Developing and Prototyping a Plan for the Effective Use of Internet Technologies by a Manufacturing Company

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Abstract

In the new Information Age, Information Technology (IT) workers need to know how to adapt new Internet-based technologies to help established companies stay competitive. Cal Poly Pomona, a Southern California university whose motto is "Learn by doing," provides its students with opportunities to learn how to accomplish such a task through an interdisciplinary, 3-quarter-long senior project program. This paper presents the process that a student team followed to prepare an operational plan for effective and innovative use of Internet technologies by a manufacturing company. The project customer was a large, global company that manufactures aluminum gas cylinders (hereafter called Cylco) in Southern California. During the project, the students not only developed a plan but presented prototypes to illustrate how the applications might eventually look and function.

The student team divided the project into three phases, each of which took one academic quarter to complete. At the end of each phase, the team presented its findings and suggestions to executives and decision makers at Cylco to obtain feedback and approval before they proceeded to the next phase. During the first 10-week phase, they gathered and analyzed information about the company and the industry in which it operates. They particularly looked at how other firms in the same industry were using Internet technologies. They then integrated this information into a framework that would help Cylco effectively use Internet technologies to support its corporate vision. During the second 10-week phase, the student team performed further in-depth analyses and developed an operational plan for the successful use of Internet, intranet, and extranet technologies at Cylco. They suggested applications and functions for each unit in the organization. During the final phase, the students developed application prototypes for functional areas selected by Cylco.

Cylco's response to this project was positive. The student team demonstrated that with this methodological approach they could research and analyze information about industry and Internet topics, provide a plan for implementation of Internet, intranet, and extranet applications for the company, and develop a prototype for one department the company selected. They also provided recommendations to help the company exploit the use of the Internet to market its products and improve customer service. Cylco was so impressed with the student team's work that they contracted with another team from the same senior project program to carry this project forward during the following academic year.

1. Introduction

In the new Information Age, Information Technology (IT) workers need to know how to adapt new Internet-based technologies to help already established companies stay competitive. Cal Poly Pomona, a Southern California university whose motto is "Learn by doing," provides its students with opportunities to learn how to accomplish such a task through an interdisciplinary, 3-quarter-long senior project program. This paper presents the process that a student team followed to prepare an operational plan for effective and innovative use of Internet technologies for a manufacturing company. The team consisted of 5 seniors, 3 from the Computer Information Systems (CIS) major, and 2 from the Marketing major, under the direction of a CIS Department faculty member. The project customer was a large, global company that manufactures aluminum gas cylinders (hereafter called Cylco). During the project, the students not only developed a plan but presented prototypes to illustrate how the applications might eventually look and function. While this project is the work of undergraduate students, their methodology and approach might be useful to IT departments undertaking similar projects.

The student team planned and managed its own work and met regularly with one another and with their faculty advisor. They divided the project into three phases, each of which took one academic quarter to complete. Team members met with individuals at different levels within Cylco throughout the project. They made a formal presentation of their work to Cylco at the end of each phase. Customer feedback from these meetings then was incorporated into plans for the next project phase.

During the first project phase, the team gathered and analyzed information about Cylco and the industry in which it operates. They particularly investigated ways in which other firms in the industry were using Internet technologies. They then integrated this information into a framework for an operational plan that would help Cylco effectively use Internet technologies to support its corporate vision. During the second phase, the student team performed further in-depth analysis and utilized their framework to create an operational plan for the successful use of Internet, intranet, and extranet technologies at Cylco. They suggested applications and functions for each unit in the organization. During the final phase, the students developed prototypes for application areas selected by Cylco. The specific methodology, which might be applied effectively by consulting firms and IT departments in industry, is elaborated more fully later in the paper.

2. Company and Industry Background

Cylco has been in business for over 100 years, and has six manufacturing sites based in the United Kingdom, United States, and Australia, as well as sales offices in many other countries. Cylco cylinders are used in six major gas markets, including medical, life support, beverage, fire, scuba, and specialty gases. Cylco views itself as setting the standard worldwide in the design, manufacture, and supply of high performance engineering materials, alloys, and semi-fabricated components used throughout the manufacturing industry. Like many other firms, Cylco would like to exploit Internet technologies to help its employees become more efficient and effective in their efforts to research the market, promote products and services, serve and educate customers, produce, sell, and deliver products, and provide after-sales customer service.

During their initial research phase, the student team discovered important information about Cylco and the industry in which it operates. The gas cylinder industry is in the mature stage of its life cycle. The threat of potential entrants to the industry is low because it requires large investments of capital to establish a proper infrastructure, and the quantity of customers is not high enough to justify this type of large investment. Cylco, the leader in the gas cylinder industry, has six main competitors. In fact, 50 customers represent 96% of Cylco's market.

Cylco's reputation as an industry leader is reflected in its vision statement. Cylco considers itself "an international company dedicated to excellence through product quality, creating value for customers, employees and shareholders through innovation, technology and operational expertise." Further, Cylco views itself as "a world class company specializing in the design, manufacture and supply of high performance materials, alloys and semi-fabricated products to manufacturing industry world-wide." This statement points out the value that Cylco places on the quality of its products and on conformance to all major global specifications. In fact, to ensure quality, Cylco performs quality control at major points throughout the manufacturing process. In addition, Cylco conducts its own research into materials and engineering processes and has sponsored research at major universities.

Cylco uses a global marketing perspective when selling to customers, which means it treats the world market and its home market as one. To become a global company, Cylco has built a strategy that reflects the existing commonalties of market needs among many countries. This strategy allows it to maximize returns through global standardization of its business activities. In addition to maintaining business with its current customers, Cylco wishes to expand its market by finding new applications and recruiting new customers for currently offered products.

Cylco strives for complete customer satisfaction. The customers who buy from Cylco are large and may use their products in their own production processes or resell them to individual customers. These individual customers (i.e., "end users) may not be familiar with the Cylco name. In order to increase Cylco name recognition at the level of individual customers, Cylco has implemented a "Safety First" education program to educate dealers and individual customers in the proper handling and maintenance of high-pressure gas cylinders. These educational programs are available in different languages and viewing formats to ensure their appeal to the global market.

3. Information Technology at Cylco

To find out more about Cylco's IT infrastructure, the student team interviewed IT employees at Cylco about their current systems. They discovered that the Southern California Cylco location outsources some IT processes and employs a core of eight employees: an IT manager, a systems administrator, three programmers, two SAP specialists, and one PC support person. One of the programmers was designated by Cylco as the IT liaison for this project.

In their interviews and visits to the company, the students discovered important facts about Cylco's IT infrastructure and applications. Cylco is also considered an industry leader because it leverages its investments in information technology, especially a state-of-the-art order tracking system. It recently had implemented the sales and finance portions of an enterprise resource planning system produced by SAP. It also recently had installed the manufacturing portion of a new MRP system that is tied to the sales system. These innovations were considered to be the first stage of a two-phase project.

Cylco used client/server technology for its SAP and MRP systems. They were using Windows NT with the TCP/IP protocol for their local area networks. For internal security, they used standard Windows NT functions. Employees had software such as Microsoft Office installed locally on their personal computers, but most did not have access to the Internet.

Cylco had a corporate web site whose maintenance was outsourced. Employees outside of the IT department were responsible for updating information on this website. Those employees with access to the Internet used Microsoft Internet Explorer for their browser. For Internet security, Cylco was using a proxy server. Cylco had been working on a draft plan for intranets for the Sales & Marketing, Human Resource, and Finance Departments, but these plans were not yet implemented.

4. Project Methodology

Once the student team learned about the gas cylinder industry, the role that Cylco played in that industry, and the state of Cylco's IT and Internet involvement, they developed a three-phase plan for their project. Their goal for the first phase was research and analysis in order "to gain mutual understanding and knowledge." The second phase involved the creation of an operational plan and the third phase the creation of a prototype to demonstrate how Cylco might implement that plan.

4.1 Phase 1 – Mutual Understanding and Knowledge

During this phase, the student team worked with Cylco to reach consensus on an innovation "vision" that would use Internet technologies to enhance Cylco's goals. To accomplish this task, the student team needed to understand and articulate how other businesses were using Internet technologies to tap into potential growth and increase efficiency in general.

The team divided its research activities during the first project phase among individual team members, who then met weekly to analyze and review their findings. Student team members used a number of search strategies to find out how other companies were benefiting from Internet applications. They searched the Internet and the professional literature and interviewed manufacturers. In addition to weekly review and brainstorming sessions, team members also utilized an Internet-based discussion database.

Their investigation on the Internet helped the student team uncover perceptions of Cylco and the products it offers, as well as information about the clients it serves, the industry in which it operates, and the nature of its competition. The team learned that Cylco has a very good reputation in the aluminum gas cylinder industry. Its name appears in several World Wide Web sites that refer to the history and development of the industry, as well as award-winning and quality products. Of the six markets that Cylco serves, the scuba market is most prominently displayed on the Internet. There are chat rooms for scuba divers who discuss issues such as safety, warranty, prices, and refilling of tanks. The comments about Cylco that scuba divers had posted on the Internet were both positive and negative, however. The team's research uncovered a need for on-line customer assistance for this particular market, since the web seems to be the place where scuba divers publicly exchange information about product quality, guaranties, warranties, defects, and benefits.

After they gathered information, the team began working on a framework for its operational plan that was organized into functional areas and subareas. The functional areas consisted of individual departments located within Cylco, i.e., Accounting and Finance, Human Resources, Information Technology, Production, Research and Development, and Sales and Marketing. The subareas consisted of departmental application areas, such as the subarea Customer Service located within the application area of Sales and Marketing. Individual team members then concentrated on different functional areas. When completed, the team presented the framework to representatives of each department at Cylco for preliminary review and clarification concerning subarea functions. After improving the framework based on customer feedback, the student team created a Web site to present its framework for an "ideal" Intranet solution for Cylco.

Next, the student team reviewed preliminary information about available Internet technologies, in order to understand the scope and possible applications for the Internet, intranet, and extranet at Cylco. Once the team completed this analysis, they developed a project plan, which was formally presented to Cylco near the end of the first phase. Once Cylco approved the project plan, the student team began an intensive literature review focusing on successful applications of Intranets, Internets, and Extranets by major manufacturing companies. The research included current literature available on the Internet and through research in professional publications.

4.2 Phase 2 – Create an Operational Plan

During this second project phase, the student team continued their intensive investigation into ways in which businesses are currently utilizing Internet technologies, and explored innovative Internet solutions for Cylco. In addition to reviewing the literature, the research involved interviews with experts. After the student team analyzed this information, they determined which applications would fulfill Cylco's vision, and brainstormed on new and innovative solutions for Cylco. With continued feedback from Cylco, the student team developed an operational plan that takes into account Cylco's corporate vision, its current state of technology, and its available resources. A preliminary operational plan built to the framework developed during Phase 1. This operational plan, which was displayed on the team's web site, was presented to the client at the end of this phase. It served as the basis for the remainder of the project.

4.3 Phase III – Create A Prototype for Selected Areas

Following the presentation of the preliminary operational plan developed in phase two, the client selected certain application subareas within the Sales and Marketing Department for a demonstration prototype that the students would develop during Phase 3. Because of the remaining time frame for the project, approximately 12 applications were developed using a combination of both static HTML pages (text documents converted into HTML) and dynamic HTML (DHTML) pages developed with Active Server Pages (ASP), a Microsoft technology. The following section describes the plan in more detail.

5. Results and Recommended Solutions

The goal for this project was to search for innovative ways in which Cylco could effectively use Internet technologies to realize its envisioned organizational goals. The team recommended the development of Internet, intranet, and extranet applications that would exploit these technologies to Cylco's advantage. They also developed a prototype of several subareas of their proposed intranet.

5.1 Internet Applications

Cylco's existing Internet site presented corporate information: the company story, a corporate profile, company vision and values, various accounting and other reports, job opportunities, press releases, as well as links to other companies within the larger Cylco Group.

The team analyzed the content of competitor web sites to compare and assess Cylco's web presence in the industry. As a result, the team discovered features valuable to the gas cylinder industry that were not part of Cylco's web site. The team recommended improvements that could better serve current clients and attract potential customers and help Cylco increase its market share in the highly competitive, innovative, and fast changing aluminum gas cylinder industry. Based on their research, the team suggested adding the following to Cylco's website:

- Company brochures to provide information to customers in an interactive format. [1]
- A contact list, to display Cylco's address, as well as the names, titles, telephone numbers and e-mail addresses of key employees. [2]
- A dealer locator, to show contact information for major Cylco dealers around the world to help potential international customers to identify the nearest Luxfer distributors.
- Job listings for all current job openings to help the Human Resources Department recruit more efficiently. [3]
- An on-line catalog to provide customers with answers about products.
- An on-line interactive customer questionnaire and registration, with an email response, to enable Cylco to improve customer satisfaction. [4]
- A frequently asked questions (FAQ) forum to provide basic information about the company and its products.
- Safety guidelines, to educate users in using, filling, refilling, cleaning, and disposing of cylinders. [5]
- Trade show listings, with an additional "virtual" trade show booth for nonattendees.
- Videos, including a "Company Promotional" and a "Safety for End-Users" video in streaming format (e.g., Real video, Microsoft Netshow, or Lotus ScreenCam).
- A virtual tour of the Southern California manufacturing facility. [6].
- A feedback and comments page to invite customer feedback to improve the site.

5.2 Intranet Applications

An Intranet is an intraorganizational Internet that delivers informational resources to employees' desktops quickly and inexpensively via an Internet browser. It protects information from unauthorized access because it is only available to employees with valid login identifiers and passwords. Intranet access can also be extended to provide employee access to vital information anytime, anywhere, either from home or from remote business trip locations. An Intranet builds "communities of process" within an organization by allowing employees, who are focused on the same set of business tasks, to link together and to share important knowledge and information.

The student team defined a set of applications for a company Intranet for each of the six departments of Cylco: Accounting, Human Resources, Information Technology, Sales and Marketing, Production, and Research and Development. Employees would be able to log into the main intranet page with a user name and password. They would all have access to a common area of the website, as well as to certain segments of the departmental areas. Access to some pages within the department areas would be limited by the login information to employees within that department or to those with certain job responsibilities (e.g., managers, programmers).

The planned common area of the web site available from the main intranet page includes several sections:

- Company information, that provides a corporate calendar, an organizational chart, the corporate mission statement, news and announcements, and a safety manual.
- A general communications area that includes a general chat room and a discussion database.
- An employee area with an employee directory, a list of employees who have birthdays during the current month, and training information.
- Help Desk area with solutions to frequently asked questions, a help desk forum, and a help discussion database.
- Resource Management area that provides equipment scheduling, a resource library, room scheduling, and a training calendar
- Search engines for the intranet and the Internet.

Cylco selected the Sales and Marketing Department for the team prototype, and the sales manager at Cylco decided which subareas should be included. The team used both static and dynamic html pages (generated with ASP technology "on the fly" from a database) in its solution.

Static HTML page technology was used to produce:

- A list of competitors with hyperlinks to their web sites
- A customer care program list
- A list of distributors for various gas cylinder markets
- A list of companies that ship Cylco's products
- Information pertaining to industry trade shows
- Other hyperlinks that are likely to be useful to Sales and Marketing employees.

Dynamic HTML pages are useful in areas that require up-to-date information because they are created when the client asks for them from data within a database. The following dynamic HTML pages were built by the team either on their own or by using purchased third party ASP components:

- A calendar for departmental meetings, important events, and vacation times, based on technology purchased as a third party ASP component (Excite Calendar 1.0).
- A Christmas card list to allow Sales and Marketing to send appropriate holiday greetings to customers.
- An on-line form to allow Sales and Marketing to update their database of companies, which is used in other applications such as the contact application below.
- An on-line form to store and update contact information in a database that Sales and Marketing employees use to store information about customer inquiries.
- A file upload utility, which utilized an ASP third-party component called SA-Fileup 2.3.
- A visit report form to allow marketing managers to enter information about customer visits.

5.3 Extranet Applications

Extranets are interorganizational systems, or intranet application areas shared by two or more companies. Quite frequently they are shared spaces for a company and its suppliers and/or distributors. Extranets support "business-to-business" activities, the part of the Internet that is growing most rapidly. Extranet applications can be particularly valuable to global manufacturing companies such as Cylco because of the ways in which they enhance customer and supplier relationships.

5.3.1   Enhancing Customer Relationships

The student team realized from its research on extranets that Cylco could use an extranet to provide on-line ordering and customer service to its customers. Authorized customers could log into Cylco's extranet and place their own orders on-line. Sales people would be able to spend time less time taking orders and more time providing more specialized, value-added services. In addition, customers would be able to monitor their orders via the extranet, which is especially important in a global market that spans many time zones.

5.3.2 Enhancing Supplier Relationships

The student team was very impressed with the use of extranets by manufacturing companies in other industries. For example, Ford Motors Co. set up an extranet with its suppliers to provide controlled information sharing that is intended to improve the performance of its supply base. [7]   Ford gives it suppliers such valuable information as purchasing and supply guidelines, product quality, logistics necessary to reuse containers, data that helps classify parts for customs when they are shipped across national borders, information about government regulations, and directions on disposal of obsolete materials.

Although this extranet strategy would be innovative in the gas cylinder industry, the team recommended that Cylco plan to work toward implementing it in the future, since its current distributors, suppliers, and customers did not have the technology necessary to participate in an extranet. Cylco ought to look forward to developing extranet applications to improve its transactions and global business relationships, but success depends on participation by its suppliers and distributors. Cylco should encourage both groups to adopt these technologies and business practices.

6. Recommendations for Future Activities

The student team recommended that Cylco Gas Cylinders proceed next to development of the intranet for the remaining functional areas of the company (Accounting, Human Resources, Information Technology, Production, and Research and Development) as well as for the subareas in the Sales and Marketing Department that had not been part of their prototype. The team emphasized the importance of effectively training all the involved employees to ensure that they understood the functions and the advantages and benefits of using a departmental and company-wide intranet

In addition, the student team recommended that Cylco Gas Cylinders consider setting up an extranet network to work with its customers and suppliers. One of the benefits of this strategy is that it improves relationships with customers by providing better support and customer service. Customers would be allowed to access the shared extranet space anytime and anywhere in the world. Since this strategy provides value to customers, it could give Cylco a competitive advantage in the industry. Furthermore, by freeing up Cylco personnel from routine tasks that could be handled by customers via the extranet, employees could devote more time to building and strengthening quality relationships with the customers and the suppliers. In a similar manner, by setting up an extranet with suppliers, efficiency could be gained through shorter cycle times, reduced transaction costs, and the freeing up of critical resource time, allowing employees to focus on strategic initiatives on both the front and back ends of the transactions.

Finally, the student team recommended that Cylco Gas Cylinders connect its intranet to intranets at its international UK and Australian locations to allow them to reap the benefits of anytime, anywhere global collaboration. For example, if a Research and Development engineer at the California location was testing a new product, he or she could gather important information by communicating over the web with an engineer who had just finished testing the same product at Cylco's Australian location. Similarly, if the Sales and Marketing Department at the UK location was negotiating with an important potential customer, who already was an established client with the California location, efficiency could be gained by sharing information about this client between the two sets of Sales and Marketing people. This sharing of knowledge would benefit Cylco, and allow them to properly own and manage customer information to acquire a stronger market share worldwide. In these ways, a global intranet could give Cylco a competitive advantage.

The student team strongly recommended that Cylco consider these improvements that would competitive advantage shorten cycle times and provide excellent customer service. With limited time and human resources, setting up and maintaining the above systems would lessen the risk of missing information that could close a sale or preserve a good working relationship with the customer or supplier.

7. Conclusions

In order to remain a world leader in its industry, Cylco contracted with an undergraduate senior project team to investigate and recommend ways in which Cylco could make use of Internet, intranet and extranet technologies.

Although Cylco had a company web presence and is considered a leader in its industry, the student team was able to recommend a number of ways in which Cylco could utilize Internet, intranet, and extranet technologies to improve its global business practices. First, they recommended adding a number of features to Cylco's Internet site that they found on the web sites of Cylco competitors. They also recommended the ways in which Cylco could gain a competitive advantage by providing information and services not provided by its competitors. The features that would allow Cylco to continue as an industry leader and worldwide standard setter included an on-line catalog, company brochures, a dealer locator, contact information, an on-line customer survey, question forum, safety guidelines, information about trade shows, safety and other videos, and a virtual plant tour.

The team proceeded to develop a framework and then an operational plan for an ideal intranet solution for Cylco's southern California location and finally developed prototype applications for the Sales and Marketing Department to demonstrate its functionality. Approximately twelve areas were developed using a combination of static and dynamic HTML technology. The static HTML pages included a list of competitors, a customer care program, a distributor list for various gas cylinder markets, distributor information, a trade show list, and industry links. The dynamic HTML pages were generated from a database and included applications that incorporated third party ASP applications that can be purchased, or that were developed by the student team: a Calendar, a Christmas Card List, Company Maintenance, Customer inquiries, file upload, and a reporting application for tracking visitors.

In conclusion, this project demonstrated that a student team could research and develop a strategy that used Internet technologies to enhance a company's leadership position in its manufacturing industry. The team defined project goals and developed a three-phase methodology that allowed them to successfully complete the project. During the first phase they developed a framework for the utilization of the Internet, intranet and extranet technologies. They then drew up an operational plan that followed Cylco's vision and current resources. Finally, they developed a prototype for several subareas in the Sales and Marketing Department to give Cylco an idea of what was possible using a minimal cash outlay and limited time period. Finally, they made recommendations to show how the Internet, an intranet shared by Cylco's global locations, and extranets shared with suppliers and customers could strengthen Cylco's position in its industry as well as in the new Information Age. They also documented their research and development activities for the customer. Cylco was so pleased with the results of this project that it contracted with the same program for a follow-up senior project during the next academic year.

References

[1] Heller, Mike, "Global Networking," *Telephony*, v. 232, May 5 1997, p. 26-27.

[2] For an example of both the contact list and dealer list, see: http://www.usdivers.com.

[3] http://www.cio.com/archive/webbusiness/0096_personnel_content.htm

[4] An example of interactive questionnaire can be found at: http://www.specialgassystems.com/profile.htm

[5] An example can be observed in http://www.orcbs.msu.edu/chemical/gascylinder.html.

[6] An example of a manufacturing virtual tour can be viewed at: http://www.specialgassystems.com/instal.htm.

[7] Minaham, Tim, "Private Net Improves Talks Between Ford and Suppliers," *Purchasing,* v. 124 no.10 (June 18' 98) p. S26.