Project Extranets: A Strategic Necessity or A Tool For Competitive Advantage?

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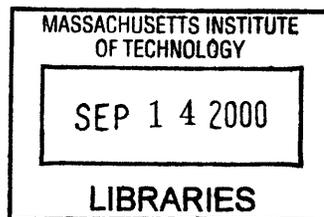
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by

Ryan Carley
and
Matthew Robinson

Abstract

An exploratory study was conducted to determine the strategic advantage that firms may gain by using project extranets on real estate development projects. Eight organizations were interviewed to determine their priorities, risk preferences, and needs regarding project communication technologies. Interviews were conducted with Corporate Owner/Occupiers, Owner/Non Occupiers, and Institutional Owner/Occupiers. The hypothesis tested was that owners and developers of real estate were looking to use project extranets to gain a competitive advantage.

Research results indicated a resounding 'no' to our hypothesis. No owners or developers are currently looking at extranets as a source of competitive advantage *at this time*. However, the research data did provide insights into what is necessary for the technology to deliver for organizations to view a project extranet as a source of competitive advantage in the future. Owners were segmented into categories based on risk profile and needs regarding project extranets. Corporate Owner/Occupiers with real estate support needed assistance with predictability and execution. Corporate Owner/Occupiers of Manufacturing operations needed increases in speed. Institutional Owner/Occupiers needed certainty. Finally Owner/Non-Occupiers needed mitigation of market risks.

Thesis Supervisor: John D. Macomber

Title: Lecturer, Department of Civil Engineering

CARLEY, Ryan   New Orleans, LA
Candidate for MSRED, 2000   Massachusetts Institute of Technology
BArch, 1996   Tulane University

Ryan worked for the Senior Vice President of Tulane University upon graduation to oversee the re-structuring of the Housing Authority of New Orleans. The Housing Authority was responsible for over 12,000 public housing apartments throughout the City of New Orleans. He assisted in coordination and re-structuring of the Modernization Department and developed a Strategic Plan for the agency involving over $150 million in capital funds with a projected $300 million budget over the next years. Ryan was soon promoted to Assistant Director of Development and Modernization where he was responsible for developing and monitoring annual budgets and coordinating the design and construction of HOPE VI and conventional construction projects.

After three years with the Housing Authority, Ryan worked as a Design Manager on the Harrah's New Orleans entertainment complex. The project included a 200,000 square foot casino with administrative and gaming space as well as retail and entertainment venues in the surrounding district. He spent time in the coordination of numerous design issues on the fast-track, design-build construction project.

ROBINSON, Matthew   Abington, PA
Candidate for MSRED, 2000   Massachusetts Institute of Technology
BArch, 1996   Cornell University

After graduating from Cornell University, Matthew worked at DiMella Shaffer Associates, a 50 person architectural firm that specializes in congregate care retirement communities. These years have Dimella Shaffer have exposed him to all of the phases in the construction of a project. Matthew's primary responsibilities have involved the development of an assisted living prototype and its implementation to various sites throughout the country. The first 108,000 s.f. project was completed in 1999 in Salt Lake City, Utah. Projects in California and Illinois are currently in construction.

His architectural training and background have given Matthew an excellent understanding of what makes a 'good' building and how architecture can contribute to the community. At MIT, Matthew has furthered his understanding of the financial and marketing issues involved in real estate development.

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INTRODUCTION

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Statement of the Problem

To build the Railroads in the 1870's, messages were sent by telegraph, their speed was limited by keying morse code, design drawings were sent by train or stagecoach. This method of communication placed tremendous limitations on information. By the 1960's, during the construction of the Interstate Highway system, phones were used to communicate, computers were introduced to survey and calculate earthwork and drawings could be shipped by truck and air. There was some improvement to information distribution, but not much. Currently, we have the ability to produce 3D images with derived drawings, to store and retrieve information in relational databases, and to collaborate in real time with team members over an extranet. Many claim there is currently a huge improvement in Business effectiveness.

The building design and construction industry is both immense and sharply fragmented. Every building project involves architectural design and engineering firms, general contractors, subcontractors, product manufacturers, and supply companies. This structure, with multiple players operating as independent contractors on a single project, lengthens the building process but is necessary for economic and legal reasons. Despite the number of designers, contractors, and subcontractors involved, no standardized communication channel exists to organize all data necessary to complete most projects. A typical $100 million construction project alone will generate 150,000 separate documents: technical drawings, legal contracts, purchase orders, requests for information, and schedules.[1]

Since its inception, the Internet's greatest asset has remained its ability to facilitate and optimize real-world processes and events through a seemingly fully-

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[1] The Economist. "Construction and the Internet."

automated global network, connecting individual user-to-individual user, enterprise-to-enterprise, and any combination thereof through a common language. Companies are currently using the Internet to communicate and collaborate with supply chain partners and manage distribution relationships, as well as to transact with existing business customers.

The diagram below illustrates the generic value system for the real estate industry. Lines that connect the different entities are usually contractual obligations and therefore also represent the path of communication between parties. Traditionally within this value system no centralized system for communication exists. That is a promise of the Internet and project extranets.
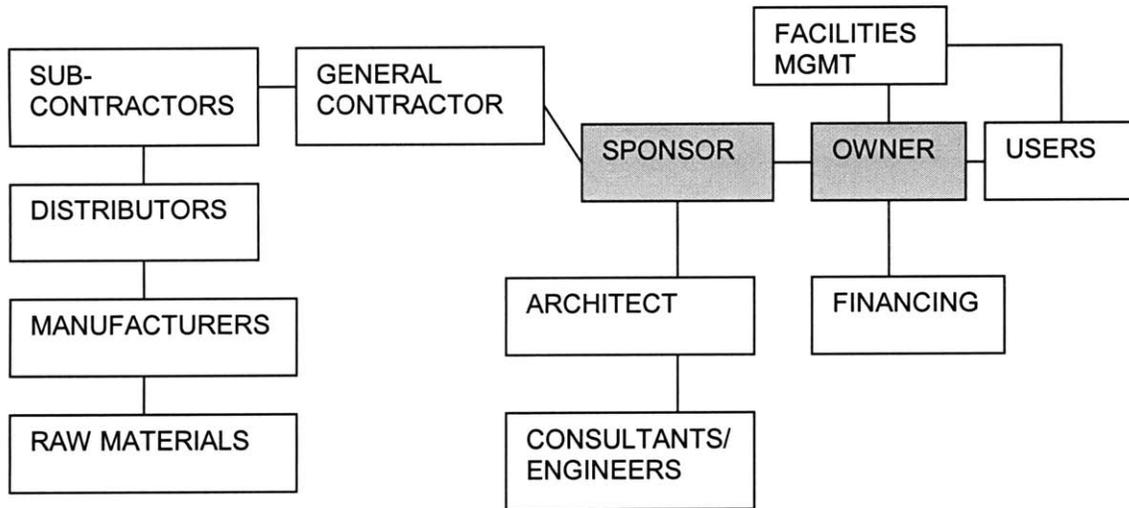
Diagram: Real Estate Value System
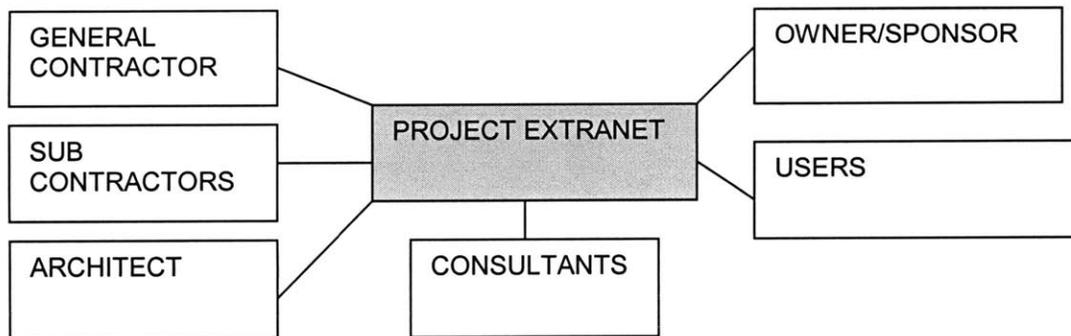
Diagram: Project Extranet and Centralized Information

Purpose of the Study

We are interested in understanding the impact of Project Extranets on the Real Estate Development Industry. Our study examined various owners and developers of Real Estate to determine their priorities, risk preferences and needs regarding Internet technology. The hypothesis tested was that owners and developers of real estate were looking to use project extranets to gain a competitive advantage. We wanted to investigate what factors impacted the selection of the products to be used as well as the entity in the value chain that would drive the usage of Extranets.

Significance of the Study

The study's significance lies in improving our current understanding and links between technological advances, competitive advantage, and people. While organizations continue to compete in this continually changing market-place, the Internet continues to enhance possibilities and allows people to do more with less.

Limitations of Study

It is difficult to financially quantify the concept of extranets. The traditional method of establishing Returns on Investment (ROI) does not apply to this industry due to the multitude of variables that can occur when managing a construction project. Everything from weather, to the labor market, to the supply of building materials, to the skills of managers have to be taken into account in quantifying a return on investment. Instead of choosing this analysis, our study looked qualitatively at the usage habits of current owners as well as the benefits that they can discern.

Sample Selection

Our study examined corporate real estate owner operators, traditional real estate developers, and institutional facility operators to determine their attitudes and objectives regarding the onslaught of Internet technology into the real estate industry. We were interested in understanding how important the Internet, particularly Extranet technology has become in managing the development and construction process. Once we had a clear understanding of Extranet technology, it was important to understand how that technology is meeting the varying needs of different owner types.

The companies included in the study are as follows:
- Owner/Non Occupier (Developer): Millennium Partners – MDA, Charles E. Smith Realty Companies, Boston Properties, and Tishman.
- Corporate Owner/Occupier: State street corporation, Fidelity Investments, and Genzyme corporation.
- Institutional Owner/Occupier: Various projects at the Massachusetts Institute of Technology

Exploratory interviews were organized to determine the organizations' development and construction process, their views regarding risk throughout their process, their current use of Internet technology, and the impact of Extranets on their existing process. The following interview questions illustrate our objective:

1. How would you describe your design and construction process? What areas do you see needed improvement?
2. Please rank the various areas of risk in a development project according to their importance:
3. Design, Construction, Financing, Planning, Legal, Entitlement
4. In what ways do you think the Internet may influence the design and construction process?
5. Time, Quality, Scheduling, Ease of management, Documentation, Remaining within budget, Claims, Administrative costs, Mitigating risks, Project opening, Finance, Carrying costs
6. Does your current development team use the Internet? In what ways? And has it changed the team's roles, responsibility, and organization? Future plans?
7. What Internet services/products would you internally develop vs. buy from an external source?
8. What pitfalls have you encounter or expect to encounter in using a project extranet?
9. Does your organization have plans to procure building materials online? Would you want your project extranet database linked to your facilities management applications and databases?

Our results were extremely informative and illustrate the complex nature of the development and construction industry as well as the varying needs of different owner types. We found that within each type of owner, there were a number of

distinct requirements that organizations had established for their own benefit. These results are discussed in greater detail in our analysis.

The subject of the use and effectiveness of web-based collaboration work sites is a relatively new topic for research. As such, few materials (other than press releases and vender marketing information) are available that deal directly with how owners and developers of real estate are using the technologies that are available. Academic research on the subject has not been able to support any conclusions. This is mainly due to the youth of the industry and the pace of growth in technological advancement.

WPL's Guide to E-Commerce and Web-Based Project Management in Construction, was helpful in addressing the technical issues involved with collaborative project web-sites. Also, the publication was useful in giving an overview of the myriad of companies supplying Internet solutions and what needs their products fulfill. The analysis of the web as a resource, a communications/network device, a marketing tool, a project management tool, a collaboration tool, and an e-commerce marketplace gave excellent and relevant examples regarding how the construction industry can and is using the new technology.

The Extranet World E-Newsletter edited by Stephen Orr provided useful ongoing updates on this fast changing industry. Mr. Orr keeps a running database of all extranet providers, as well as product reviews and new technology updates.

In considering the strategic significance of the Internet on the business of Real Estate, we found the following literature very informative: Porter's Competitive Advantage, Porter and Millar's "How Information gives you Competitive Advantage," and Evans and Wurster's Blown to Bits. While none of these dealt directly with the practice of real estate development, they did provide a

framework to understand how technology will affect the competitive nature of business in general.

Deborah Ulian's MIT MSRED thesis from 1998 provided valuable information on how companies were beginning to be affected by technology. Her thesis underscored the important role that 'people issues' will continue to have in the Internet Age. Ulian's thesis also provided insight into extracting theories from company interview data.

Articles and papers by John Macomber were helpful in tying together the promises of information technology with the reality of business. Of particular note is Macomber's article, "You Can Manage Construction Risks" which gave an introduction to the owner's perspective during a construction project. Macomber's speech, "Leveraging Technologies..." addressed issues of increased owner exposure as an outgrowth of using project extranets.

Crossing the Chasm by Geoffrey Moore was helpful in addressing the differences between early adopters of technology and mainstream users. This topic is critical to the future widespread use of extranets by real estate owners. Providers of extranets must find ways to 'cross the chasm' in order to open the mainstream market for their product's use. Key points from this book will be discussed further in the Environmental Scan chapter.

In Cluetrain Manifesto, Levine et. al. demonstrate that the Internet gives individuals in the workplace the ability to cut across the traditional boundaries that once existed in companies. www.cluetrain.com burst unexpectedly onto the scene with 95 Theses to ignite a vibrant and viral conversation criticizing corporate assumptions about the nature of online business. It breaks down the nature of exchanges that now take place as a result of the fewer barriers that the Internet allows: Customer to Customer, Customer to Employee, Employee to

Employee. These entities can now communicate with each other in language that is natural, open and direct. The book discusses the consequences to companies that are not listening to these exchanges and the opportunities that open exchanges provide both consumers and employees. Ultimately, the book is about the ability of the Internet to provide new exchanges that empower people to both communicate and increase productivity in order to abolish 'cluelessness.'

To best understand the current market for extranets during design and construction, a brief review of Geoffrey Moore's "Technology Adoption Life Cycle" is helpful. Moore introduced this concept in his book <u>Crossing the Chasm</u> as a model for understanding the acceptance of new products. In this model, each group represents a different psychology and demographic profile. As high technology products mature, they must be marketed to these different customer profiles.

Innovators / Early Adopters (Visionaries) / Early Majority (Pragmatists) / Late Majority (Conservatives) / Laggards
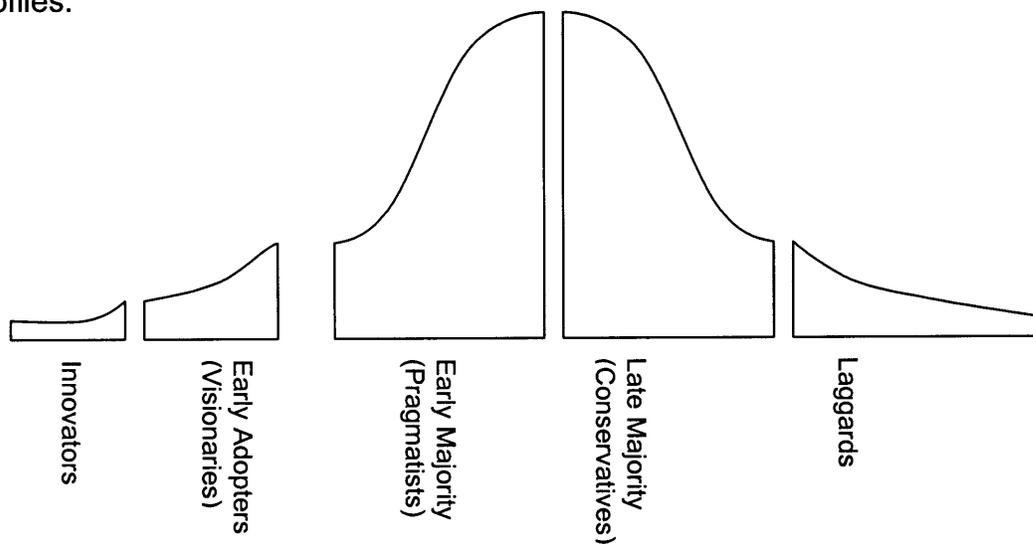
Technology Adoption Life Cycle

Innovators actively and aggressively adopt new technology. *Early Adopters* easily understand how new technologies can benefit their business. The *Early Majority* is driven by a strong sense of practicality and represents approximately one-third of the whole adoption life cycle. The *Late Majority* is similar to the Early Majority except for their discomfort with handling technology. Finally, the *Laggards* shun new technology all together. In between each profile is a 'crack' in which the marketer of a new product must change strategy. The most dramatic of these 'cracks' is the transition from *Early Adopters* to *Early Majority*. Moore characterizes this as a 'chasm.' *Early Adopters* want a change agent and the *Early Majority* wants a productivity improvement.

In the world of extranets, we have seen the *Innovators* adopt the technology as well as the *Early Adopters* or *Visionaries*. This position is evidenced by the lack of large market share by any provider, the small percentage of projects that are conducted online, and the general experimental attitude that abounds in the market. According to ENR Magazine, "E-Business has barely penetrated the second the third tier contractors, those with less than $100 million in annual revenue.[2]" It appears now that many extranet providers are trying to cross the chasm and gain a foothold in the mainstream market.

According to Extranet World, a website dedicated to the AEC extranet market, there are currently 97 collaboration/project management tools. Of those, 45 offer a service based program and the remaining 52 offer product based solutions. (See "The List" page 83) In the course of our research, the following companies have attained some level of acceptance within the industry:

- Collaborative Structures (FirstLine)
- Buzzsaw.com (ProjectPoint)
- Cephren (ProjectNet formerly BlueLine Online)
- Bidcom.com (InSite)
- Bricsnet (ProjectCenter formerly Evolv)
- Framework Technologies (Sitebuilder)
- MP Interactive (E Builder)

Two recent trends are noticeable in the industry: E-Commerce and Consolidation. Many of the online collaboration sites are expanding into the E-Commerce marketplace. In January 2000, collaboration service Blueline Online.com merged with construction products procurement service E-Bricks.com. The new firm, dubbed Cephren after the master builder of the

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[2] Rosenbaum, "Company Cultures Viewed as Threat to Web Collaboration."

pyramids, is representative of the trend. According to CEO Rob Majteles, "we can deliver an online framework that blends collaboration with exchange capability. Breaking them in two doesn't make sense.[3]" Soon after this announcement, Bricsnet and Buzzsaw.com announced similar building material procurement exchange initiatives. By May, Peter Cohan estimated that approximately 170 competitors were going after the transaction market backed by approximately $1 billion dollars in venture capital[4]. Cohan estimates that with an average transaction fee of 2%, the available revenue for procurement services in the construction industry is about $26 billion.[5]

Mergers such as the Blueline Online/E-Bricks merger are expected to continue as the extranet market matures. Yankee Group analyst Stannie Holt believes that "marketplaces for the building industry ... are ripe for consolidation because of overcrowding.[6]" Peter Cohan believes that "three to five significant competitors are likely to emerge as dominate players over the next several years...[7]" The proliferation of firms, as noted by the list at Extranet World, is precipitating the markets expectations of consolidation. In the first week of June 2000, Bidcom.com announced the acquisition of Cubus Corporation. The acquisition is expected to complement Bidcom's suite of collaboration products by offering a product geared to smaller, less complex construction projects. When asked about the acquisition, CEO Doug Sabella said, "I definitely think there will be more consolidation. There are a lot of players out there with assets, but they don't have scope and scale.[8]"

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[3] Cone, "Hybrid Service Builds Trust With Builders."
[4] Cohan, "Deconstructing Buzzsaw.com."
[5] Cohan, "Deconstructing Buzzsaw.com."
[6] Gilbert, "Consolidation in the Construction Marketplaces Begin."
[7] Cohan, "Deconstructing Buzzsaw.com."
[8] Gilbert, "Consolidation in the Construction Marketplaces Begin."

Interview with:
- Maria Ann Marino – Senior Vice President of Planning and Development
- Dianne Drobia

June 28,2000

State Street is a financial services company with 16,000 employees and occupies 5.5 million square feet. The Planning and Development office handles leasing, negotiation, dispositions, acquisitions, and local project management. Approximately $65 million a year are spent on capital projects. Currently State Street has 100 projects in various stages of development totaling $50,000,000 in value.

The Planning and Development Team

Since 1998, State Street has moved to 'end to end project management' in which they reduce the crossover between project management and construction management. Prior to this initiative, a project manager would be assigned to a project, would define the needs of the internal customer, and would manage the architect during the process. The construction manager would be assigned to the project to supervise the general contractor during the duration of construction. State Street recognized that no one person took ownership of a project and sought to use project executives to create the link.

State Street rarely hires outside project managers. They only do so when there are internal staffing shortages or the particular project is complex and unusual for their department. When outside project managers have been used, State Street has found the experience to be not very successful. These managers are not familiar with the corporate culture and procedures of State Street.

Information Technology is handled on an individual departmental basis. In the absence of a central IT department, the Planning and Development Department has little resources to devote to expanding their own IT capabilities.

Lafayette Center

Lafayette Corporate Center is a recently completed 410,000 SF rehabilitated office space in downtown Boston. State Street completed the tenant improvements for the 280,000 SF of space they were to occupy as well as a joint cafeteria. The remaining space was to be leased out to financial service firm, MFS.

State Street used FirstLine on the project with the expectation that it would facilitate communication among a larger than usual project team. They chose to use an extranet due to the size, complexity, and duration of the project. These factors forced the use of a 'better communication tool.' Any success from the use of FirstLine State Street is attributed to a couple of managers who insisted on using the system. Two project mangers at State Street as well as the architect were persistent in rallying the team to use FirstLine.

In the course of the project, State Street did confront 'bugs' in the system. Most of these dealt with technical issues of networking, connectivity, firewalls, and email issues. Of the networking problems, the speed of accessing data was a major obstacle. In general, State Street felt that using the extranet was valuable, but the learning curve was very steep.

Extranets and Risk

FirstLine captured documentation and helped expedite communication. Marino remarked that, "it facilitated communication and warehoused information. So if this helps mitigate risk then maybe the technology did play a role in shifting or controlling risk."

Extranet Benefits

State Street views an extranet as beneficial if it necessitates fewer meetings or if it enhances speed of the team. At Lafayette, the project team was all based in Boston, so they believe the results were not as dramatic as they could have been, given remote consultants. For future large projects, State Street is looking at using extranets again.

Most extranet products, including FirstLine, have many features that try to address accountability issues. State Street however does not focus on the technology related features to address accountability. In Marino's words, "technology will not resolve any more than a strong project leader." As more project go online, State Street is concerned that the technology does not simply become a tool to 'cover your ass.'

The complexity of the Lafayette Corporate Center made an online system valuable. But State Street recognizes the software's limitations. They "would not force it on all projects." Small projects are too expensive to administer on the web. State Street has yet to determine the criteria. But it would deal with complexity, location, size (over $10-20 million), and duration (over an 18 months. construction project). Duration of a project is important to State Street due to the high turnover of staff

Technology and the Real Estate Industry

The use of project collaboration websites is "inevitable" for the real estate industry. However, Marino believes that one will never, "manage completely over the Internet."

Make or buy decision

All extranet decisions will be based on the type of ongoing use. Currently, the technology is too new and untested to make decisions regarding its overall application. Due to limitations on their departmental IT staff, State Street would most likely look for an 'off the shelf' extranet product to meet their needs. Recently, State Street developed in house an approval process system, but they are doubtful, that they have the resources to develop their own extranet.

Value Chain Integration

A software application that links projects from conception, through construction, into facilities management may interest State Street in the long term. The Planning and Development has recently upgraded their leasing and property services software and feels that it would difficult to abandon these prior investments. Companies smaller than State Street may find systems like these easier to implement in the short term.

Selecting an Extranet

Maintaining the schedule and budget are of the utmost importance to State Street. In order to meet these goals, the Planning and Development department believes that only the owner should be able to make decisions about an extranets use. If for example, the contractor controls the extranet, then the architect will be skeptical about its use. At State Street, Marino sums up their position as, "we are huge on control around here."

Changes in Information Flow

If extranets do deliver projects with more information transparency, then State Street believes that this clarity will help projects stay on budget and on schedule. No benefits are seen to information ambiguity. This simply confuses the process and hurts the schedule.

The promise of transparency of information also translates into the potential of information overload. An electronic filter mechanism is needed. On Lafayette, FirstLine was able to filter data so that only those people who needed the data received it.

Extranet Pitfalls

In State Street's experience with FirstLine, they discovered the learning curve for using an extranet goes beyond simply knowing how to use a windows based interface. To leverage the technology, the project team had to become accustomed to looking for answers online and using the extranet to maintain all correspondence. Furthermore, the on going administration of the site proved to be more than they had expected.

Other pitfalls relating to the widespread adoption of extranets include 'buy-in' from the project team and internal technical issues. Technical issues such as speed were seen as hampering the increased productivity due to online collaboration. As complex projects become put on the web, State Street foresees difficulties arising from the various technological advancement of their project team. This is especially true of subcontractors, some on whom are still using manual requests for payment applications.

The Future

There are no major technologies included in State Street's short-term plans. Instead, they are moving to integrate their existing software assets and provide for their full utilization.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	• Reduced turn around time		
Quality			• No Impact
Scheduling	• Information transparency will benefit schedule		
Management	• Reduction in mgmt time	• Potential information overload	
Documentation	• Captured documentation		
Remaining on Budget	• Information transparency will keep project on budget		
Claims	• Problems will come out sooner		
Administrative Costs	• Less meetings • Higher productivity	• Very expensive to administer extranet • Lots of training time	
Mitigating Risks	• May play a role by facilitating communciation		
Project opening			
Finance			
Carrying costs			

Interview with:
- Sarah K. Abrams, Vice-President of Portfolio Management

June 26, 2000

Description of Organization:

Fidelity Investments is a privately held financial services company with over 28,000 employees worldwide. They occupy approximately 8 million square feet of real estate worldwide. Their national real estate operating budget is approximately $120 million annually; their annual capital budget varies between $200-$250 million.

Design & Construction Process:

Fidelity Corporate Real Estate, LLC has approximately 180 employees. The group consists of a CFO, Vice President of Planning & Acquisitions, Vice President of National Engineering, and the Vice President of Portfolio Management (including construction.) All report to the President.

Once land is purchased or space is leased and the acquisition becomes a project, Abrams, as Vice President of Portfolio Management takes the lead role. They are responsible for all construction projects whether it is a new building or a tenant fit-out project. This group is also responsible for physically moving business unit clients into new space and for managing the space over the long term.

The construction process consists of partnering relationships with a few construction companies, architectural and engineering companies. Fidelity's process of selecting the partnered companies includes interviews, evaluation of

qualifications, and bidding of fees. The division works with, architects, engineers, contractors, internal and external clients to provide facilities.

Fidelity currently has over 8 million square feet of space with the following under construction:

- 600,000 sq. ft. in Texas
- 200,000 sq. ft. in Rhode Island
- 250,000 sq. ft. in New Hampshire
- 175,000 sq. ft. in Covington
- 200,000 sq. ft. in Boston

Fidelity's Real Estate division currently uses the Internet throughout their organization for the following functions:

- Internal and external email correspondence through email
- View drawings
- View digital site photographs and images
- Limited amount of public information

Fidelity has not invested in any extranet technology at this time, however they do require that their construction managers set up a system to post drawings and information using a Microsoft based operating system. This requirement is established in the Contract Bid documents before a project starts. While Fidelity has not had any significant resistance to this requirement, Ms. Abrams stated that it is tough getting individuals to use the Internet.

Extranets and Risk Management
One of Fidelity's primary concerns regarding Internet use in any manner is security of information. Because of the nature of their business, there is a large amount of proprietary information that the organization does not want on another organization's server. Ms. Abrams stated that the nature of their business and

the size of their organization affords them the opportunity to internally host their own system. Therefore, Fidelity would be more likely to either acquire a licensed product rather than using a service or internally develop their own system to collaborate.

The Future

Ms. Abrams stated that the Extranet products that exist and continue to be developed are simply tools to make life easier. She does not expect these tools to change the industry at all. In her opinion, while the Construction industry may be fragmented, it remains a people intensive industry that requires quality workmanship from individuals. It is possible that the tool can possibly increase productivity.

Additionally, Ms. Abrams stated that there are no incentives for owners to use the products because the controls can be acquired and used independently of a particular provider. In the future, Ms. Abrams thinks the industry will be consolidated and there will be a much smaller group of Extranet sites. In order for her organization to start considering the technology more seriously, she thinks there needs to be a more complete package that provides a full scope of services such as permitting, leasing assistance, obtaining competitive prices on property acquisition, lower interest rates on loans and space planning.

Fidelity has recently made a significant investment in a Facility management software called CAD/CAFM by Powergreen that allows them to track their entire portfolio and provide the reports that are needed to lease and manage their portfolio both nationally and regionally. The software tracks leases, integrates with an Oracle database and tracks projects and has altered the way that Fidelity manages its portfolio. Ultimately, the new software has allowed Fidelity Corporate Real Estate to turn information into knowledge. That is the kind of the tool that Fidelity requires for their organization.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing			Simply a tool to make managers lives easier.
Quality			Work is about people - quality cannot be improved by Internet.
Scheduling	Definitely would be helpful if it was a package that does updating and notification to responsible individuals		
Management	It can be used as a tool to enhance communication.		
Documentation			Not much different from before when files were handed over to Facilities division.
Remaining within budget			People are responsible for maintaining budgets
Claims	Double edged sword that can go either way depending on the issue at hand		
Administrative costs	Does allow people to do more. Maximize capabilities		
Mitigating risks	Information definitely helps to soften risk		
Project opening			Need to see concrete results before an opinion is rendered
Finance			Has not seen a package that provides cheaper financing. Usually is done better through companies' investment finance committee
Carrying costs	If opening is done sooner, then carrying costs are positively impacted		

Interview with:
- Gordon Braillesford, Director of Facility Planning

June 29, 2000

Genzyme is a highly diversified company that uses a wide range of technologies to provide human health care products and services. The company has extensive capabilities in sales and marketing, manufacturing, research and development, and other disciplines necessary for success in the health care market.

Genzyme operates in the following areas:

- Therapeutics
- Diagnostic products
- Gene therapy
- Genetics
- Molecular oncology
- Pharmaceuticals
- Surgical products
- Tissue repair

Design & Construction Process:

Genzyme works with developers to purchase and lease space and to complete long-term capital projects. Due to the complicated nature of Genzymes buildings and laboratories, Mr. Braillesford works with internal engineers and external architects to develop programs once a project is initiated. Genzyme performs the project management on over 90% its construction projects. Outside managers are used for smaller jobs, but Genzyme has not been pleased with the performance of most external project managers. Genzyme manages the projects

that are under construction, primarily due to the highly technical nature of the products and the specifications that the Genzyme engineers require.

The range of work that Genzyme performs ranges from space planning, facilities management, engineering services, and project management for capital improvement.

Genzyme uses the following Project controls to manage the design and construction process:

- Capital approval process: an internal process that is used to communicate project information to internal directors.
- Management reports baseline progress: Mr. Braillesford submits timely management reports to the teams that are involved in a particular project to insure schedule adherence.
- External resources
  - A/E
  - General contractors
  - Specialties
  - Subcontractors

Mr. Braillesford uses Microsoft Outlook and email to correspond and coordinate during the design process. They use email to communicate and resolve a number of design issues. Additionally, Genzyme uses Live-link, a directory structure analogous to Windows Explorer, to establish and organize project files. Live-link is helpful because it is used throughout the organization and is helpful when they are working with internal clients. Therefore, any collaboration product that they decide to use must have a database query capability as well as a directory structure that can be used throughout the organization. When selecting contractors and designers, Genzyme requires respondents to have adequate

Internet access as well as the ability to submit digital photographs and email capabilities.

Extranets and Managing Risk

Mr. Braillesford is currently evaluating extranet products to determine a system that will work for Genzyme. Because of the amount of paperwork that is currently used in their projects, Mr. Braillesford is looking for a product that will assist them with project initiation and programming, the ability to manage projects once construction is underway, training on building maintenance, project closeout and archiving upon project completion. Additionally, any product that Genzyme chooses must provide them the ability to differentiate information between various users. For example, internal clients and external consultants require different types of information, and he needs to be able to perform these activities with one system.

Mr. Braillesford's primary concerns are security and post-construction activities. Due to the nature of Genzyme's business, security is an important issue. The information that Genzyme uses is proprietary and confidential, therefore Mr. Braillesford is working to determine the benefits of using an internally hosted system versus and externally hosted operation. At this time, Mr. Braillesford is leaning towards a system that Genzyme would purchase and maintain internally, however, he does think that the organizations that specialize in extranets may offer good security provisions as well.

Because maintenance is an important internal customer that must operate the building upon completion, Mr. Braillesford is concerned about post-construction activities and how those actions will change with extranet technology.

Mr. Braillesford has received mixed reactions from his team regarding the introduction of extranets into the construction process. The developers have

been slow to offer input and averse to using computers and technology. The architect views it as a barrier while the engineers and the contractors prefer online collaboration tools.

Genzyme is talking to contractors and architects to understand what collaboration products that they are using. Mr. Braillesford stated that a number of organizations in the New England area are using Firstline. Genzyme is also looking E-room as a collaboration tool.

Genzyme has been unable to evaluate products due to the time and learning curve that is required, however they like E-room because it would be their own system and would be running on their server which would mitigate their concerns about security. Based on their research and progress, Genzyme expects to use an Extranet product to collaborate on their next project.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	• Drawing review • RFI review and flow tracking		
Quality		Technical expertise of individuals is a concern.	
Scheduling			
Management	Expects product to improve workflow, errors, notifications so that process begins to manage itself.	• People's willingness to use the product. • Contractors ability to own & support the technical requirements.	
Documentation	If information is kept in one location and used properly		
Remaining within Budget			Not sure that package will offer the type of updating and reporting that they require to perform budgetary functions.
Claims	If team uses product, then definitely sees a reduction in claims.		
Administrative costs			Will continue to need people but perhaps people will be able to do more.
Mitigating risks			Unsure about what Internet can do regarding risks; collaboration sites will give project managers more info.
Project opening			
Finance			Current packages have no impact. Will most likely continue to use traditional methods.
Carrying costs			Again, if timing is shortened, then carrying costs would be less, but Internet won't impact rates

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Interview with:
- Kathleen MacNeil, Senior Associate
- Howard Morris,

June 14,2000

Millennium Partners Boston is a joint venture between MDA Partners LLC and Millennium Partners. MDA Partners LLC has developed over 4 million square feet of commercial and residential space in greater Boston. Millennium Partners, based in New York City, is developing over $3 billion worth of commercial and residential space in major cities throughout the United States.

The design and construction process

As a private developer, Millennium characterizes design and construction as an out-sourced process. Millennium hires architects, consultants, and construction managers to handle the specifics of design and construction. The developer's role is to assemble and lead the team.

Risk is viewed as increasing as the process moves from conception and planning through lease-up. This is in part a factor of the amount of capital at risk. During feasibility studies, Millennium will have less time and money invested in a project than in construction. Furthermore, Morris believes that the most important risk that he faces is always market risk. Unlike financial risks that can always be hedged, the risk of not being able to lease the built space is always a considerable factor.

Possibilities of the Internet

Both MacNeil and Morris agree that the Internet will be able to replace the mundane tasks that are required to create buildings. Requests for Information,

submittals, and other paperwork are logical places for the Internet to have an immediate impact. However, the Internet will never be able to fully replace the need for face to face contact. The quantity of meetings will "definitely be reduced." Teleconferencing technology has already allowed the Boston office to make less frequent trip to New York City. MacNeil expects further advances in video conferencing and e-conferencing to continue to lessen but not eliminate meetings.

According to MacNeil, "It is unclear if any of these systems will be able to affect the time frame of the projects that the we are working on." She feels that, "The quality of laborers continues to decline and technology will not be able to fix that." Construction is a physical process and at some point there has to be a guy that will correctly make a bolt connection." The architect's responsibilities include observing and maintaining the quality of the project. Web cameras, digital imagery, and web-based collaboration will not replace the need for the architect to make site visits to ensure quality.

With regard to claims, Morris believes the Internet might lead to a shifting of liabilities between parties. This is based on Millennium's observation of a reduction in claims due to the advent of Construction Managers. CM's have facilitated communication between team members and have incentives in place so that problems are surfaced sooner. If extranets do encourage communication, then Millennium expects to see problems continue to surface even sooner.

Using the Internet
Millennium currently uses email and uses the Internet for content related searches. Examples include research on prospective tenants and reviewing vendor catalogs online. The ability to view catalogs and product cuts online was

faster than ordering catalogs and it also afforded the opportunity for Millennium to review cuts with the architect over the telephone.

The construction manager, Bovis/Lendlease currently has an intranet that handles technical data, forms, and procedures. They are currently looking into using an extranet and are considering 'testing' it on one of their projects in development.

Extranets and Decision Making

According to Morris and MacNeil, contractors seem to be making the largest effort to push extranet technologies. This may be due to four factors:

- Automatic contractor buy-in
- The developer wants to stay lean organization – continue to out-source design and construction
- No switching costs for contractor if they push the technology
- Construction is the largest line item on the budget. One can lump the costs of extranets into that budget easier than with soft costs.

Make or Buy Decision

For Millennium to pay for and use the technology there must be a proven payback or return on the investment. More academic research and more completed projects that have used extranets would provide the comparisons that Millennium needs to make a decision.

Currently Millennium can create many of the same features of extranets, but for use as an intranet. Viewer packages, email, Internet conferencing, scheduling, etc. can all currently be done independently without the use of an extranet.

<u>Extranet Pitfalls</u>

Morris and MacNeil agree that the developer must set the tone to use the system. Without the support from the developer, it is unlikely that the 'collaboration benefits' will be realized. Furthermore, the developer is in a position to demand use of an extranet.

In regards to the transparency of information that extranets can provide, Morris brought up an interesting point - "Sometimes you don't want information." By sharing information, a developer may not get the benefits that are afforded by the ambiguous information that currently exists in the marketplace. Morris has noticed that many developers like to keep things 'hazy' and then use the power of their personality. For example, if the case of change orders, a developer might ask the contractor to just hold them and settle them latter on. At that latter point, the developer may be able to extract a more favorable outcome than if every change is completely documented with price ramifications.

MacNeil questioned the potential added liabilities for the developer that are created as everybody on the team has information. If the developer using an extranet knows that that some building product is going to arrive at the site late, s/he may have a legal responsibility to notify the tenants if it affects their move in date. Prior to the free flow of information, the developer might not have access to this knowledge.

Compounding the issue of added liabilities from information transparency, MacNeil also sees pitfalls related to 'information overload.' "As everybody shares information," remarked MacNeil; " it might end up that all parties start performing the same job." The developer was outsourcing the design and construction, but with the free flow of information, the developer may need to process more information. In doing so, the developer may take some of the liability for the jobs

that were intended to be outsourced. According to MacNeil, "Sometimes you don't want information."

The Future

Morris and MacNeil view the real estate industry as a segment that is slow to adopt both technology and change. They believe that, "whatever happens with Internet technologies, it will be perfected in other industries and then brought to the real estate industry."

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing			• Unclear Impact
Quality			• No Impact
Scheduling			• Unclear Impact
Management	• Mundane tasks will be automated		
Documentation	• Centralized documentation		
Remaining on Budget			• Undetermined
Claims	• Raise problems before they become claims		
Administrative Costs		• May have to process more information	
Mitigating Risks			
Project opening			
Finance			
Carrying costs			

Interview with:
- Jonathan Randall, Assistant Vice President, Construction

June 28,2000

Boston Properties (BXP) is a fully integrated, self-administered, and self-managed real estate investment trust that develops, redevelops, acquires, operates, and owns a diverse portfolio of Class A office, industrial, and hotel properties. As of March 31, 2000, Boston Properties owned 139 properties totaling 36 million square feet.[9]

Randall has been working for Boston Properties for 3 years. He is currently the construction manager for 111 Huntington Avenue. His past completed projects with Boston Properties include a 260,000 sf office building in Waltham and a 180,000 sf office building in Cambridge (8 Cambridge Center). Prior to this position he worked for 9 years at Turner Construction. He has an MBA from Boston University.

Design and Construction Process

BXP requires all consultants to have contracts directly with the BXP and not through the architect. They want to be involved in all decisions and therefore use the contractual obligations to ensure that. General contractors and major subcontractors are always selected on the basis of a negotiated contract.

During the design and construction process, Randall believes that BXP needs a better "cross pollination of information." To reduce errors, they need everyone working off of the same drawings. For example, the architect currently provides a 'background' to the engineers for them to do their work. This background is

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[9] Source: Boston Properties Web Site.

delivered infrequently compared to the modifications to the design. Changed information such as this does not get communicated soon enough.

BXP has a project manager that deals with the marketing, finance, and legal issues. A construction manager is in charge of the largest line item, construction. His job is to bring the project in on time and on budget.

Selecting an Extranet

The owner has to push the use of an extranet system to the rest of the team. Since all of BXP's projects have negotiated contracts with the general contractor, all projects live by the golden rule; "the one with the gold makes the rules." The general contractor, however should handle administration of the system. After Construction Documents are completed, the contractor is the primary person creating and managing paperwork. Automation of these tasks allows the contractor the greatest potential savings from it use and administration.

Currently BXP is in a trial and error phase with different extranet systems. Price structure has been a major determinant of use. Many of the vendors have very different price points. For example, Bricsnet is charging BXP $250 per month for unlimited users on 111 Huntington. An Israel firm sought $8,000 per month for their services on the same project. (111 Huntington has a 36-month construction schedule.) Ease of use was another factor in selecting a system. The size of a project may also determine the use of an extranet. A smaller project with a $5 million dollar development cost might not be able to afford a full service extranet system. Instead, smaller projects might opt for a 'light software package' that many of the venders are now providing.

All of the major extranet vendors (Bricsnet, E-Builder, Cephren, Bidcom, Constructware) are trying to get a foothold in the construction industry. BXP is the obvious place for them to go to get an exclusive contract. In exchange for

getting their systems used, they are giving away warrants, equity, etc. BXP has agreed to use Bidcom for future projects in exchange for an equity stake in the company.

Randall believes that "Nobody has built the system yet." This system will have no double entry and will integrate completely with the general contractor's operations. All companies currently have their own systems and it is hard to get one system to do it all.

BXP is flexible in their decision to use Bidcom as a project extranet. The selection of an extranet is not paramount over maintaining a client relationship. On a build to suit project in Clemsford, MA for Tell-labs, the tenant wanted to use Constructware. BXP has decided to switch systems and use the software for that project.

Benefits

BXP itself does not directly see the benefits from the use of the extranet. There is no efficiency created on the owner's end. Reductions in courier and blueprint costs fall directly to the contractor, primarily the mechanical coordination. These items are reimbursable so may indirectly lower the cost of that line item. BXP is not receiving any credits from the contractor for these items nor are they receiving a reduced construction schedule. Randall believes that the use of an extranet will not condense or affect the construction schedule at all. Furthermore, BXP has seen no reduction in the need for face to face meetings.

Using Bricsnet

Every subcontractor working on the mechanical coordination of 111 Huntington Avenue is using Bricsnet. The software creates a log that details the revisions that occur during coordination. Only the mechanical/electrical subcontractors

need to be using the software. BXP does not put any of their project financial information on line. Security on the site has not been an issue to date.

Redline features that Bricsnet provides in their software have not been used by BXP. Instead, they are mainly using the RFI, change order, and submittal features. For 111 Huntington Ave., the extranet is a tool for construction and was not used for the design process.

When Randall needs the answer to a question regarding his project, he will usually use traditional communications technology in lieu of looking for the answer on Bricsnet. A slow Internet connection makes searching for an answer online more time consuming than placing a telephone call.

Impacts of Technology

The RFI logging feature creates more accountability and allows BXP to better manage outstanding items. Having your name attached to an RFI is seen as a powerful incentive to complete work in a timely manner. No major changes have occurred within their organization as a result from using the new technologies. BXP has seen no need to cut project staff nor have they seen differences within the general contractor's or architect's organization

Allowances have to be made for training. Bidcom wanted 5-6 hours of training for all consultants on the project team using the software. Randall believes this time commitment was excessive and that extranet providers could focus their training based on the ease of use of windows systems.

Make or buy decision

At Turner Construction, Randall was asked to created a web based Intranet. At first this required a significant amount of double entry because the programs were not compatible. He sought a system that was able to have an estimate that

becomes a budget, that becomes a cost report, that becomes and invoice, a change order, etc. Turner spent $1 million trying to fix the system and then gave up. In trying to make a system, Turner ran into the problem of having no technical support or 'help desk.' At BXP, software development is outside their core business and they will look to purchase the technology.

Value Chain Integration

Randall sees many difficulties in trying to tie a design and construction extranet into the facilities and property management systems. BXP, like many other real estate companies, have already made large investments in time and money on their existing legacy assets. There would have to be a tremendous benefit to switching to a completely new system. In regards to online procurement of building materials, BXP has no plans to do so at the current time.

Extranet Pitfalls

BXP is wary of the financial performance and longevity of the extranet providers. All of the companies are very new and are solely funded by venture capital money. Randall questions whether they will be able to survive on $250 per month. For BXP, they had to question what the chances would be that their vendor would go bankrupt during the long duration of their project's schedule.

Other pitfalls for extranet usage relate to technical issues. System crashes, speed, and capacity are all issues that the vendors will have to control in order to have wide spread adoption of the technology.

Changes in Information Flow

BXP does not see any benefit to maintaining the ambiguity of information that characterized work prior to the introduction of the extranet. BXP does not make their money in construction. Their goal is to get the tenant into the building on time. As a public REIT, BXP has a long-term mentality.

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Information overload caused by the use of an extranet may be more of an issue during the design process. During construction, the files exchanged over the Internet are simply electronic versions of the paperwork that everyone is used to.

Risks

BXP views risk as an increasing spectrum from design, to entitlements, to financing, to construction, and finally lease-up.

1. Design - risk is limited to A&E fees...assumes developer has experience in given industry type (office, hotel, residential etc..) and gives design team appropriate direction during design process

2. Entitlements - obviously every project is unique however most developers acquisition of site is contingent upon receiving necessary permits & approvals for certain SF, use and commencement of construction

3. Financing - obviously timing is everything....in this economic climate developers typically will not control deal w/out some form of financing in place....interest rate risk can be mitigated however that is the real risk...depending on developer and project easily could be 4th riskiest

4. Construction - again everything depends on the size, scale and complexity of project...for example our risk profile for a 3-story steel frame, brick facade office building is considerably different from a high-rise downtown tower..BP mitigates this risk by hiring the best CMs in business and our size and sheer volume of construction projects ensures best pricing and timing on long lead items such as steel and pre-cast concrete

5. Lease-Up - w/out a doubt the riskiest part of any development project unless a build-to-suit....it is where you make or break the project....just ask any developer who developed an office building between 1989 and 1993

(The above comments regarding risk are extracted from a communication with David Provost, Boston Properties' Project Manager for 111 Huntington)

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	• Faster RFI turn around		
Quality			
Scheduling			• No Impact
Management	• Creates accountability • Easy to manage outstanding items		
Documentation	• Eliminates some confusion		
Remaining on Budget			• No Impact
Claims			
Administrative Costs		• Some training costs	
Mitigating Risks			
Project opening			
Finance			
Carrying costs			

Interview with:
- Andrew Gutowski, Vice President of Development

July 21, 2000

The Charles E. Smith organization is comprised of a diverse portfolio of office, retail and residential buildings. Based in Arlington, Virginia, the corporate office encompasses a public company and a private company.

- The public company, Charles E. Smith Residential Realty, is traded on the New York Stock Exchange under the symbol "SRW." Smith Residential develops, acquires, owns and operates apartment buildings in Washington, D.C., Chicago, Boston and Southeast Florida.
- The private company, Charles E. Smith Commercial Realty, LP is a master limited partnership based in the Washington, D.C. area, that owns, acquires, develops, leases and manages high-quality commercial office and retail space and corporate real estate properties.

Charles E. Smith owns and manages what they build, creating both single and large mixed-use properties that are complete working, living, shopping and recreational environments.

Charles E. Smith has embraced the Internet in order to advertise and lease apartments, they also provide high speed Internet connections and business centers that are connected to the Internet in all of their properties. Throughout the organization, a large part of their communication is done through e-mail, however the development division continues to complete projects in a more traditional manner, without the use of extranets.

Andrew Gutawski began as Vice President of Development approximately two months ago and is excited about the new Internet technology that exists but has not yet made any concrete moves to integrate extranets into the development process. Mr. Gutawski stated that some individuals in his division are skeptical about the technology but he is moving forward and expects to began using extranet technology within the next year. Mr. Gutawski stated that they are looking for the following qualities in a product:

- View design and construction documents over the internet
- Review, answer and track RFIs.
- Review and track change orders.
- Monitors submittals and shop drawings
- Project management oriented package.
- Central document repository.

The following are some of the issues that Mr. Gutawski is currently contemplating:

- *Internal or External hosting*: Because they currently perform management and leasing tasks online, Mr. Gutawski felt that it may be easier to host their own site, however, he also thought that a company that is set up to handle those tasks may be able to provide more secure service.
- *Choosing a system*: Mr. Gutawski is currently contemplating whether or not to use one system on all projects, or whether to use a few systems on each project to determine how successful they are.
- *Managing the process*: Mr. Gutawski was unsure as to whether or not they would prescribe and fund a system or whether they should put the burden on their architects and contractors. He did not think that there would be a problem getting architects and contractors to use the system because of their size and history they have been able to attract high quality designers and builders with good track records in the industry.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	Feels that on-line collaboration with one set of documents and information will definitely improve their timing on projects.		
Quality			Perhaps people will be better informed, but quality is still a people issue that the internet can't fix.
Scheduling	If everyone is aware of and has constant access to the schedule, then it will definitely have a positive impact.		
Management	Knowledge is power. If managers have more good information, then they will be able to manage better.		
Documentation	Looks forward to one stop shopping regarding documentation.		
Remaining on Budget			Still an issue beyond the control of the internet
Claims	If documentation is well kept, then claims should become a non-issue.		
Administrative Costs	Should be able to do more with less.		
Mitigating Risks			N/A
Project opening			N/A
Finance			Will not impact the way that CE Smith finances projects.
Carrying costs			Internet probably will not impact their carrying costs.

Interview with:
- N. Scott Bates, Director of Business Development

July 17, 2000

Tishman Construction Corporation of Massachusetts is an affiliate of Tishman Realty & Construction Co., Inc., which celebrated its 100th Anniversary in 1998. Tishman affiliates comprise a diverse group of real estate and construction companies responsible for building more than 400 million square feet of all types of space for their own account as well as for others. Their total value of construction under contract is $4.0 billion. Current Tishman Construction Corporation of Massachusetts clients include: Hilton Hotels Corporation, Massport, Delta Air Lines, MCI/WorldCom, Level (3) Communications, Atlantic Retail Properties, City of Lawrence, and Dover-Sherborn Regional School District.

Landmark Tishman projects include the World Trade Center twin towers and the renovation and restoration of Carnegie Hall in New York City, the John Hancock Center in Chicago, and the Walt Disney Company's EPCOT Center in Florida.

Environment
Bates feels that there are approximately 10 'competitive' products in the market for project specific websites and it will eventually consolidate to 3 or 4 companies. In general, Bates believes that "People (the customers) are confused." Marketing campaigns and sales speeches further the confusion in that everyone is claiming the "best product." Time and resource constraints are limiting the ability of companies to accurately compare products and services. Furthermore, not enough academic case studies or unbiased research has been conducted to assist project teams in making a decision. Even if case studies can

be completed, the multitude of variables in a construction project make quantifying the benefits extremely difficult and rather subjective.

Within this environment, Bates observes that the power of extranet marketers and salesmen can be very powerful. Often it appears that the "first (vender) in the door" will get the job simply because it lessens the owners confusion. Bates acknowledges, "there is presently and will continue to be a lot of shake-out (in this industry)."

In selecting an extranet provider, the long-term viability of the company is a major factor. "Everyone wants to jump onto something that is here to stay." Bidcom and Cephren's backing by Oracle was a major factor in Tishman selecting their products and services for some of the projects in development.

Using Extranets

On various projects, Tishman has or is in the process of using the following extranet services: Cephren, Constructware, E-Builder, Framework Technologies, and Bidcom. Most often, the decision to use a system and the choice of the system came from the owner. However, Tishman is looking to move towards a corporate standard.

Bates currently sees the use of a project specific website as a differentiator. Many other companies still have not proven their technological abilities. In the current market, Tishman can team up with an extranet provider to demonstrate their acceptance and use of technology. According to Bates, they will not win a project solely on the basis of an extranet, but it helps to differentiate them from their competitors. As the technology becomes widespread, within the next couple of years, the differentiation benefits are expected to dissipate.

At the current time, Tishman is anticipating using a project specific website on long duration, larger budget, construction projects that have complex team structures. A project with a construction schedule of less than 6 months would not be a suitable candidate due to the 'ramp up time' required to learn the system. Projects in which multiple owners involved, multiple contractors, multiple architects, or that need to include public disclosures would strongly warrant an extranet's use to organize the communication between the team members.

Pushing the Extranet

Bates believes "everyone (in the industry) should be pushing for the adoption of project specific web sites." However, it is the owner that must ultimately support its use. "The only way (an extranet) is going to work is if the owner demands it." Without the owners demand, team members will slip into old habits that at first seem easier than learning a new system. To be effective, Bates believes that there has to be at least 80% involvement of the project team members. Otherwise, there will be no collaboration benefits.

Bates believes that there is still a lack of understanding on the part of the software developers about what construction is all about. There are so many different arrangements (CM, design-bid-build, design-build, etc.) based on size of project and region of the country. 'One "shoe" does not fit all'. Developers also did not anticipate the volume of information generated by one construction project and therefore are having trouble scaling up to meet demands.

Extranet Benefits

Bates believes that is difficult if not impossible to quantify the benefits of using a project specific website. Any reduction in schedule or budget could be a result of a multitude of other factors only one of which could be the use of an extranet. Instead, Bates feels the real test for an extranet will be to ask the project managers if they felt it was beneficial.

In the current workplace, Bates does not believe that the project managers are seeing the benefits yet. More sharing is expected of project managers than ever before. In Bates words, "the industry needs to think like a team and not individual companies. Software developers must also understand our business more." These two issues pose the biggest barriers to acceptance of extranets by managers.

With more acceptance of extranets, Bates conjectures that projects may see diminished claims. Any reduction would be a result of managers using the system to find and correct problems earlier than they would have otherwise. As for affecting the schedule, Bates thinks it is too early to make any definitive conclusions. In the long haul, more efficiency is expected. Project managers will be able to do more within the same amount of time. Fewer meetings are also expected to be result of effective extranet usage.

Bates believes the owner will reap the most benefits from the use of an extranet. The system will put more accurate information at his disposal. The contractor will see benefits from the communication afforded by the extranet. Contractors will be using the most in completing RFIs and submittals. Finally the architect will see the least amount of benefit. Architects are in a position to answer correspondence from the contractor. For them, it as a good source for document retrieval. They can use the database behind the information and run queries regarding schedules, costs, etc.

Online Procurement

The ability for online procurement of building materials in any serious capacity is "going to take a lot longer." For strictly commodity items at the subcontractor level, Bates sees no barriers to e-commerce. However, for Tishman, most items are not completely price driven. Relationships, quality, availability, trust and a

whole host of other factors go into making a decision to purchase materials. Any e-commerce site would have to make serious pre-qualifications in order to ensure these factors. In buying materials, Bates believes they are actually buying 'people.' People to perform and carry out the work.

Extranet Pitfalls

The need for adequate, responsive customer service is critical to the success of extranets, especially during this time of new technologies and services. Bates is of the opinion that vender's training and support services have been diminishing rather than remaining on a constant level. He also sees a scalability problem with the huge volume of information that needs to be processed.

The current pricing of extranet services appears uneven. Furthermore, Tishman is performing valuable services to the venders by using their products and providing feedback. According to Bates, "we are a beta site" for these extranets. Venders are also leveraging Tishman's name as a client to market themselves. Tishman finds it sometimes difficult to justify paying full price when the promises of technology are not in place yet. Still, we need to continue to learn about the systems and shape them to meet our needs.

The Future

According to Bates, "We need to get over this … 'I can't do this mentality.'" A new mindset needs to emerge within the industry. "People need to embrace the whole team and not guard information as they did in the past." These changes will bring about dramatic shifts in the way business is conducted. But in order for all this to happen, the industry must first understand why it is that the "we need to change the way we do business." Academic research and marketing campaigns should be focused on this issue first.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	• Reduced turn around time		
Quality			• No Impact
Scheduling			
Management	• Reduction in mgmt time	• Learning curve takes some additional work	
Documentation	• Accurate accessible information		
Remaining on Budget			
Claims	• Diminish claims		
Administrative Costs	• Efficiency • Higher productivity • Fewer meetings	• May have to process more information	
Mitigating Risks			
Project opening			
Finance			
Carrying costs		Many extranets are too expensive	

Interview with:
- Tom Tharpe– Construction and Contracts Administrator
- Kevin McLellan – Project Manager

June 25, 2000

MIT is one of the world's outstanding universities. Education and research with relevance to the practical world as a guiding principle continue to be its primary purpose. MIT is independent, coeducational, and privately endowed. It is organized into five schools that contain 21 academic departments, as well as many interdepartmental programs, laboratories, and centers whose work extends beyond traditional departmental boundaries.

Design & Construction Process:

MIT currently uses and controls approximately 9,828,609 square feet of space. The MIT Department of Facilities provides the physical environment, utilities, and support services necessary to promote the educational and research activities of the Institute. The Engineering, Construction, Maintenance, and Operating Groups of Facilities accomplish this. To ensure quality service to the MIT community, the department provides strong coordination and communications between multi-functional groups and their customers. Training and the development of self-directed work teams promote a work environment that encourages employee initiative and development. The facilities division considers themselves a customer services oriented department. Design and Construction provides construction coordination for new construction as well as all space change and renovation projects for the Institute. In addition, this group provides architectural, interior and engineering design, and estimating services for all projects. The Systems Engineering group, part of the Design and Construction section, provides the building systems engineering leadership necessary for the long-term

benefit of the Institute. The Engineering staff advises Design and Construction project managers executing renovation and expansion projects.

MIT does projects ranging from routine preventive maintenance and renovations to large capital projects such as the Stata Center which is currently under construction. The Design and Construction division hires outside construction managers at risk, on larger projects and MIT project managers track progress, perform reporting, and facilitate progress by working with internal customers.

Extranets and Managing Risk

When selecting contractors and designers, MIT requires respondents to have Internet access, the ability to submit digital photographs, and e-mail capabilities. Additionally, MIT has started to require respondents to use Internet collaboration sites that are supplied and funded by MIT.

Mr. McLellan is currently using BidCom on a large renovation project. Mr. McLellan chose BidCom because he needed a project management package and not simply a file storage system, which is what he considers a number of the extranet packages to be.

Mr. Tharpe is currently responsible for a number of smaller renovation projects throughout MIT's campus, and has decided to use Frameworks to coordinate that activity.

The individuals in the Facilities division have chosen to use different packages because they are in the testing stages of the technology. The division felt that it would be more beneficial to experiment with a number of different packages to determine both strengths and weaknesses before deciding to use one system throughout the Institute. This approach has been successful thus far, because

they have realized that their needs vary based on the size and scope of the projects that they are working on.

Some of the extranet technology concerns that Mr. Tharpe and Mr. McLellan have are security, actual and post-construction activities.

While MIT has chosen to use externally hosted services, they remain optimistically cautious about the security of the services. Given the Institutes' advanced approach, early adaptation of technology, and thorough research, they felt that the externally hosted systems would provide necessary security because the company's primary focus is providing a secure service.

Their main issue with construction activity is control of users. Both Mr. Tharpe and Mr. McLellan feel that it is extremely important for the owner to have the maximum amount of control during construction. However it has been difficult to change the mindset of contractors and architects that are not used to communicating electronically. Mr. McLellan has found it difficult to convince his consultants to use the product, and has to mandate its use.

Mr. McLellan stated that when the product is used properly, the results have been positive. They have been able to make decisions quicker, and with good information and they were able to complete the design review process in a shorter amount of time than normal.

MIT evaluated the various products based on the following issues:
- Access: they required a product that had multiple levels of security access so that they would be able to set varying requirements based on the user.
- Ability to support multiple platforms

- Ability to provide history, backup, and technical support: this category was ranked and the organization with the highest ranking was evaluated more closely.

- Financial stability of the provider: MIT looked at the funding sources, investors and number of employees of each organization.

- Hosting: needed the ability to provide website hosting as well as client and public pages. MIT is looking to provide project updates to both its internal and external customers and integrating this into the extranet site is extremely important.

- Redline: must have the ability to redline drawings using the software. This was a key feature that MIT was interested in because in their experience, this process took too much time.

- Email: MIT wanted notification of directed activity as well as verification of delivery and receipt of information. They felt this tool was important in managing a project.

- Pending reports: Whether it is RFI's, shop drawings, or a change orders, MIT needs to know what is pending versus complete. The product must possess this capability.

- Discussion threads

- Database features (grouping, sorting, issues): Needs the ability to produce the type of information that they feel necessary and display it in their own fashion.

- Supports multiple projects: while they are testing products now, in the furture MIT is looking to use one or two products therefore it is important that the products be able to support multiple projects.

- Daily technical support: Reliable technical support is a must because of the nature of the business that MIT conducts.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	▪ Drawing review ▪ RFI review and flow tracking ▪ Historical record of documents		
Quality			Remains a people intensive industry that depends on skilled labor
Scheduling			Sees no impact on changing the way projects are scheduled
Management	Requires less staff or will allow individuals to accomplish more with the same amount of people.		
Documentation	Electronically archived documents aids in transition of information to facilities to operate buildings.		
Remaining within budget			
Claims			Has not dealt with any claims yet, but feels that if people continue to input all information into system, they should have fewer claims because information will be maintained in one central location.
Administrative costs	Thinks they will be able to do more work with the product.		
Mitigating risks			N/A
Project opening			N/A
Finance			Does not believe internet will influence the way that MIT finances its projects
Carrying costs	Expect building to be opened earlier based on improved communication,		

Interview with:
- Susan Personette, AIA, Senior Project Manager

July 7, 2000

Susan has been with the Design and Construction Services Department for 11 years. Her background is in Architecture and her primary responsibilities include budget, schedule, and quality.

Design and Construction Process

In their capital projects, MIT prefers to have most of the consultants under the architect's contract. This allows MIT to have 'one stop shopping' for accountability and ease of management. In addition to these consultants, MIT may directly hire specialized consultants such as environmental engineers, or in the case of IT, Collaborative Structures. The general contractor is often selected on the basis of a negotiated contract. Personette's last recollection of a bid awarded job was 8 years ago.

In addition to capital projects, the facilities group also works on many small projects each year. Personette estimates that these 'space change projects' represent approximately 70 projects per year with a duration of 2 months.

Problems relating to communication and conflict resolution are the major issues that MIT encounters during the design and construction process.

Media Lab

Personette is the senior project manager on MIT's Media Lab expansion project. Currently in design development, the Okawa Center for Future Children (the labs new home) is expected to be completed in January 2004. The 155,000 square

foot building is expected to cost $375 per s.f. in hard costs and $125 in soft costs. In March 2000, MIT announced that Collaborative Structures' FirstLine would be used to host project communication. (Business Wire, 3/13/00)

The project team includes:

- MIT Design and Construction Services
- Construction Manager - Macomber Construction
- Architect – Fumihiko Maki from Japan
- Architect – Leers Weinzapfel from Boston
- Media Lab Facilities manager.
- Media Lab Client Team – gives all information and feedback to Facilities manager
- Local engineers and consultants

Selecting an Extranet:

Prior to selecting FirstLine, MIT analyzed 7 different extranet providers to determine which service best fit the Media Center project's needs. The IS personnel of the architects, and the construction manager assisted in the search. FirstLine was selected for three primary reasons:

- High level of service
- The ability to influence the design of the product
- Using only email to send drawings between the two architects and all of the consultants would not work.

In addition to the Media Center's extranet needs, MIT also considered adopting one system for all of the facilities' projects. The search for a standard extranet became, according to Personette, 'bogged down by internal politics.' The department was looking towards Framework Technologies' product to fulfill this role, however, Personette believes Frameworks may be better suited for only

smaller projects. From this experience, MIT has learned that, "one size does not fit all," when it comes to extranets. 'With everything so new," Personette believes that, "we will be left with only a handful of vendors.'

In regards to who should make the decision to use an extranet on a project, Personette believes that it should be a management (owner) decision. There should always be a project champion that pushes for and encourages the team to use the technology. "This should always be the owner." Only an owner will have the ability to "grind it though people and be persistent for its use."

Using FirstLine

Personette characterizes her department's usage of FirstLine as immediate excitement, followed by a 'fall off' period where users begin to wonder if using the extranet is more work than the way they used to operate. This cycle then repeats as users acclimate to the system but then find some cumbersome functions that impede progress. Users would express their frustration in claiming that they "wish (FirstLine) was as fast as email."

Personette describes these difficulties as problems growing out of adjusting to a new technology. To ease the transition, MIT has asked Collaborative Structures to make refinements to their software and interface. Team buy-in for the system has been very successful due to two reasons. First, input from all parties was used in selecting a system. Second, the use of a Collaborative Structures as third party server, created a legal separation in which the owner cannot taper with the posted files.

The project team is expected to continue using FirstLine into construction. MIT will require the major subcontractors to use First Line. Personette expects these to include the following trades: Curtain wall, MEP, Structural Steel, and perhaps concrete. Webcams and other digital equipment will most likely not be used to

monitor the construction process. MIT's experience has been that the union labor is opposed to their use.

FirstLine as a Design Collaboration Tool

For the project team, FirstLine was 'absolutely critical as a collaborative design tool.' Unlike many projects with 'star' architects, there was not a design architect that passed drawings onto a local production architect. Both architects were expected to work together and the web enabled communication between the long distance parties that would not have been possible otherwise.

The facilities department also found FirstLine's discussion thread map feature very valuable during the design process. Managers in the department could easily monitor progress on important issues. To aid in the design process, the team established a log of 'Design Issues' which were tantamount to Design Requests for Information. As topics were brought up, they were logged into the Design Issue database. Again, the discussion thread feature assisted in monitoring the resolution of the items. By using these features of FirstLine, the Media Lab's design process became more formalized.

Changes resulting from the technology

Prior to adopting FirstLine, MIT had many early discussions on how they should file the documents generated during the design and construction process. They came to conclusion that they "didn't have to use the extranet as a file cabinet." The database that an extranet would provide would allow them to store files differently. Instead of searching through multiple folders, MIT could access the information through the database.

With access to such a database, MIT had to come to grips with leveraging the technology instead of resorting to the same old business practices. To search for answers to complex questions regarding her project, Personette embraced the

new technology. The discussion threads added a new dimension to the answers that the project manager needed. For simple questions, a simple phone usually would suffice.

The facilities department also had to be constantly reminded to use the extranet instead of using the email systems to which they had grow accustomed. As a manager, Personette usually downloads, prints, and files documents in addition to the electronic versions.

Benefits of FirstLine
Due to increased accountability and transparency of information, problems with communication and conflict resolution have been lessened. FirstLine kept all project members 'in the loop' during crucial decisions. During construction, Personette speculates that the process is so paperwork intensive that the technology will continue to greatly benefit the communication and conflict resolution problems.

According to Personette, '(FirstLine) will save more than the $100,000 (they) spent on it. Perhaps it savings will be more like $400,000-$500,000." She sees great potential in the ability to have a complete project record on a CD at completion of the project. The facilities department will easily be able to extract valuable data from this project to use for future planning.

Rating of Risk during the Process
Most of the risk surrounding the Media Center Expansion surrounds the design and schedule for completion. The legal risk is perceived to be quite small and construction risk is no different than for any other project. Personette has focused on mitigating the design risks associated with having a high profile architect that has completed only one project in the U.S. MIT had Macomber Construction use Maki's completed buildings in Japan to help establish a budget

in US dollars. While the construction itself may not propose any unique risks, (other than a special curtain wall detail) maintaining the construction schedule is crucial for the university. For MIT, "time is students." A building has to open for the start of classes. Personette felt that the dependence on schedule is more important for an institution than for a private real estate developer.

Impacts of Technology

Personette believes that the project schedule will go more smoothly during construction due to FirstLine.' Already she has seen a reduction in turnaround time for responses and she expects this to continue. The extranet is seen as a process tool and is not expected to have any impact on the project's quality. FirstLine does create a clear record of events that facilitates distribution and modification.

One of the areas that MIT would like to see improvement during construction is in conflict resolution. The online, real time tracking features of FirstLine create instant accountability that Personette believes will surface problems sooner. Thereby reducing the need for conflict resolution in the field.

In reducing administration costs, MIT is expecting to have less meetings and higher productivity from their team members. Information is more accessible and the heightened accountability will cut management time irrespective of the location of the team member. Tremendous cost savings are also expected to be gained through the reducing in Federal Express and courier costs. All costs associated with running and administering the extranet itself MIT have been pushed to Collaborative Structures. MIT wants 'one-stop shopping' for their IT demands and does not want to commit departmental resources to running the system. Personette has observed that there has been no change to the structure of their internal team due to the use of FirstLine. It is simply a newer tool.

Extranet Pitfalls

The largest risk MIT sees in this new technology is the risk of the dotcom companies going bankrupt during the long duration of the Media Center Expansion. Before signing a contract, MIT reviewed Collaborative Structures' financial statements to ensure their longevity. Switching costs involved in changing systems mid-project are seen as very high and would be considered a difficult task.

Speed and issues regarding different competencies and hardware were other pitfalls that MIT had to deal with. Some consultants have dial-up modems, some have old computers, and some have high-speed Internet connections. MIT expects this problem to get worse as the Media Center moves into construction when an even larger audience of individuals log onto the system.

The Future

In the long term, MIT would like to link all the projects that the university is working on. This would give the facilities department the ability to see all the projects together and collect current data. MIT would be interested in integrating the design and construction extranet with a facilities management database. However, Personette believes that the technology is "quite a long way from doing that." The legacy assets that are currently being used in the facilities group may impede the early adoption of any integrative technology. In regards to on-line procurement of building materials, MIT would allow their contractor to purchase materials on an electronic market place.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	• Reduce turn around time		
Quality			• No Impact
Scheduling	• Project will go more smoothly		
Management	• Reduction in mgmt time		
Documentation	• Accessible Information		
Remaining on Budget			
Claims	• Problems will come out sooner		
Administrative Costs	• Less meetings • Higher productivity • Lower mailing costs		
Mitigating Risks			
Project opening	• Will help to keep team on schedule		
Finance			
Carrying costs	• Will receive benefit greater than cost		

Interview with:
- David T. Lewis – Senior Project Manager, Construction

July 14, 18, 21, 2000

Lewis has an architecture background. He has worked as an architect, an owner's representative for retirement community projects, and as a project manager for design and construction for a museum in Kuala Lumpur. Since April 2000, he has been working as a senior manager in charge of construction for MIT Stata Center.

The Stata Center Project

The project currently in construction totals approximately 430,000 square feet and will bring together teaching and research space for the Laboratory for Computer Science (LCS), the Artificial Intelligence (AI) Laboratory, the Laboratory for Information and Decision Systems, and the Department of Linguistics and Philosophy. The budget for the project is over $60 million.

- MIT Design and Construction Services
- Architect – Frank O. Gehry and Associates (Los Angeles)
- Local Architect – Cannon (Boston)
- Contractor – Beacon Skanska
- Stata Center Client Groups
- Consultants:
- Landscape (Philadelphia)
- MEP (Boston)
- Structural (Los Angeles)
- Lighting (Germany)
- Subcontractors including:
- Steel fabrication (Providence)
- Metal skin – (Venice, Italy)

The construction process for the Stata Center in divided into five phases:

- Slurry wall (foundations)

- Parking Garage

- Shell and Core of Building

- Interior fit up

- Landscape

Selecting an Extranet:

The decision to use an extranet on this project was based on two primary issues. First, the use of a remote star architect for a high profile building demanded better communication during construction. Second, the complexity of project's design required a collaborative environment. The decision to use Bidcom as the extranet provider was made prior to Lewis' arrival on the project. Gehry's office was a major force pushing for its adoption.

Prior to the selection of Bidcom, the Stata Center team was using the Internet to communicate. Gehry's office had set up a project website for communication but it did not have the features of Bidcom's product. MIT also had created a project website; however, it was used for public relations and not communication.

Lewis believes that anybody can make the decision to use an extranet, however, the architect and contractor, "must be happy with it." The contractor and architect must be in agreement because their companies' use and communication over the system is vital to the success of the extranet as a tool.

Using Bidcom

Lewis relays that MIT as well as the rest of the project team has and continues to spend an "inordinate amount of time" trying to use Bidcom. He qualified this statement with the belief that the project team is 'really using the system' and trying to push the technology. The construction schedule is expected to allow for

the team to get used to Bidcom. Submittals and RFIs that deal with the concrete slurry wall have to put into the system. The team is learning the application using this limited number of items and once they have achieved proficiency, the construction will progress to the parking garage and shell and core construction. This portion of the work will have more submittals, shop drawings, and RFIs than the slurry wall phase.

The contractor will decide which subcontractors will be required to submit shop drawings electronically. It is expected that MEP, structural steel, and metal skin trades will be using Bidcom. The RFI, memos, submittals, and meeting note databases are already getting a lot of use by the team. Lewis describes the current state of use as a time of establishing precedents on how the team will use and communicate electronically.

The inalterability of documents that are posted is cited as one of Bidcom's strong points. Also noted was the ability to link responses, to easily determine to who gets documents, and to easily determine who received and read the documents. With these strong points, Lewis points out that the workflow is rather rigid and he believes it may not be flexible enough for truly 'unique' projects.

In the course of it's use, MIT and the rest of the project team have found many 'bugs' and awkward procedures in Bidcom's product. Lewis cited that meeting notes have to be composed online or else have to be cut and pasted into the Bidcom database in a time consuming procedure. Also, the layout and organization of the databases were seen as inefficient. MIT has found resistance on Bidcom's part to change existing databases and add requested fields. This resistance stems from the changes that will affect all other Bidcom customers that are using the service as well.

Benefits of Bidcom

Lewis characterizes the use of Bidcom as an improvement to the traditional way of communicating. He recognizes it as being faster and in some ways more flexible. For shop drawings, the only way to send full size sheets is to mail them. Mail is seen to be too slow. For overnight services, if drawings are prepared at 9:00 AM or 5:00 PM, they will be delivered at the same time. Electronically, the communication is instant.

There are two major categories of benefits resulting from using an extranet: Communication and Information Availability. Under the category of communication, benefits are received by increased responsibility, ease of distribution, and speed. Features such as date stamps and sent and received logs heighten the quality of communication by creating responsibility for users. "People feel more responsible for what they say when they know it will become part of a permanent record." To Lewis, at first this seems like a negative, but in practice he sees this heightened responsibility as giving the team members "confidence in not being misquoted." The team is also more careful in how they communicate. The extranet at times has acted like a neutral third party. Over the telephone, communication can become more emotional and documentation of the discussion can become subjective. The extranet may disintermediate this problem. The speed and ease of distribution of documents over the extranet helps to separate the distance 'between the fax machine and the team member's office."

Under the category of information availability, Lewis sees tremendous benefit from the restriction on place. Information can be received at any locations at any time. Furthermore, all team members are aware the 'master files' are kept and can reference them as needed.

Lewis is using the system due to the "secure and accurate communication that is possible over long distances. " Communication is now seen as "formal, rapid, and pretty precise." It is helping the team to transfer directives between team members. Shop drawings and submittals are simply directives for the rest of team to follow. If these directives can be as clear as possible, the team will see benefits. According to Lewis, "communication is the biggest issue and leads into trouble with record keeping."

In the long term, Lewis believes that by consistently using an extranet, the perceived risk in a project will be lowered. The owner pays for this perceived risk in a high contingency. As projects are completed using the system, and impacts from claim reduction are realized, then lower contingencies are expected to follow.

Changes resulting from the technology

MIT has seen no change to the team's roles through the use of Bidcom's extranet. Lewis mentioned that he is unwilling to change too much in the way he processes workflow. He will make minor adaptations, but is not seeking to redefine his role. For example, Lewis typically blind copies his internal project team about major issues. Bidcom does not have a blind copy feature so Lewis has found another procedure to perform the same task.

Impacts of Technology

Lewis sees no impact of the construction schedule that is directly attributable to the use of Bidcom. He believes that "with good management you could do it just as fast as you could if you used an extranet." As for claims, Lewis believes that disputes will always occur on construction projects. When a dispute arises, it will deal with quality, schedule, or cost. MIT's policy in resolving disputes is to find the 'truth' that may or may not underlie the claim. If additional services were

required, the university will pay what is fair, but refuses to pay more than what is fair. The extranet is expected to help in finding the 'truth.'

MIT is expecting some impact in terms of administration costs. There are definitely savings on postage. "The entire system is essentially short cutting the postal system, and centralizing the information system. In the end this may be all that it is doing." MIT is not expecting to see a reduction is meetings. The project team is already using teleconferencing and video-conferencing technologies. When the cost of the extranet and the time of learning the product are factored in, Lewis is unsure if there are real administrative savings. In his words, "they are experimenting with it."

Extranet Pitfalls

The most profound pitfall MIT has run across in using Bidcom has been that the applications provided are not as developed as stand alone products. The databases and interface is not as current as what MIT could get directly from Oracle. Also, the products are not as intuitive as commonly available products such as Microsoft's suite of office applications. The teams do have the time to read through manuals or go to long training sessions. Therefore, having an intuitive program is essential for full usage.

Another important pitfall that MIT is minding is the risk of the team not using the system. If the team does not use Bidcom, collaboration, communications, and information benefits will not appear. Lewis keeps a close eye on who is using the system and to what extent. By watching the distribution list on a item, Lewis can ascertain who hasn't read their pending items in days. He then is in a position to place a phone call or send a paper fax to alert that team member of the pending issue. Currently most RFI's, all shop drawings, and most submittals are being done over Bidcom with complete buy-in from the architect, engineers, contractor, and owner.

The Future

MIT sees itself as learning about these new technologies in an experimental manner. From their experiences, they are learning what to ask for from an extranet provider. Extranets are viewed as a "new vehicle for sophisticated users." Any standard database program will not meet their needs.

Impact Summary

Area of Impact	Positive Impact	Negative Impact	No Impact
Timing	• Communication is in real time		
Quality			
Scheduling			• No benefit that good management alone wouldn't realize
Management	• Distribution is easier	• Program may not fit with current procedures	
Documentation	• Centralized documentation		
Remaining on Budget			• Undetermined
Claims	• Easier to find source of claim		
Administrative Costs	• Savings in postage		• Undecided on how total admin. costs will be impacted
Mitigating Risks	• Lower perceived project risk		
Project opening			
Finance			
Carrying costs			

The hypothesis tested was that owners and developers of real estate were looking to use project extranets to gain a competitive advantage. Our results indicate a resounding 'no' to our hypothesis. No owners or developers are currently looking at extranets as a source of competitive advantage *at this time*. But the results of our thesis do not end simply with a 'no.' Instead, the reasons underlying the responses are perhaps more valuable than the question itself.

First, we must understand the changing owner's perspective during the life-span of the extranet industry. The diagram below represents owner's attitudes towards the products studied in this thesis. Just four years ago, in 1996, almost no owners were aware of project extranets. Today, awareness is rather high but usage of the technology is still limited. Only 4 of the 8 firms surveyed had used or were in the process of using a project extranet. Causing the hesitation are three major issues. First, the youth of the industry allows for little opportunity to accurately quantify the benefits of collaborating online. Second, the rapid introduction and development of new technologies makes adoption in an immature market difficult. Standard 'features' have not been fully established and appear to change frequently. Third, the sheer number of vendors and price points make the owner's decision more complicated.

1996	2000	2005
No Awareness	Some Awareness & Experimentation	??

Millennium Genzyme, Fidelity, and Charles E. Smith are still conducting research and have yet to adopt any systems. Boston Properties, MIT, State Street Bank, and Tishman are experimenting with different systems and doing so only on

select projects. The real question is whether extranet technologies could be a source of competitive advantage in the future.

To evaluate how extranets could be a source of competitive advantage in the future, we must next look at what the technology must deliver for these businesses. Below, the participating companies have been segmented based on the type of business they perform. This segmentation aids in drawing out similarities in risk profiles across organizations that perform similar functions.

	Risk		
	Market	Finance	Design & Construction
Corporate Owner /Occupier Manufacturing *Genzyme* Support *Fidelity* *State Street*			Delay is Critical Delay is bad
Institutional Owner/Occupier *MIT*			No Delays
Owner/Non-Occupier *Millennium* *Boston Prop.* *C.E. Smith* *Tishman*	Critical		

Corporate Owner/Occupier – Manufacturer

To the corporate owner/occupier of a manufacturing operation, design and construction delays are critical. Any delay in opening a plant is a delay in 'time to revenue.' Market risks are shifted away from real estate and facilities and onto the markets in which they are selling the products. (In Genzyme's case, the pharmacutical market) For any product to be a source of competitive advantage, it must be able to further their core business. With the facilities group, that

translates into completing projects <u>faster</u>. An improvement in facility construction could further their existing generic strategy. (i.e. a cost focus, or differentiated strategy)

Corporate Owner/Occupier - Support

For other corporate owner/occupiers, real estate is a support function that is necessary for housing employees and other types of equipment. These owners view risk during design and construction as very important but usually do not have the same 'time to revenue' aspect of a manufacturing operation. The support function of real estate to these owners demands <u>predictability</u> and <u>execution</u>.

Owner/Occupier - Institutional

Similar to corporate owners, Institutional Owner/occupiers have little market risk to contend with in real estate operations. Therefore, design and construction risk again becomes critical. Institutions such as universities have limitations on schedule delays do to operations. If for example, MIT cannot complete the Media Center expansion in January, the schedule has to slip until after the next semester in Septmeber. These limitations force the institution to search for <u>certainty</u> when it comes to the design and construction schedule. For universities, "time is students."[10]

Owner/Non-Occupier

Owner/Non-Occupiers are in a very different position. For them real estate is their core function. Unless a building is a 'built-to suit.' the market risk "is where you make or break the project... just ask (anyone) who developed an office building between 1989 and 1993.[11]" Financing risks can be hedged and design /construction risks are overshadowed by the market. If a building schedule is delayed yet there is not market for its use, the risk of completing it on time is

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[10] Interview with Susan Personette from MIT.

moot. To aid them in their businesses, these owners need to mitigate <u>market</u> risks.

Management

In executing a project, facility and project managers must be able to balance the needs and decisions of people on the project. An extranet will benefit the firm, if it aids the manager in a project's completion. The collaboration features of extranets hold great promise to aid managers in leading the project team. At this time many managers simply do not have enough experience with the systems to see the effects.

```
+------------+   +------------+   +--------------+   +------------+
| Executives |   | Users      |   | Departmental |   | Financing  |
|            |   |            |   | Units        |   |            |
+------------+   +------------+   +--------------+   +------------+
              \         |              /               /
               \        |             /               /
                +--------------------+
                | Project / Facilities|
                | Manager             |
                +--------------------+
                   /            \
         +------------+      +------------+
         | General    |      | Architect  |
         | Contractor |      |            |
         +------------+      +------------+
```
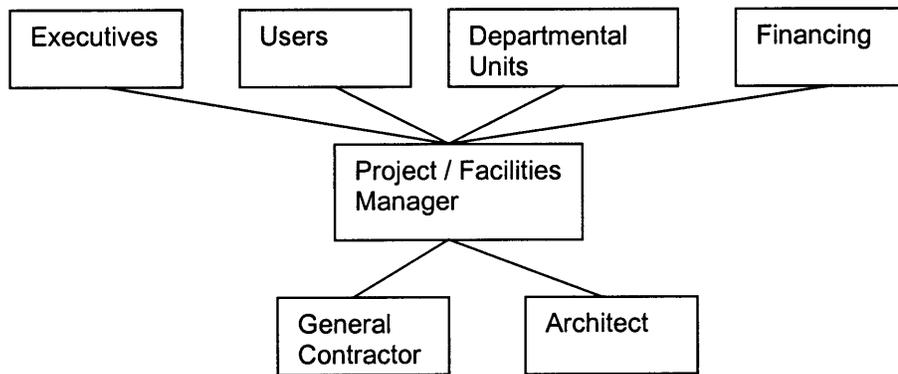
The leadership of management is an important issue related to the use of an extranet. Essentially the extranet allows the multiple organizations in the project team to communicate and share information in new ways. Seven out of the eight real estate owners believed strongly that the decision to use an extranet is part of the owner's domain.

> *"The developer must set the tone to use the system. Without the support from the developer, it is unlikely that you will get the 'collaboration benefits." MacNeil, Millennium Partners Boston*
> *"The owner has to push the use of an extranet system" John Randall, Boston Properties*

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[11] Interview with David Provost from Boston Properties.

"The only way (an extranet) is going to work is if the owner demands it." Scott Bates, Tishman

Underscoring the owner's decision to use an extranet are the powerful interpersonal relationships and team skills that must be harnessed. Susan Personette from MIT described the need for a 'project champion,' (who should always be the owner) that will be able to "grind (the system) through people and be persistent for its use." State Street Bank attributed their project's success to two project managers and the architect who inspired the team to continue using the product.

Strategic Necessity or Competitive Tool

Based on the preceeding analysis as well as the interview data, the role of the extranet as a strategic necessity or competitive tool may depend on the market segment of the user. Currently extranets are neither. In Sarah Abrams' words (Fidelity), they are "simply tools that make life easier." For developers and other non-occupier owners, it appears that they will always remain a 'simple tool.' No extranet will mitigate the developer's biggest risk: market risk. If extranets help to bring buildings to completion faster and easier, then they may become a strategic necessity. Similarly, an Institutional Owner's extranet will never be able to bring the certainty of schedule that is needed to be a competitive tool. For corporate owner/occupiers that use real estate as a support function, extranets will never be a source of competitive advantage. Real Estate is too far from their core business that the ability to complete buildings faster would simply be a necessity. Finally, corporate owner/occupiers of manufacturing real estate may be able to derive a competitive advantage from the use of extranets. Real estate is an integral part of production. As such, if in the next few years, extranets can prove their ability to improve the speed of construction, using an extranet may very well lead to a furthering of a competitive advantage.

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Statistics

The following are some important statistics that relate to both the e-commerce market as well as the construction industry:

- Revenue for U.S. e-commerce applications was $39 billion last year, and this year the figure will be nearly three times that at $114 billion.

- The global e-commerce market will generate between $1.4 trillion and $3.2 trillion by 2003, depending on whether conditions in the market are maximize. Of the $3.2 trillion, 50 percent of the market is materials - $1.6 trillion – and the balance is labor. Bass estimates that 20 percent of the $1.6 trillion is not likely to go online, leaving an available market of about $1.3 trillion. About 170 competitors are going after this market backed by about $1 billion in venture capital. However, three to five significant are expected to emerge as dominant players over the next several years, and the need to fill these players' exchanges with orders will likely force down transaction fees.

- In addition to the transaction services, about 250,000 building projects per year are expected to use services that help team members collaborate. The total available market is about $1.5 billion.

- Over $28 billion in construction trade will be conducted online by 2003.

- The revenue share construction and engineering companies get from e-business is 8 percent.

- On average, 11 percent of companies' IT budget goes to e-business and Internet.

- In 1998, the construction market was valued at $627 billion, and it is growing at a rate of 2 to 3 percent annually.

- There were 103,000 architectural firms in the U.S. in 1998.

- Fifty percent of companies are providing customer service on the Internet.

- The industry consists of 45,000 manufacturers, 180,000 retailers, 750,000 architects, and 1.4 million contractors.
- Types of e-commerce and their relationship to the construction value chain:[12]

Owner/ GC	GC/ Subcontractor	Subcontractor/ Supplier	Supplier/ BPM	GC/ Supplier	GC/ BPM
Exchange	Exchange	Reverse Auction	Catalog	Reverse Auction	Catalog
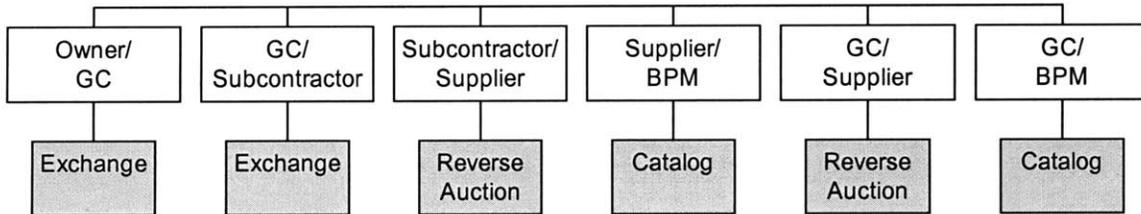
- Internet Usage and Needs:[13]
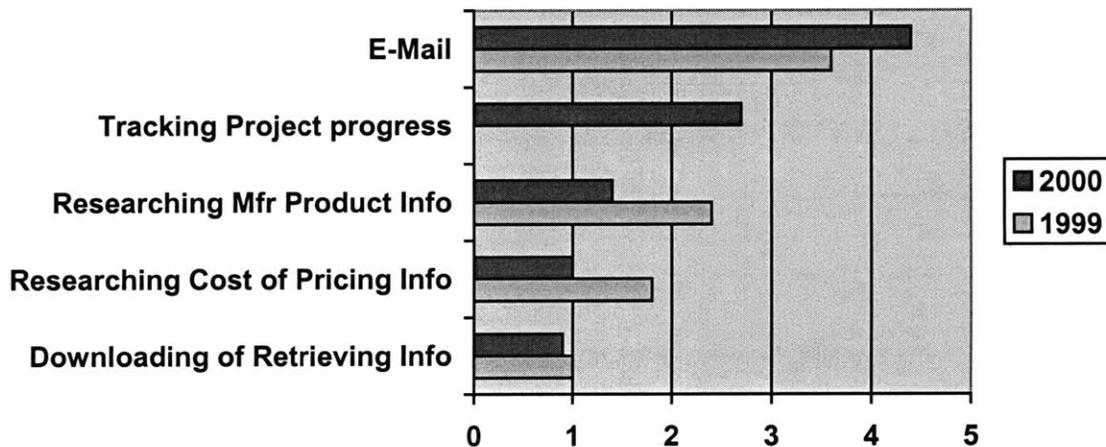
- The following is a breakdown of the elements of e-business as they relate to the real estate & construction industry:
    - Project management which includes financial reporting, design, and estimating type services.
    - Collaboration services includes extranets and project websites.
    - Information: research information on materials, products, and pricing.
    - E-Commerce services: bidding, procurement, logistics of shipping and delivery.

[12] Source: John Bodrozic, Meridian Project Systems
[13] Source: Sweet's Group, April 2000

"The List" of collaborative extranet providers according to "Extranet World."

Player	URL	Desc	Collaboration	Commerce	Free	FreeMode	Product	Reference	Service
Advanced Construction Technologies' The Powertool.	http://www.thepowertool.com	Comprehensive project and e-commerce service	X	X					X
Alventive	http://www.alventive.com	Formerly VDS; -online design community	X	X					X
BidCom InSite	http://www.bidcom.com	Service--bought Cubus 6/2000	X	X					X
BlueprintOnline.com	http://www.BlueprintOnline.com	Electronic engineering data distribution	X						X
BlueTie.com	http://www.bluetie.com		X				X		X
Bricsnet ProjectCenter	http://www.bricsnet.com	Service	X					X	X
Build-Online	http://www.build-online.com/	Construction e-commerce in Europe	X	X				X	X
Bullwhip Extranet	http://www.bullwhip.com	Free service	X			X	X		X
Buzzsaw.com	http://www.buzzsaw.com	Free service; subsumed Autodesk ProjectPoint; Partially funded by Autodesk	X	X	X			X	X
Cephren ProjectNet (formerly Blueline Online and e	http://www.cephren.com	Service and product e-commerce	X	X				X	X
Collaborative Structures FirstLine	http://www.costructures.com	Service	X						X
CollabWare	http://www.collabware.com	Collaborative MCAD and services (in beta)	X					X	X
ConstruX LLC's The Contractor Office	http://www.construx.net	Custom construction and installation of extranets based on a successful tem	X	X				X	X
DrawingRoom	http://www.drawingroom.net	Drawing sharing on the Web-free service	X		X				X
EAI e-Vis.com	http://www.e-vis.com	Service for sharing project information	X						X
eProject.com	http://www.eproject.com	Free web service	X		X				X
eQuorum.com	http://www.equorum.com		X						X
HotKoko	http://www.hotkoko.com	Service on Web	X						X
HotOffice.com	http://www.hotoffice.com	Shared office apps; collaboration	X				X		X
ITeamwork	http://www.iteamwork.com	Free and simple web service	X			X	X		X
JobCostOnline	http://www.JobCostOnline.com	Web-based construction management and more	X	X				X	X
Microlar Systems' e-Manage Net	http://www.microlar.com		X						X
MPInteractive e-Builder	http://www.e-builder.net	Service	X						X
OnBedrock	http://www.onbedrock.com	Due out in the fall of 2000	X	X					X
Personable.com	http://www.personable.com	ASP for MS Office and other general-purpose software with collaborative fac	X				X		
PlanWell	http://www.planwell.com		X						X
ProjectGrid.com	http://www.projectgrid.com		X						X
Projects On line	http://www.projectsonline.com	Service	X						X
ProjectTalk	http://www.projecttalk.com	Project hub from Meridian (soon to accept on-line registrations)	X						X
PTC Windchill 3.0	http://www.ptc.com/	"Product but with strong collaborative features - mainly PDM"	X				X		
RedHut.com	http://www.redhut.com	Residential construction e-commerce	X	X					X
ServiceChannel	http://www.servicechannel.com	Work order automation for contractors and owners	X	X					X
Struxicon	http://www.struxicon.com	Real-time Web-based procurement and project management	X	X					X
SupplyFORCE.com	http://www.SupplyFORCE.com	Supply-chain management services	X	X					X

Name	URL	Description	C1	C2	C3	C4	C5	C6
	om							
Swifttouch.com	http://www.swifttouch.com	Comprehensive Web-based PIM	X			X		X
TeamOn	http://www.teamon.com	Customizable PIM with good email management	X		X	X		X
TheJobSite.com	http://www.thejobsite.com	Commerce - reference and light collaboration for residential and light comm	X	X				X X
Trade-Power.com	http://www.Trade-Power.com	On-line b-b construction materials marketplace	X	X				X
UpShot.com	http://www.upshot.com	Sales force automation--free up to five users	X		X	X		X
VENline's VENpoint and CADline	http://www.venline.com	"Service: Virtual Engineering Networks (VENs) - project management	X					X
VisionPlanner.com	http://www.VisionPlanner.com	Project pre-planning--pre-announced....	X					X
Webridge	http://www.webridge.com	Consulting & implementation - manufacturing focus	X					X
WorkWired	http://www.workwired.com	Free collaborative service	X		X			X
ZCentral	http://www.zcentral.com	Free service	X		X	X		X
ARCHIBUS/FM Web Central	http://www.archibus.com	Product	X	X		X		
Aventail	http://www.aventail.com	Software and services	X	X			X	X
Bentley ProjectWise	http://www.projectwise.com	Enterprise-level back-office software	X				X	
Binary Tree eTeam	http://www.binarytree.com	Software	X				X	
BuildNET	http://www.buildnet.com	Solutions and services for builders	X	X			X	X X
CADWeb	http://www.cadweb.co.uk	Product and services	X				X	X
Calypso Technologies Pronto	http:www.pronto-info.com	Software	X				X	
Centech Solutions Iris-Docs	http://www.irisdocs.com	Software	X				X	
Cimmetry's jVue	http://www.cimmetry.com	Java thin-client version of Autovue CAD viewing and markup software	X				X	
Co|Create's OneSpace	http://www.cocreate.com	Software for manufacturing	X				X	
covia (formerly Adobe Glyphica's Team Online)	http://www.covia.com	Software for collaboration and commerce	X	X			X	
Dassault Systemes CATWeb	http://www.dsweb.com	Full 3D model sharing over Web for CATIA	X				X	
Document iTeam Project	http://www.documentum.com	Software	X				X	
eArgos	http://www.eargos.com	Software for homebuilders	X				X	
Edgewater Services OnLineProject	http://www.projectedge.com	Software and service	X	X			X	X
Emerging Solutions ConstructWare and HealthFlash	http://www.emergingsolutions.com	Software and service for construction and health industries	X				X	X
eRoom	http://www.eroom.com	Software; asp	X				X	X
Framework Technologies ActiveProject	http://www.activeproject.com	Comprehensive and flexible extranet software	X	X			X	X
FrontRunner Software	http://www.frontrunner.com	Project management & Web collaboration software	X				X	
IDEAL Scanners Digital Container	http://www.ideal.com	An internet appliance for scanning - storing and sharing documents of all s	X	X			X	
iManage (formerly NetRight iManage)	http://www.imanage.com	Collaboration and ecommerce solutions	X				X	
Immersive Design IPA	http://www.immdesign.com	Share 3D animations over the Web	X				X	
InfoAdvantage AdvantageWARE	http://www.infoad.com	Software	X				X	
Informative Graphics Brava!	http://www.infograph.com	Collaborative redlining & viewing Java software; underlies DrawingRoom.net	X				X	
InQuest ProjectQuest	http://www.projectquest.com	Software	X				X	
IntraACTIVE InTandem	http://www.intraactive.com	Collaborative software	X				X	
Involv Web Teaming	http://www.involv.com	Software and service	X				X	X
Lotus' QuickPlace	http://www.quickplace.com	Notes-based collaborative software	X				X	
Marin Research Project Gateway and Project Observa	http://www.marinres.com/	Software and services	X				X	X
MarketStreet.com Vista 2000	http://www.marketstreet.com	Project communication and management software and services	X				X	X

Name	URL	Description					
Meridian Prolog Web site	http://www.mps.com	Software	X			X	
Microsoft ProjectCentral	http://www.microsoft.com/office	Software for Web-based project management (add-on to Project 2000; in beta)	X			X	
Netmosphere Project Home Page	http://www.netmosphere.com/	Software	X			X	
NexPrise's ipTeam	http://www.nexprise.com	Software for manufacturing companies	X			X	
NuSpectra Inc.	http://www.nuspectra.com	Real-time streaming audio/video Web-controlled site camera	X			X	
OnlineBuildings.com	http://www.onlinebuildings.com	Collaborative software service	X	X		X	X
Open Archive.com's echive Publisher	http://www.openarchive.com	Publish files to the Web or to CD	X			X	
Open Text LiveLink	http://www.opentext.com	Collaborative software	X			X	
Pacific Edge's ProjectOffice	http://www.projectoffice.com	Software that integrates with MS Project & Instinctive's eRoom	X			X	
Plan View	http://www.planview.com	Collaborative project management software	X			X	
Primavera TeamPlay	http://www.primavera.com	Software	X			X	
ProjectMind.com	http://www.projectmind.com		X	X	X	X	
Punch Networks WebGroups	http://www.punchnetworks.com/	File sharing product and service	X			X	X
Rational Concepts Proj-Net	http://www.rationalconcepts.com	Project management software and web-based proposal management	X			X	
Robbins-Gioia PM Boulevard	http://www.pmblvd.com/virtualpmo	"Services software solutions"	X			X	X
Sigma Design International's eZ	http://www.ezmeeting.com	IP-based (no server needed) collaborative software	X			X	
Tecoplan's WebVOX	http://www.tecoplan.com	3D model sharing	X			X	
ThoughtStar's QuickTeam (merged with Imanage)	http://www.thoughtstar.com	Software	X			X	
Unigraphics Solutions' in-KEY	http://www.ugsolutions.com	Collaborative solutions for manufacturing	X			X	
United Systems RT/Solutions	http://www.uccs.com/rts	Software	X			X	
Vianovus Paragon	http://www.vianovus.com	Software & services	X			X	X
WebProject	http://www.wproj.com	Software - Java-based	X			X	
Welcom	http://www.welcom.com	Wide range of project management software products	X			X	