed on May 30, 1999, and the project proposal was submitted for review by Dr. Abate on May 31, 1999.

Approval for the project proposal was given on June 27, 1999, and chapter four was completed shortly thereafter on July 18, 1999. Chapter five was completed on July 24, 1999, and after extensive review and proofreading, the project report was submitted on July 25, 1999.

Summary

In summary, the sections provided above introduced the problem to be investigated, the goal to be achieved, and the potential barriers and issues encountered during the completion of the project paper. Also included were the plan and approach for the project along with a timeline of milestones and expectations. In the next chapter, this report provides a thorough review of literature relevant to future business-to-business electronic commerce initiatives at AAM.

Chapter II

Review of the Literature

The literature review that follows is organized by subject heading. The subjects included are extranets and the ANX, business-to-business portals, supply chain integration, and e-commerce enabled procurement systems. A review of the literature pertinent to these subjects was critical to achieving the project's goal of providing a brief executive summary. In addition, this literature review focuses on e-commerce technologies that are viable and capable of being successfully deployed in an eighteen-month period.

Extranets and the ANX

Companies are deploying extranets as a strategic tool to communicate with their customers and suppliers. According to an online survey conducted by InformationWeek Research, one in four businesses have created an extranet (Chabrows, 1998). These extranets give customers and suppliers access to internal company systems and applications over the Internet.

The automotive industry, realizing the value of extranets, launched the ANX in 1995 (Scott, 1998). The ANX provides automotive trading partners with a single, secure network for e-commerce. It will eventually replace the redundant and costly multiple connections that currently exist throughout the automotive supply chain. The automotive industry expects the ANX to cut its costs by \$1 billion a year and to ultimately involve as many as 40,000 companies that have a stake in manufacturing, financing, and insuring cars and trucks.

Extranets.

In a related text, Baker contributed to the project by outlining how extranets fit into a company's overall business strategy (Baker, 1997). Also included were chapters detailing how to plan, implement, and operate a corporate extranet. According to Baker, extranets are intranet-based applications and services that employ secured access to external users or enterprises. This is accomplished through passwords, user IDs, and other application-level security mechanisms. Therefore, an extranet is the extension of two or more intranets with a secure interaction between them. The extranet maintains control of access to those intranets within each enterprise in the deployment.

Baker goes further to say that the heart of an extranet is not technical definitions but the services it provides. There are two basic services offered by an extranet. Network services that provide the fabric to keep everything running, and user services that provide the resources people use to share information. Typical network services are directories, replication, security, and management.

In another related text, Bayles contributed to the project with an analysis of the benefits versus the costs of an extranet (Bayles, 1998). Among the tangible and intangible benefits explored in the text were those related to infrastructure, sales and marketing, and customer service and support.

Costs savings included reduction in cost of supply and cost of sales; meeting, travel, and telephone time reduction; and printed communication costs. Hard costs that were accounted for included tangible goods such as hardware, wiring, software, and telecommunication lines. Also discussed were soft extranet implementation costs such as labor, training, and loss of sales opportunities.

Kosiur in his text, *Building and Managing Virtual Private Networks*, contributed to the project with a detailed explanation of the technology of today's extranets (Kosiur, 1998). Chapters included discussions of the basic components of a virtual private network (VPN) (e.g. security, firewall, and routers). Also covered were topics that included security and network performance management. Appendix B of the text included a listing of commercial VPN products and providers.

Another related work by Covill contributed to the project by discussing the administration of extranets (Covill, 1998). Topics included in the text were help desk support, accounting for and sharing extranet costs, and policies and procedures. Also covered were the cost savings realized by corporations that have implemented the technology. Practical advice is given on how extranets can and cannot be used.

Booker, in a recent article, contributed to the project with a discussion of the Cleaver-Brooks extranet (Booker, 1999). Cleaver-Brooks, the leading maker of commercial and industrial boilers, opened its OrderNet extranet site last September. The site automates and streamlines the interaction of the company with its 1,500 independent sales and service representatives.

ANX.

Articles and white papers provided on the Automotive Industry Action Group's (AIAG) ANX Internet Site contributed to this project by detailing the past, present, and future direction of the automobile association's ANX extranet (AIAG, 1999). The AIAG is a nonprofit trade association of North American automobile manufacturers and suppliers. The association's members include the Big Three along with over 1200 automotive supplier companies. The mission of the AIAG is to improve the global productivity of the North American automotive industry.

AIAG member committees focus on business processes and supporting technologies. These committees research, develop, and provide training on standard business practices in a variety of areas. These include automatic identification, CAD/CAM, EDI/electronic commerce, continuous quality improvement, materials management, returnable

containers and packaging systems, and transportation/customs. Key AIAG projects are Auto-STEP, MAP, Quality/QS-9000, Autochain Online, Year 2000, and the ANX.

In 1994, the AIAG published the document "Trading Partner Data Telecommunications Protocol Position" (AIAG, 1999). This document recommended that TCP/IP become the standard for transport of automotive trading partner electronic information. The ANX project was launched shortly thereafter in December 1995. The project was the result of the AIAG's decision (in the second quarter of 1995) to adopt the document's recommendations. The TCP/IP endorsement was in recognition of market trends (i.e. the explosive growth of the Internet) along with the rising use of Internet technologies for applications running within AIAG member companies. The initial goal of the ANX project was to develop a plan to implement data communication links between trading partners and to deliver a functioning extranet as the end result.

The ANX is an IP-based virtual private network for managing the automotive industry supply-chain. General Motors, Ford, Chrysler, and their suppliers and dealers support it. Initially, three implementation options were considered for the ANX. These included the public Internet, private network expansion, and virtual private network services. A fourth option - the ANX model - was finally adopted. The ANX model consists of:

- Multiple service providers certified by an ANX Overseer company
- All certified providers required to interconnect with each other
- Pricing to be comparable to existing VPN services

The goal of the ANX project is to save \$1 billion annually or \$70 per car. This will be accomplished by optimizing information flow within the supply-chain by reducing information lead-time. Direct savings will be derived from the following:

- Consolidation of multiple communication links
- Elimination of transaction-based charges
- Elimination of carrier management cost of multiple links
- Reduced maintenance costs and staff expenses
- Reduced hardware and software costs

Indirect savings include the ability to:

- Carry out business strategy more effectively
- Service new customers more quickly

- Support strategic partnerships more readily.

In short, the ANX will replace the intertwined web of connections that currently connect automotive suppliers and manufacturers with a single, secure IP-based network.

In another related article, Kirchoff contributed to the project with a detailed account of Ford Motor Company's plans to migrate applications to the ANX by September 1999 (Kirchoff, 1999). Theisen also provides insight into Ford's migration plans with a look at the company's vision of two TCP/IP networks: the ANX, and the public Internet (Theisen, 1999).

Ford's current supplier networks are divided into two types: TCP/IP and SNA. The company's communication goal is to be 100 percent TCP/IP by January 2000. In the future, Ford's vision includes TCP/IP communications over two networks - the ANX and the public Internet. The ANX will be used for applications that fall into one of five categories: business-critical, high-availability, time-critical, confidential, and real-time. The public Internet will be used for applications that are non-critical and have a low requirement for end-to-end accountability.

Jackson in a presentation to the AIAG contributed to the project by outlining DaimlerChrysler's ANX plans (Jackson 1998). DaimlerChrysler's ANX connection will enable simultaneous engineering using multiple workstations or graphics terminals to run finite element analysis software, solid modeling CAD packages, and high-speed prototyping. The network will provide the guaranteed bandwidth, not just for CAD/CAM but also for applications such as advanced videoconferencing and three dimensional virtual reality design sessions. Connection to the ANX will cut DaimlerChrysler's cost of doing business and aid in reducing the current five-year product design cycle down to less than three years.

Business-to-business Portals

While business-to-consumer Internet portal sites such as Yahoo, Netscape, Lycos, and Excite battle for consumer traffic, a growing number of businesses are adapting the portal model as an efficient way for employees, suppliers, and customers to locate critical information online (Walker 1999). An important benefit of a portal system is the organized access it gives users to a variety of information. By combining powerful search technology, recognizable topic hierarchies, and personalized desktops, companies are able to use portals to transform their disorganized intranets into easily understood self-service environments.

Wilder, in a related article, contributed to the project with a description of how Emery Worldwide (an automotive logistics supplier) is building an enterprise portal using ReportMart software from Scribe Technologies (Wilder, February 15, 1999). Once

complete, the portal will give Emery's several thousand employees organized access to logistical data, financial reports, customer data, and internal information.

Wilder also contributed to the project with another article titled *Data Gateway*. In the article, Wilder described the W.W. Grainger Corporation's portal project. Grainger is a multibillion-dollar distributor of industrial and office supplies (Wilder, February 8, 1999). The Grainger portal will catalog the company's intranet content. The portal will also search and categorize relevant information from the Internet on the company's market and competitive positions. Search crawlers will be able to retrieve the financial statements of competitors and notify the person responsible to analyze the information.

Another indication of the growth of business-to-business portals is Harbinger's (an automotive e-commerce supplier) launch of an Internet portal (Kanell, 1999). Kanell contributed to the project with an article describing Harbinger's business-to-business e-commerce efforts. The Harbinger portal provides information about electronic commerce, offers service help to customers, and lets companies do business with each other over the Internet. The site also creates records of transactions as it handles orders between two companies.

A recent article by Rogers in the *Computer Reseller News* contributed to the project by outlining Netscape's plan to move aggressively into the area of business-to-business portals (Rogers, 1998). Netscape's Custom Netcenter is divided into three categories: vertical, intranet, and extranet portals. Vertical portals target an audience such as a telephone service provider offering another avenue of communication to its customers. Intranet portals offer corporate information to employees. Extranet portals are an entry point companies would use to communicate with suppliers and business partners.

Pearson contributed to the project with an article that detailed Open Text Corporation's strategy to move customer intranets beyond publishing, knowledge management, and workgroup collaboration (Pearson, 1999). The company's corporate portal product provides a unified user interface to information both inside and outside the corporation.

Supply Chain Integration

Last year, the AIAG completed the Manufacturing Assembly Pilot (MAP) project (Hoy, 1998). The object of MAP was to improve the quality and speed of information flowing down the supply chain. The project demonstrated that (in an "agile" supply chain) information must be able to flow from the OEM to the last supplier in the chain without being truncated or distorted at any tier along the way. In the study, EDI was the primary method employed, and e-mail was used for ancillary communications.

An article by the business writers of *Business Wire* contributed to the project by reporting the details of the new AutoChain Online supply chain management solution offered by Harbinger Corporation (Business Editors, 1998). AutoChain Online measures supplier conformance with the EDI implementation requirements set by the big three automakers:

Ford, DaimlerChrysler, and General Motors. The system, developed under the auspices of the AIAG, provides a central location for tier one, two, and three suppliers to track, manage, and report on their ANSI X12 and EDIFACT messaging capabilities.

DaimlerChrysler.

One example of the automotive industry's commitment to an integrated supply chain is DaimlerChrysler's linking of its private Supply Partners Information Network (SPIN) to the Internet (IBM, 1998). This connection allows buyers and engineers to share design and other data with important suppliers. SPIN is an intranet-based supply chain management and support environment for distributing files over the Internet. In its first year of operation, SPIN increased productivity of DaimlerChrysler's extended network of suppliers by 20 percent. The network allows DaimlerChrysler to distribute applications and communications packages about policy, procurement, and inventory methods over the Internet.

Over 3,500 supplier locations are registered to access the SPIN Web site. In addition, more than 12,000 users have IDs with which they can access a variety of information (e.g. PDF files of DaimlerChrysler's EDI Guide, and QS9000 certification policies and procedures). Suppliers are also able to access dynamic database applications, such as real-time materials requirements data and procurement analyses.

Ford.

In her text, Bayles contributed another example outlining Ford's plan to connect 15,000 dealers worldwide using its FocalPt network (Bayles, 1998). Ford's goal is to provide fully integrated automobile life-cycle support. The FocalPt network supports the sale and service of cars. It includes promotional, inventory, and financial information designed to help Ford salespeople close deals. In addition, FocalPt will automate the information exchange between Ford and its dealer service centers.

Oracle Automotive.

Oracle ERP2 is the enterprise resource planning application in use by many automotive suppliers, including AAM. An Oracle product summary of Oracle Automotive Release 11 contributed to the project with its detailed description of the manufacturing and supply chain processes inherent in the product (Oracle, 1999). Product capabilities included customer life cycle management, strategic procurement capabilities, and end-to-end supply chain synchronization. Built-in to the product are other features such as support for just-in-time and flow manufacturing.

E-commerce Enabled Procurement Systems

A recent white paper titled *Content Management* discussed the cumbersome non-production procurement processes currently in use by Fortune 500 companies (TPN Register, 1998). This paper contributed to the project by giving a comprehensive review of e-commerce enabled procurement systems. Non-production supplies (also known as indirect supplies or maintenance, repair, and operations (MRO) products) encompass

everything from office staplers to pipe fittings. They are materials that a company routinely uses but do not go into its manufactured products.

The current procurement processes for these supplies are characterized by tremendous amounts of paperwork, lengthy cycle times, frequent errors, and costly "maverick" buying outside the bounds of established procurement rules and contracts (TPN Register, 1998). Consequently, companies are looking to e-commerce enabled procurement (i.e. Internet-based systems) as a means to save time and money in the indirect buying process. Purchasing departments wish to streamline the process by allowing employees to easily search, find, and order contracted items from approved suppliers.

In a related article the Wall Street Journal, Warner contributed to the project by discussing how the automotive industry, in an effort to cut millions of dollars from the cost of purchasing activities, is beginning to implement procurement solutions that use open standards-based supplier managed catalogs (Warner, 1998). Ford is implementing this type of Internet-based procurement system. At the heart of these systems are multi-vendor catalogs that allow buyers to quickly find the items they need. The catalogs reduce cycle time and eliminate order-processing errors. They also result in cost and productivity savings for both buyers and suppliers.

Three different types of Internet-based electronic catalogs are available for MRO purchases. These include sell-side catalogs, buy-side catalogs, and secure electronic marketplace services. The *Content Management* white paper gave a detailed description of each of the three types (TPN Register, 1998). Sell-side catalogs are offered by a small number of MRO suppliers on their Internet sites. These suppliers typically manage the catalog content by themselves. While this is an improvement on current procurement practices, TPN Register points out that buyers with hundreds or even thousands of suppliers do not have the time to go to every supplier's Web site. In addition, purchases from sell-side Web catalogs are difficult to track.

The second electronic catalog type is the buy-side catalog. The white paper pointed out that these catalogs are built by buying organizations wishing to improve control of their non-production spending (TPN Register, 1998). Buy-side catalogs contain data on all the products approved by the company through negotiated contracts. These catalogs are served on a company's internal infrastructure (e.g. an intranet) and are accessed by employees using standard intranet browsers.

The third type of catalog is the secure electronic marketplace service. This extranet-hosted content and contract management service is shared by multiple large buying organizations and their trading partners. This service model allows buyers to outsource to a third-party organization that specializes in content and contract management. In fact, electronic marketplace service vendors handle the entire supplier engagement and acquisition process and host all supplier catalog content for the buyer and the seller.

In a related Gartner Group research note on the growth of electronic catalogs, Spieler contributed to the project by providing a list of catalog functionality questions that enterprises should consider when shopping for catalog products (Spieler, 1999). Spieler also provided a list of catalog vendors and offerings. The two deemed most appropriate to the goal of this project were the TPN Register and Intelisys products.

TPN Register.

Avery, in an article in *Purchasing Online*, contributed to the project by describing the Internet-based multi-vendor catalog offered by TPN Register (Avery, 1998). TPN Register is a joint venture of Thomas Publishing Company and GE Information Services. The company recently released its Content Management Services Suite. This secure electronic marketplace enables corporate buyers and their suppliers to easily create and maintain "virtual private" catalogs. These catalogs are hosted by TPN Register and accessed over the Internet via a buyer's corporate intranet.

By using an intensive front-end content management process, TPN Register is able to deliver accurate product and pricing information. This allows buyers to quickly find required items. In addition, it reduces the cycle time and eliminates many order-processing errors. This translates into cost and productivity savings for both buyers and sellers. The TPN Register process adds value to supplier content by standardizing attributes, converting abbreviations into understandable terms, and organizing products into logical groupings.

Line items in the catalog are classified using the Thomas Register Classification System that contains more than 60,000 product headings. Suppliers are able to review their content online, incorporate the contract pricing and terms specific to the buyer, and give approval to the content. Once the data is loaded and approved, suppliers distribute detailed line-item product information to multiple buying communities.

The current release of TPN Register's product suite demonstrates the power and flexibility of using Java on the server in an intranet/extranet environment for critical enterprise applications. TPN Register's Java architecture has better scalability and performance when compared to current two-tier and three-tier client/server architectures.

Bylinsky also contributed to the project with an article that detailed the relationship between General Electric Information Services, TPN Register, and DaimlerChrysler (Bylinsky, 1997). The three companies are currently in the deployment phase of TPN Register's electronic marketplace service.

In another article related to the project, a product agreement between Oracle and TPN Register was discussed (Glass, 1998). This Oracle and TPN Register procurement solution combines Oracle Purchasing and Oracle Web Requisitions with TPN Register's electronic marketplace solutions. The companies estimated that implementing an Oracle and TPN Register solution would generate 10-20 percent savings. General Electric is

deploying the solution in several of its businesses to achieve significant cost and productivity savings.

Oracle is also expanding its e-commerce offerings with the acquisition of E-Travel according to a recent article (McGuirk, 1999). Oracle's new eTravel system will allow end users to plan and book corporate travel using a standard browser. The product allows significant cost savings by cutting travel brokerage fees. Benefits to companies also include increased use of preferred suppliers and increased compliance with corporate travel policies. Another benefit is the integration of travel planning into ERP systems to provide comprehensive business intelligence that includes data on corporate travel and entertainment. These costs are typically the third or fourth largest cost for most corporations. Cost reductions of this type are directly related to goal of this project report.

Intelisys.

Warner, in an article in the Wall Street Journal, contributed to the project with a detailed report on Ford Motor Company's effort to cut billions of dollars from its MRO expenses (Warner, 1998). Ford spends an estimated \$15.5 billion each year on non-production goods and services, making it, by company estimates, one of the biggest purchasers of such goods worldwide. Ford employees by the end of this year will use an Internet-based ordering system running on software designed by Intelisys.

Using the Intelisys electronic marketplace system, employees will no longer need to receive catalogs, fill out purchase orders, and have them cleared by their bosses over days or weeks. They will simply log on to an Internet system and browse manufacturers' catalogs, order from a pre-approved group of suppliers, and download the request in a matter of minutes. Ford expects to save nearly 30 percent (\$5 billion) in processing and transaction costs using the system.

Intelisys will provide Ford with a customized enterprise-wide workflow process that integrates order approval, merchandise receipt, and vendor payments to reduce both cycle times and processing costs. As part of the Ford project, Intelisys is teamed with the Chase Manhattan Bank. Like Ford, a number of multinational companies have turned to Chase for help in transforming their global purchasing-to-payables operations. Chase is managing Ford's payable transactions as an outsourcing service.

During the next two years, Ford and Intelisys will use business-to-business e-commerce to construct a worldwide trading network that will change the way it does business with its 5,000 suppliers. This, in turn, will change how those suppliers do business with their customers.

Information located on the Intelisys Internet site also contributed to the project (Intelisys, 1999). The site described in detail the Intelisys Electronic Commerce (IEC) solution. This product suite consists of multiple elements. The core is the Intranet purchasing system, IEC-Enterprise, which provides the ability to make purchases over the Internet. The remaining elements are directed toward the needs of suppliers. IEC-Link facilitates the

automatic transfer of an order from the IEC-Enterprise purchasing system into and out of the supplier's order processing system. Another element, IEC-SupplyNet, allows suppliers to house catalog information on the Internet. It also facilitates the exchange of purchasing messages between buyers and suppliers (e.g. fax, e-mail) using Open Buying on the Internet (OBI) standards. The number of employees able to access IEC-Enterprise is only limited by the hardware on which a company chooses to run their intranet server.

In another recent article, Girishankar contributed to the project with a description of the Chemdex Corporation Internet site (Girishankar, 1999). The Chemdex site was recently rated as the best business-to-business e-commerce site on the Internet. The site uses Oracle database and server, Tibco messaging, and OBI interfaces to handle 2,000 transactions per day. The Chemdex site is currently the trading hub for 160 suppliers and thousands of enterprise buyers of scientific research materials.

Summary

The literature review given above was organized by subject heading. The subjects covered were: extranets and the Automotive Network Exchange, business-to-business portals, supply chain integration, and e-commerce enabled procurement systems. The following chapter describes the research methods and online tools and resources that were employed during the completion of this project report.

Chapter III Methodology

Research Type

This project paper is a research based descriptive study. The key outcome of the investigation is a strategic plan for the implementation of electronic commerce at American Axle and Manufacturing. In addition, the results of this study are formatted into an executive summary outlining the most effective business-to-business e-commerce strategy for AAM.

Research Methods Employed

The primary research methods employed during the course of this project were browser-based Internet searches. The literature reviewed included textbooks, white papers, Web site reviews, trade journals, and magazine articles referenced by a select set of online resources. Relevant texts were located, ordered, and delivered using the Amazon.com Internet site. Full text articles from trade journals, magazines, and white papers were also located and downloaded from a collection of online electronic commerce resources.

Online Tools and Resources

A variety of online e-commerce resources were used to locate and download literature relevant to the goal of the project. These resources included ACM Search (www.acm.org/dl/Search.html), E-Commerce Times (www.ecommercetimes.com) Electric Library (www.elibrary.com), Forrester Research (www.forrester.com), Gartner Group (www.gartner.com), and ProQuest Direct (proquest.umi.com). Perhaps the most powerful search tool to be employed during the course of the project was the intelligent search agent, Copernic 99.

Copernic 99 is a well-documented freeware search agent. It uses predefined channel sets, which allow researchers to target inquiries to all major Web search engines, search for relevant text in newsgroups, and access popular e-mail directories to find people (Copernic, 1999). Copernic conducts fast, multithreaded, full Boolean searches with progress displays and customizable search depth. Once results are compiled, Copernic displays returns (including name, location, and introductory text) in a right-click-enhanced list box sorted by relevance.

Chapter IV Results

Analysis of the Literature

An analysis of the literature reviewed during the completion of this project report is provided in the following sections. These sections include extranets and the ANX, business-to-business portals, supply chain integration, and e-commerce enabled procurement systems.

Extranets and the ANX.

The goal of the ANX is to bring the benefits of the electronic commerce revolution to the automotive industry (AIAG, 1999). The ANX service delivers the reliability, performance, and security required of a business quality network while supporting all automotive applications. ANX service will shortly become the universal method for automotive trading partners to access each other's business applications.

The ANX also provides the opportunity to solve data communications problems once instead of one trading partner and application at a time. New applications will be deployed faster, redundant connections will be eliminated, and communications costs will be reduced. The ANX's mission is to create an environment that maximizes the ability of each trading partner to compete efficiently. In addition, extranets such as the ANX are slowly extending themselves to other industries. In the future, they will grow to provide ubiquitous data networking. Networking that is more secure and better protected than most private networks.

AAM has completed phase one, two, and half of phase three of its ANX implementation plans (AAM, 1999). Phases one and two were completed in 90 days. Phase three has a planned completion date of the last quarter of 1999. AAM is currently investigating the use of the ANX for EDI data communications to GM and to connect to its outside suppliers. AAM's ability to rapidly implement the ANX is evidence of the AIAG's success in putting together an effective organizational structure and in producing a viable production network.

Baker states that the heart of an extranet is not technical definitions but the service it provides (Baker, 1997). While AAM has succeeded in working out the technical issues in connecting to the ANX, the company has no applications scheduled to migrate from its legacy data links to the new extranet. In contrast, Ford Motor Company's ANX implementation plans are quite aggressive (Kirchoff, 1999). The company intends to use the ANX as its strategic telecommunications transport and network service for supply chain communications. In fact, all of Ford's U.S. and Canadian suppliers connected to the company's private IP VANs are requested to migrate to the ANX by September 30, 1999.

Currently, Ford has 11 ANX-enabled applications: C3P-IMI file transfer, C3P-FRPPAH file transfer, PDGS file transfer, EDM CADD5 file transfer, global prototype inventory requisitioning, analytical warranty, mainframe IP printing, common manufacturing management, engineering release, procurement and receiving, and material supply. The company's future deployment plans include applications that are high volume, business critical, or confidential (e.g. EDI and direct data links mainframes).

DaimlerChrysler is another automotive trading partner with aggressive ANX migration plans (Jackson, 1999). According to Thomas Stallkamp, DaimlerChrysler President, the company is committed to the use of the ANX. DaimlerChrysler's plans include migrating e-mail, interactive CAD, EDI, and the majority of its other applications to the ANX. The ANX will be used at DaimlerChrysler to electronically route product shipment schedules, order information, CAD files for product designs, purchase orders, and other financial information.

DaimlerChrysler has an extensive ANX support organization (Jackson, 1999). The goals of this internal information systems staff are to:

- Support internal application development and coordinate the strategic use and integration of the ANX
- Design, develop, evolve, and support DaimlerChrysler's technical infrastructure
- Provide trading partner interface and connectivity support

Thus far, DaimlerChrysler's internal ANX staff has successfully connected 15 applications to the ANX (DaimlerChrysler, 1999).

Business-to-business Portals.

The definition of business-to-business portals and the technology to implement them is constantly changing (Wilder, February 8, 1999). Intranets, extranets, and even common Web sites are being renamed as business portals. What differentiates portals from simple Web sites is their ability to incorporate data from multiple sources in multiple formats and organize it into a single, easy-to-use menu. Open Text Corporation, the worldwide leader of Web-based collaborative knowledge management software, offers a product called Livelink that would allow AAM to quickly establish a corporate business portal (Pearson, 1999).

Livelink is a highly scalable, collaborative, knowledge management application used to create and manage intranets and extranets (Pearson, 1999). Livelink's features include enterprise document management, virtual team collaboration, business process automation, enterprise group scheduling, and information retrieval services. Recently the Parsons Corporation, one of the world's largest engineering, procurement, and construction organizations implemented Livelink to manage its enterprise-wide intranet and global extranet.

Parsons' employees from around the world use Livelink to share knowledge for the development of proposals and to review drawings online. The large number of complex documents drafted and revised both internally and externally created the company's need for a Web-based knowledge management and portal product. The company also uses Livelink to manage a global extranet that permits thousands of Parsons' partners worldwide to collaborate on joint-venture projects.

Another example that demonstrates Livelink's capabilities as an extranet portal is the Dana-Farber Cancer Institute's implementation of the application (Dobbin, 1999). Dana-Farber is using Livelink to manage an extranet that links scientists and physicians at Harvard-affiliated medical facilities in the Boston area. Scientists and physicians at these institutions use the extranet to share research documents, participate in online workgroup discussions, and maximize existing lab resources.

Dana-Farber is also deploying Livelink to manage their intranet to improve the institute's administrative efficiency and flow of information. Like Dana-Farber, AAM currently does not have intranet, extranet, knowledge management, or workgroup collaboration applications in place. Livelink's ability to combine these key functions into an effective business-to-business portal makes it a good fit with AAM's existing IT applications.

Supply Chain Integration.

Since Oracle Automotive ERP2 is the enterprise resource planning application in use at AAM, initiatives to integrate the company's supply chain must also include plans that apply applications that are tightly integrated with Oracle. Oracle's standard supply chain integration products include Oracle Automotive, CARaS EDI, and release management (Oracle, 1999). These applications are currently in use across the AAM enterprise (AAM, 1999).

In order to further optimize the AAM supply chain, Oracle, in collaboration with I2 Technologies, offers advanced solutions for enterprise supply chain planning and optimization. I2 supply chain applications are capable of providing strategic business planning and detailed schedule leveling for one enterprise or many within a supply chain. The Oracle/I2 supply chain suite of applications include assembly sequencing, multi-plant planning, master planning, rapid response assembly, inbound transportation management, aftermarket planning, vehicle sub-system planning, advanced ordering, and collaborative demand management.

E-commerce Enabled Procurement Systems.

TPN Register.

The Content Management Services Suite from TPN Register offers AAM many advantages. This secure electronic marketplace is an extranet-hosted content and contract management service that is shared by multiple large buying organizations and their trading partners (Avery, 1998). The TPN Register model would allow AAM's buyers to

outsource to a third-party organization (i.e. TPN Register) that specializes in content and content management.

Once contracted, TPN Register would handle the entire supplier engagement and acquisition process and host all supplier catalog content on behalf of AAM and each of its suppliers. Suppliers would only need to provide their catalog data once, and the data could be repackaged and supplemented with contract-specific information for each new buying customer. In addition, suppliers would be able to access the service online to make catalog content updates.

By choosing TPN Register's electronic marketplace service, AAM would receive rapid access to a global marketplace made up of preferred automotive suppliers. In the process, it would also avoid extensive infrastructure and ongoing maintenance costs. The AAM virtual catalog would combine its supplier's product data with AAM's negotiated pricing and contract terms. Because it is a service, this option provides AAM greater enterprise-wide scalability than software products. Instead of having to load additional software onto each desktop, AAM would simply need to ensure that associates have a standard Internet browser to access the service. Authorized AAM associates would be able to search for and order contracted items from pre-approved suppliers, giving them instant visibility to negotiated items and pricing. Consequently, AAM would benefit from a significant increase in contract compliance.

Organizations that buy MRO supplies through private electronic marketplaces such as TPN Register's report a number of benefits (TPN Register, 1998). Buyers are able to reduce their non-production spending levels by up to 20 percent. They are also able to accelerate the sourcing process and reduce the data-entry errors that are common in today's accounts payable systems. In addition, suppliers are able to generate more orders from existing customers and to expand their customer base. Suppliers are also able to lower the costs associated with order processing and the maintenance of product information. The cost-effectiveness and scalability of TPN Register's electronic marketplace make it a good fit with AAM's world-wide purchasing objectives.

Another important benefit of TPN Register's procurement solution is its alliance with Oracle (Glass, 1998). Since 1998, AAM has deployed Oracle's ERP2 purchasing module across all of its facilities (AAM, 1999). The TPN Register and Oracle partnership brings Oracle Purchasing and Oracle Web Requisitions together with TPN Register's electronic marketplace services (Glass, 1998). This combination integrates services, software, product information, and negotiated prices as part of company's purchasing infrastructure.

General Electric (GE) is currently implementing the Oracle and TPN register solution in several GE businesses. TPN Register will provide supplier and content management services for both GE's manufacturing and services businesses. GE is also implementing Oracle's data warehouse and analytical tools to evaluate their procurement and supplier performance. "This is a key enabler in helping GE attain a Six Sigma quality level in

strategic procurement," said Gary Reiner, GE's chief information officer and senior vice president (Glass, 1998).

In GE's deployment, Oracle's and TPN Register's applications work together to manage the buyer's trading partner community by creating and maintaining product catalogs based upon the industry standard Thomas Register classification system. Raw supplier data is converted into useful information that enables buyers to electronically locate, evaluate, and select products through a self-service, web-enabled application. In addition to GE's internal deployment, GE Information Services (GEIS) has signed up as customers 20 large and 1,400 medium-sized and small manufacturers wishing to have similar deployments of TPN Register (Bylinsky, 1997).

DaimlerChrysler's is also working with TPN Register and GEIS to deploy the electronic marketplace with its 3,500 MRO suppliers. A high percentage of these suppliers are currently providing goods to tier one direct material suppliers (e.g. AAM) using traditional purchasing channels. AAM might easily leverage this established base of suppliers, already connected and conducting business with DaimlerChrysler, using TPN Register's electronic marketplace service.

Intelisys.

The Internet procurement system offered by Intelisys also offers benefits to AAM. Unlike TPN Register, Intelisys' IEC-SupplyNet is designed around a more open purchasing process and standard (i.e. Internet OBI). The OBI architecture is based upon the premise that process owners should be responsible for information associated with their business processes.

For example, buying organizations such as AAM are responsible for requisitioner profile information, account codes, tax status, and approvals. Selling organizations are responsible for electronic catalogs and the associated price, order entry, and inventory mechanism. The OBI protocol and formats ensure that buyers and sellers are able to interoperate. This contrasts with existing Internet procurement architectures in which selling organizations must acquire and maintain accurate profile information on thousands of shoppers, in addition to maintaining dynamic catalogs.

An Intelisys system currently being implemented by Ford will enable plant employees and purchasing managers to order goods and services from their desktops directly from approved suppliers. The technology automates and integrates the entire procurement process from purchase through delivery. Unlike the TPN Register system, payment processing is also integrated and automatic.

Findings

A review of the literature in the areas of extranets and the ANX, business-to-business portals, supply chain integration, and e-commerce enabled procurement systems has revealed the following.

Extranets and the ANX.

The ANX and other extranets will grow to provide ubiquitous data networking in the future. DaimlerChrysler, Ford, GM, and AAM are all ANX connected. However, unlike the Big 3 and many of their tier one suppliers, AAM has yet to formulate plans to migrate existing legacy connections to the ANX. This is inefficient and costly. Therefore, AAM should to begin planning the migration of its legacy data links to the ANX. AAM's ANX connection is of little value if it is not being used.

Business-to-business Portals.

Business-to-business portals are Web sites that incorporate data from multiple sources in multiple formats and organize it into a single, easy-to-use menu (Wilder, February 8, 1999). Creating an AAM business-to-business portal would benefit the company by providing associates, suppliers, and customers with organized access to a variety of corporate information. The combination of Internet search technology, recognizable topic hierarchies, and personalized desktops would allow AAM to provide associates, suppliers, and customers with an easily understood self-service environment.

The Open Text Livelink application is highly scalable and would allow AAM a quickly establish a corporate portal. In addition to the product's portal functionality, it would also provide AAM a platform on which to begin intranet, extranet, knowledge management, workgroup collaboration, and work flow initiatives.

Supply Chain Integration.

Supply chain integration products such as I2 Technology's applications do not match with AAM's current business environment. An initiative in this area would require resources that are better applied to other e-commerce projects. Once the company's business processes and IT infrastructure are more e-commerce capable (e.g. an established intranet and extranet), deployments in this area would make better business sense. I2's supply chain application will also be further tested and more mature.

E-commerce Enabled Procurement Systems.

E-commerce enabled procurement systems leverage the Internet for purchasing activities (Glass, 1998). For many companies the scope of their procurement system is limited to self-service, web-based requisitioning. The goal of web-based requisitioning is to move non-production procurement activities to the desktop. However, Internet procurement also includes online buying communities and content management. Business issues associated with Web requisitioning systems include:

- Third party desktop Web requisitioning systems are costly
- Web requisitioning systems do not integrate well with ERP systems
- Content management is not included
- Supplier integration and collaboration is missing

In addition, integration issues are often overlooked when selecting an Internet procurement system. Data synchronization is required across all components of an effective procurement solution. This type of close integration is difficult to achieve with a third party procurement system that "snaps on" an enterprise's ERP system. Intelisys is currently working through these integration issues. In contrast, the Oracle and TPN Register strategic procurement product is fully integrated. All important data and business rules are defined within the system and are synchronized out-of-the-box.

TPN Register's product is also a good fit at AAM for a couple of other reasons. First, many of AAM's 4,000 suppliers are already members of the TPN Register supplier community (courtesy of DaimlerChrysler). Second, AAM is currently working with GEIS to deploy supplier EDI, and this relationship could be leveraged during a deployment of the TPN Register service.

Each year, U.S. companies spend over \$400 billion purchasing indirect materials (Glass, 1998). Procurement of indirect goods and services generally accounts for more than 80 percent of purchasing transactions. This translates into significant overhead costs. Implementing an Oracle and TPN Register solution at AAM would generate a 10-20 percent savings through streamlined process efficiency, improved contract leverage, and optimized purchasing. This is particularly significant in AAM's case with operating profits generally below 20 percent.

Chapter V Summary

The following sections summarize and conclude this project paper. The first section is an executive summary that outlines a strategic plan for the implementation of electronic commerce technology at AAM. This summary provides a brief description of e-commerce technologies to be deployed along with a timetable for their completion. In the following section, the paper concludes with recommendation for a future project in electronic commerce.

AAM Executive Summary

The purpose of this executive summary is to outline a strategy for the deployment of electronic commerce at AAM during the next 18 months. The technologies recommended have three common characteristics. First, they are all products and services that have been tested and proven in a competitive manufacturing environment. Second, they are all deployable within an 18-month period. Finally, they will provide AAM with the processes and systems it needs to remain competitive in the next century.

E-Commerce Technologies

Business-to-business electronic commerce is projected to grow at an annual rate of forty-one percent during the next five years. The automotive industry, recognizing this fact, is making significant progress in the deployment of electronic commerce technologies. The most promising of these technologies relative to AAM's business needs are extranets, business-to-business portals, and e-commerce enabled procurement systems.

Extranets and the ANX.

Companies are deploying extranets as a strategic tool to communicate with their customers and suppliers. Extranets give customers and suppliers access to internal company systems and applications over the Internet. The automotive network exchange (ANX) and other extranets will grow to provide ubiquitous data networking in the future. DaimlerChrysler, Ford, GM, and AAM are all ANX connected. However, unlike the Big 3 and many of AAM's competitors, AAM has yet to formulate plans to migrate existing legacy connections to the ANX. AAM's current ANX connection is of little value until it is put to use.

Business-to-business Portals.

Business-to-business portals are Web sites that incorporate data from multiple sources in multiple formats and organize it into a single, easy-to-use menu. Yahoo is one of the best portal examples in the business-to-consumer segment of e-commerce. Creating an AAM business portal would benefit the company by providing associates, suppliers, and customers with organized access to a variety of corporate information. A business portal's

combination of Internet search technology, recognizable topic hierarchies, and personalized desktops would allow AAM to provide associates, suppliers, and customers with an easily understood self-service environment.

Open Text Corporation's Livelink application is highly scalable and would allow AAM to quickly establish a corporate portal. In addition Livelink's intranet, extranet, knowledge management, workgroup collaboration, and work flow capabilities make it the best fit with AAM's current mix of IT applications.

E-commerce Enabled Procurement Systems.

Each year, U.S. companies spend over \$400 billion purchasing indirect materials (Glass, 1998). Procurement of indirect goods and services generally accounts for more than 80 percent of purchasing transactions. This translates into significant overhead costs. E-commerce enabled procurement systems leverage the Internet to reduce these costs.

Oracle and TPN Register have collaborated to provide an e-commerce enabled procurement solution. Implementing this solution at AAM would generate a 10-20 percent savings through streamlined process efficiency, improved contract leverage, and optimized purchasing. This is particularly significant in AAM's case with operating profits generally below 20 percent.

Integration

The e-commerce applications recommended above will easily integrate with AAM's current "best of breed" business and manufacturing applications. Open Text is a Microsoft partner and its Livelink application will install seamlessly into AAM's current Microsoft network and messaging infrastructure. In addition, the TPN Register application is already tightly integrated into the Oracle automotive applications that make up the heart of AAM's current business systems

Deployment

Unlike its Big 3 customers, AAM has taken a "wait and see" approach to electronic commerce. To correct this shortcoming, a timetable for deployment of these three e-commerce technologies is presented below.

August 1999 - March 2000

- Resolve remaining Year 2000 issues
- Develop legacy to ANX migration plan
- Develop and issue RFP for business-to-business portal
- Develop and issue RFP for e-commerce enabled procurement system

April 2000 - June 2000

- Migrate EDI links with Ford to ANX
- Issue PO and begin business portal implementation

- Issue PO and begin procurement system implementation

July 2000 - February 2001

- Migrate EDI links with GM to ANX
- Migrate all remaining links to the ANX
- Complete business portal deployment
- Complete procurement system deployment

Conclusion

The electronic commerce technologies outlined above are being implemented by AAM's competitors, suppliers, and customers. AAM must begin similar deployments or face the real possibility of competing with substandard business processes and outdated technologies.

Future Project Recommendation

During the course of this project, three e-commerce technologies were mature enough to be recommended for immediate deployment at AAM. One other promising technology reviewed was advanced supply chain integration. While advanced supply chain applications (like the one under development by I2 Technologies and Oracle) look promising, their maturity and AAM's ability to implement them are not currently up to par. Prior to the completion of the above 18 month implementation process given above, the viability of advanced supply chain integration technologies should be revisited.

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