

AN EXPLORATORY STUDY OF INTERNET ADOPTION BY PRIMARY WOOD PRODUCTS MANUFACTURERS IN THE WESTERN UNITED STATES

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ABSTRACT

Use of the Internet as a platform to do business in the forest products industry is well established. Companies can use the Internet for a multitude of activities including purchasing from suppliers, selling to customers, improving logistics, and increasing customer service. This study examined current and potential use of Internet-based technologies to conduct business by solid wood products manufacturers in the western United States. Sixty-one percent of respondents had a website in 2000. Website development was a fairly recent phenomenon, with 65 percent of respondents developing their sites in the 1999-2000 time period. Larger companies developed websites earlier than small companies and spent more money on website development. Highest rated perceived Internet benefits were greater exposure to potential customers, increased access to industry information, and timeliness of information exchange. Respondents did not seem to believe that the Internet can create customer value or improve their competitive position. Only 18 percent used the Internet to sell products (the sales were being conducted primarily using e-mail) and 10 percent said that they would be willing to use a third-party marketplace exchange to sell products on the Internet.

The Internet represents one of the most important technological developments of our generation (2), offering considerable potential as a business tool. In addition to being an internal information-sharing platform, companies can use the Internet to identify and secure potential customers, support market development efforts, and conduct transactions.

Overall, the Internet allows for mass customization, building of stronger business relationships, a greater degree of channel coordination, heightened communication with various publics, and enhanced customer service (15).

Internet-based business has generated a number of approaches to creating models that influence business practices. Some models are process-oriented, while others are technology-based. What is important is the underlying strategic business application that is necessary to

develop effective strategies to compete in today's environment. Thus, before implementing this new technology, there is the need for management to address the strategic scope of the organization and how it fits with technology (7).

The Internet substantially narrows language and geographic gaps in conducting business. It reduces communication cost, documentation, and costs associated with time-zone differences. Any cost-saving activity will have an impact on competitiveness through increased profitability and a lower cost of moving product to market.

The Internet has also created a new vehicle for organizations to access global markets and expand international sales (1,14). Companies are experiencing increased international competition because telecommunications is no longer an inhibitor, and the Web has reduced the geographical barriers to entry; retailing has expanded beyond cross-border to become truly global (1).

In the international realm, Nicovich and Cornwell (11) reported that the

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TABLE 1. — Frequency of responses and response rate by state.

	Response frequency	Adjusted sample frame frequency	Percent of 55 total responses	Response rate by state
	------(%)-----			
California	14	39	25	36
Montana	3	18	5	17
Idaho	1	20	2	5
Oregon	30	88	55	34
Washington	7	50	13	14
Total	55	215	100	26 (weighted)

Internet could bridge the gap between cultures, thereby lowering traditional barriers to communication imposed by different languages and special distances.

As more people get connected everyday to conduct such activities as education, business transactions, personal correspondence, research, and information-gathering, the Internet is becoming an increasingly vital tool in society.

THE PRIMARY WOOD PRODUCTS INDUSTRY AND THE INTERNET

Solid wood forest products (as opposed to pulp and paper products) can be broadly characterized as primary or secondary products. This classification is not always clear, but most industry observers agree on general definitions of the groups. Primary products are those that are produced directly from raw timber input. Examples include chips, lumber, veneer, and their by-products. Secondary products use primary products as input for remanufacturing. Examples include various types of panels, engineered composites, or dimension stock. Secondary products can also include final consumer products such as furniture (19). For the purposes of this study, we have included manufacturers of plywood, lumber, particleboard, medium density fiberboard (MDF), oriented strandboard (OSB), and engineered lumber in the population of interest.

Historically, target markets for the primary wood products industry in the United States have been homebuilders, repair and remodeling contractors, secondary products manufacturers, and homecenters (18). The products that have been geared to these markets have generally been commodities. However, there is an emerging drive towards fulfilling the diverse needs of customers through differentiation of products based on service level, quality of product ser-

vice, distribution methods, and credit. This is done in order to avoid direct pricing competition (18). Although Sinclair (18) does not address electronic technologies, the Internet can provide one source of competitive service differentiation in serving customers that can ameliorate the pricing competition he refers to.

It is predicted that by 2005, "... the Internet will affect the wood industry more than any computer controlled device in the business. Customers and suppliers could be brought together (in real time) in the market space. The Internet will schedule production and troubleshoot problems. It will be a source for employment and a means to compensate pay and coordinate benefits. All activities will be documented and services for payment for products and services will be rendered. A new level of customer service, communication, and potential user satisfaction will be possible and woodworkers who embrace the Internet will grow in the new millennium" (12).

Howard Feldman, president of Feldman Engineering Corporation reported that eCommerce will play a vital role in the supply chain management of the forest products industry. The main purpose will be to provide information over the Internet to customers in order for them to educate themselves before purchase (9).

In summary, the Internet is seen as technology that will impact all levels of the forest products industry. It is predicted that firms that change their administrative, marketing, and manufacturing organizations to grasp the advantages offered by this technology will be more likely to succeed (4).

THE STUDY

RESEARCH CONTEXT

This study examined current and potential use of Internet-based technologies to conduct business by solid wood

products manufacturers in five states in the western United States: Washington, Oregon, California, Idaho, and Montana. Internet-based technologies were studied in the context of implementation strategies across a number of product types, including lumber, plywood, particleboard, etc. A non-random convenience sample of 225 companies listed in the *Random Lengths Big Book, 1999 Edition* was used in the study (16).

Respondents were asked to discuss their current or planned Internet strategies with particular emphasis on perceived opportunities and their potential to use Internet-facilitated marketplace exchanges. Objectives of the study were to:

1. Examine the current and potential uses of the Internet in the primary solid wood products industry in the western United States.
2. Discern perceived benefits of doing business using Internet based technology.
3. Identify level of importance of services and features offered by third-party Internet market exchanges

RESEARCH METHODOLOGY

DATA COLLECTION

Mailed questionnaires were used because they are a cost-effective method of data collection (compared to telephone interviews) for lengthy detailed surveys and when the number of individuals being surveyed exceeds 150 (5). The questionnaire instrument tested constructs using measures developed by the first author and adapted from other sources. The survey was reviewed and revised by the researchers and a small selection of five companies. An iterative process resulted in the final instrument.

The questionnaire consists of fixed response questions, including fixed alternative and multichotomous questions for responding firm demographic profiles, as well as open-ended questions that allow respondents to express thoughts and ideas not covered in the fixed format questions. Five-point scaling questions, anchored by 1 = strongly agree to 5 = strongly disagree and by 1 = very important to 5 = very unimportant, were employed to measure respondent levels of agreement and concern with various questions addressing Internet issues and implementation.

The questionnaires were mailed to all companies listed in the *Random Lengths Big Book, 1999 Edition* (16). Pre-addressed, postage-paid envelopes and a signed cover letter were included with the questionnaire. The cover letter also promised summary results of the study for completing and returning the questionnaire, a tactic that has been used successfully by the researcher in many previous studies. Pre-notification and reminder postcards were also sent to all companies. The study results are based on two mailings. All surveys were sent to upper-level marketing or management individuals by name and title in each company.

Nonresponse bias is a survey problem that seems to have grown in recent years as the public has become less willing to participate in surveys (17). The cause of concern about nonresponse bias is the risk that nonrespondents will differ from respondents with regard to the survey variables, in which case the survey estimates based on the respondents alone will be biased estimates of the overall population parameters (10).

Bias due to nonresponse can be evaluated by comparing those who responded to the initial mailing to those who respond as a result of subsequent mailings and other follow-up efforts because second-mailing respondents can be used as a proxy for non-respondents(3,6).

Accordingly, nonresponse bias was measured by using a two-tailed t-test conducted on frequency of companies by state, comparing respondents and the sample frame and early/late responders. Although no significant difference was found in state distribution between early and late responders at $\alpha = 0.05$, a significant difference in state distribution was detected at $\alpha = 0.05$ between respondents and the *Random Lengths Big Book* sample frame. This further supports the notion that this study is exploratory in nature.

RESULTS

RESPONSE RATE AND RESPONDENT DEMOGRAPHICS

The adjusted sample size was 215 after accounting for nondeliverable surveys (due to company closures, change of address, or deceased), and the adjusted weighted response rate was 31 percent. All industry survey respondents were surveyed at the corporate headquarters level. Given that typical re-

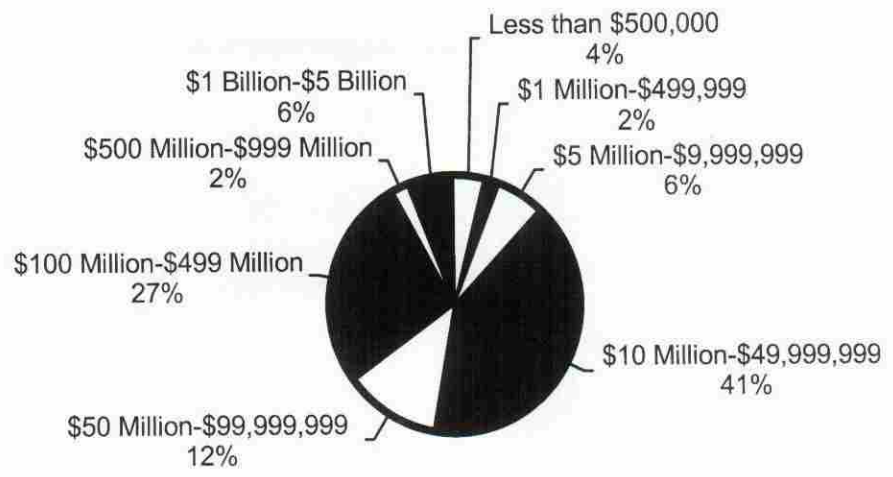


Figure 1. — Respondent size by 1999 sales (n = 49).

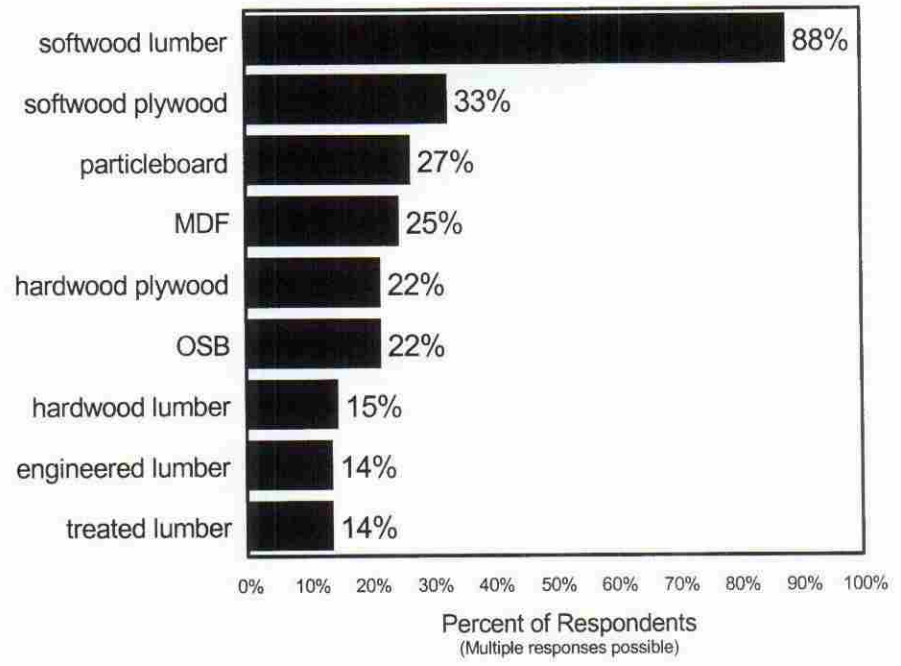


Figure 2. — Major product categories manufactured by respondents (n = 55).

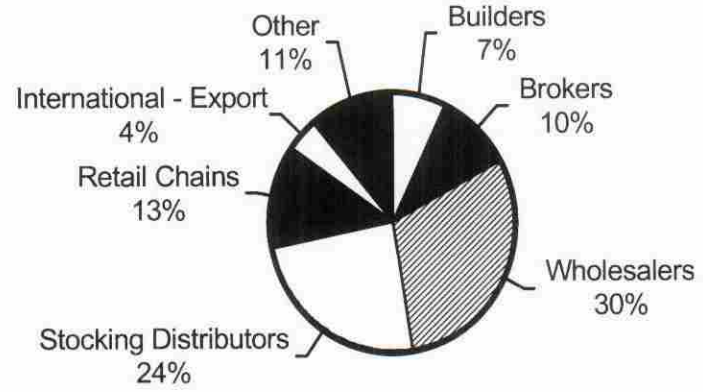


Figure 3. — Respondent sales distribution channels (n = 55).

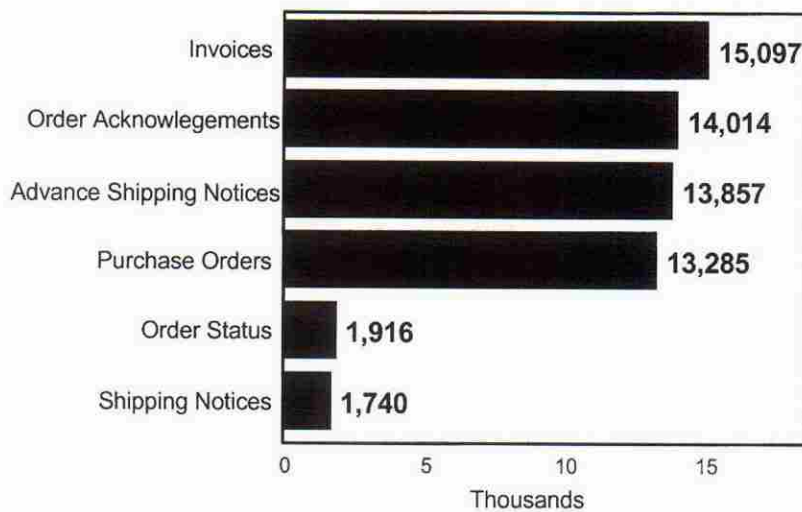


Figure 4. — Mean number of business documents processed annually by respondents ($n = 55$).

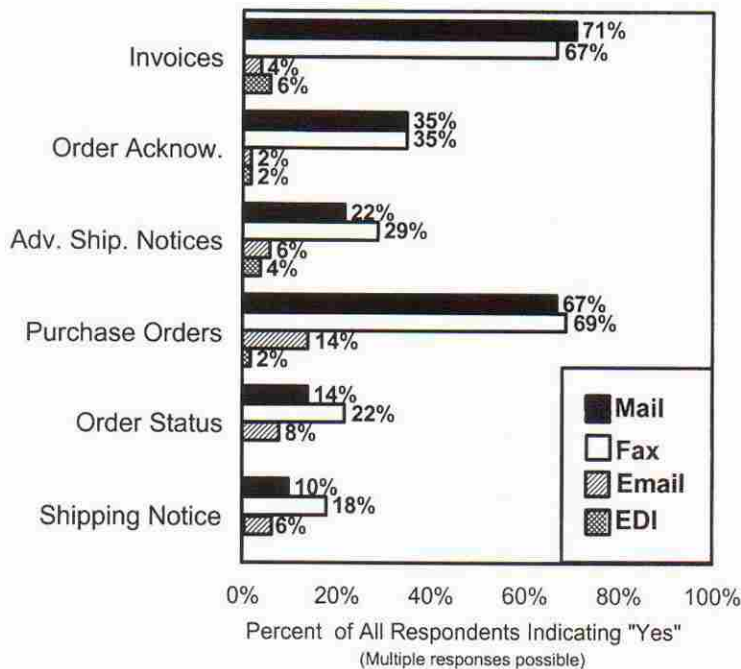


Figure 5. — Methods of transmitting or receiving business documents ($n = 55$).

response rates from industrial studies range from 15 to 30 percent, a response rate of 26 percent in this study is considered to be good. The highest response rate was from Oregon with 41 percent, while only 1 company responded out of 20 surveys mailed to Idaho (Table 1). As discussed earlier, there are nonresponse bias implications that result from these disparities.

GEOGRAPHIC DISTRIBUTION OF STUDY RESPONDENTS

Respondents were surveyed at their corporate locations. Fifty-five percent of respondents were located in Oregon, followed by California (25%), Washington (13%), and Montana (5%). One response was received from Idaho (2% response rate)

The majority of the 49 respondent companies indicating their size were small, with over 50 percent having sales of \$50 million or less in 1999 (Fig. 1).

Eight percent of respondents had sales over \$500 million in the same year.

Respondents produced a variety of products at the time the study was conducted (Fig. 2). Softwood lumber was by far the most represented product, produced by 88 percent of respondents. Softwood plywood was produced by 33 percent of respondents. The next grouping of products includes particleboard, MDF, hardwood plywood, and OSB. The final grouping includes hardwood lumber, engineered lumber (including LVL and glulam), and treated lumber.

Respondents sold the majority of their production through some form of distribution intermediary (Fig. 3). Thirty percent was sold through wholesalers, 24 percent through stocking distributors, and 10 percent through brokers. The balance was sold directly to retail chains (13%), builders (7%), or into export markets (4%). Eleven percent was sold to other channels, primarily to original equipment manufacturers (OEM) and mill sale customers. Nearly two-thirds of respondent sales were shipped by truck; 31 percent and 4 percent were shipped by rail and ship, respectively.

BUSINESS DOCUMENT TRANSMISSION AND RECEIPT

Because eBusiness often facilitates the electronic transmission of business documents, it was important to discern the types and frequency of documents respondents send and receive. In aggregate, respondents indicated that they sent or received approximately 3.3 million business documents annually (Fig. 4). Invoices, order acknowledgements, advance shipping notices, and purchase orders accounted for 94 percent of the total number of transmitted documents.

Mail and fax were by far the preferred method for respondent companies to transmit or receive business documents (Fig. 5). This was especially apparent for invoices and purchase orders. A distant third was e-mail, followed by Electronic Data Interchange (EDI). EDI is computer-to-computer electronic transmission of business documents between business trading partners. The documents are in structured formats that can be processed by both parties' computer application software. This finding indicates the level of adoption of electronic means of processing business information between respondents and their customers.

There was evidence of computer usage in business applications in that a number of respondents said they entered business transaction information directly into computers as opposed to writing it down first and then keying in the data. Sixty-one percent of respondents entered invoices directly; this figure was 38 percent, 32 percent, and 31 percent for purchase orders, shipping notices, and order acknowledgements, respectively.

An integral component of any electronic-based market exchange is facilitating the receipt of and responding to requests for quotes (RFQs). By a wide margin, respondents preferred to both receive and respond to RFQs by telephone: 75 and 82 percent of respondents, respectively. Faxing was a distant second with 25 and 14 percent, respectively, followed by mail with 10 percent of respondents both receiving and responding to RFQs in this manner. Only 6 percent of respondents used their website for both, probably through e-mail.

PERCEPTIONS OF THE INTERNET FOR DOING BUSINESS

Whether or not respondents were using the Internet to conduct business at the time the study was conducted, it was important to understand what they felt were current or potential Internet benefits. As seen in **Figure 6**, respondents perceive the greatest benefits to be in the areas of exposure to potential customers, access and exchange of information, and image enhancement.

Benefits such as lowering costs and providing customer value were ranked low, just barely above 3.0 (neutral). Conditions ranked below 3.0, or neutral, are all related to competitiveness, cost reduction, or customers. Using two-tail t-tests, mean scores for all but four benefits in **Figure 6** were not found to be significantly different from the neutral point (3.0) of the 5-point scale at the 0.05 level of significance. The exceptions were: increased sales for my company, increased value to my customers, improved competitive position for my company, and improved service to customers.

A maximum likelihood factor analysis was conducted on benefit items (8) (**Table 2**). An iterative process resulted in a reduction from 14 retained items to 3 underlying factors. Factor loadings

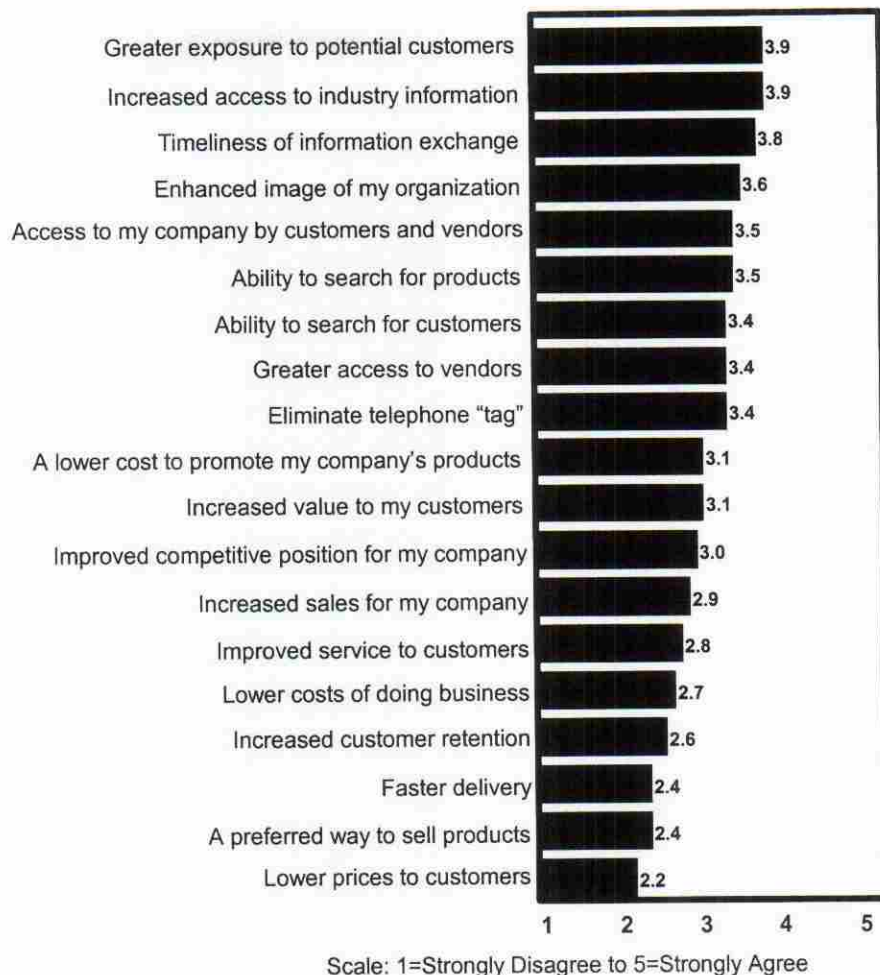


Figure 6. — Benefits that the Internet could offer to respondents ($n = 55$).

greater than 0.50 were used as separation criteria to reduce the data to three distinct factors. Each of the three factors identified were interpreted and assigned a scale name: Existing Business, Potential Business, and Information. These scales can also be construed as being surrogate variables having analytical and managerial implications. Surrogate variables are particularly useful in exploratory research (8). These three factors represent 71 percent of the variance in the 14 items. In this case, these factors could potentially become part of an Internet implementation strategy for forest products industry companies.

Third-party exchanges. — There are many third parties that facilitate the exchange of goods and services between forest products manufacturers, suppliers, and customers. These exchanges often alter buyer/seller relationships from what currently exists in traditional non-Internet marketplaces. Third-party ex-

changes (TPEs) create a market space where buyers and sellers can transact business. TPEs purport lower transaction costs, shortened cycle-time, and increased value-chain efficiency. However, this does not come without concerns, which include the perception of limited functionality and the potential requirement for the many Internet-interfaces each manufacturer must develop in order to manage multiple marketplaces, security issues, and privacy matters (13).

Ten percent of respondents expressed a strong willingness to sell products through a TPE. Eighteen percent of respondents expressed somewhat of a willingness to sell using TPEs and 33 percent were indifferent.

The most sophisticated example of using the Internet for conducting business is the linkage to a company's back office applications. Four percent of respondents indicated that they were very

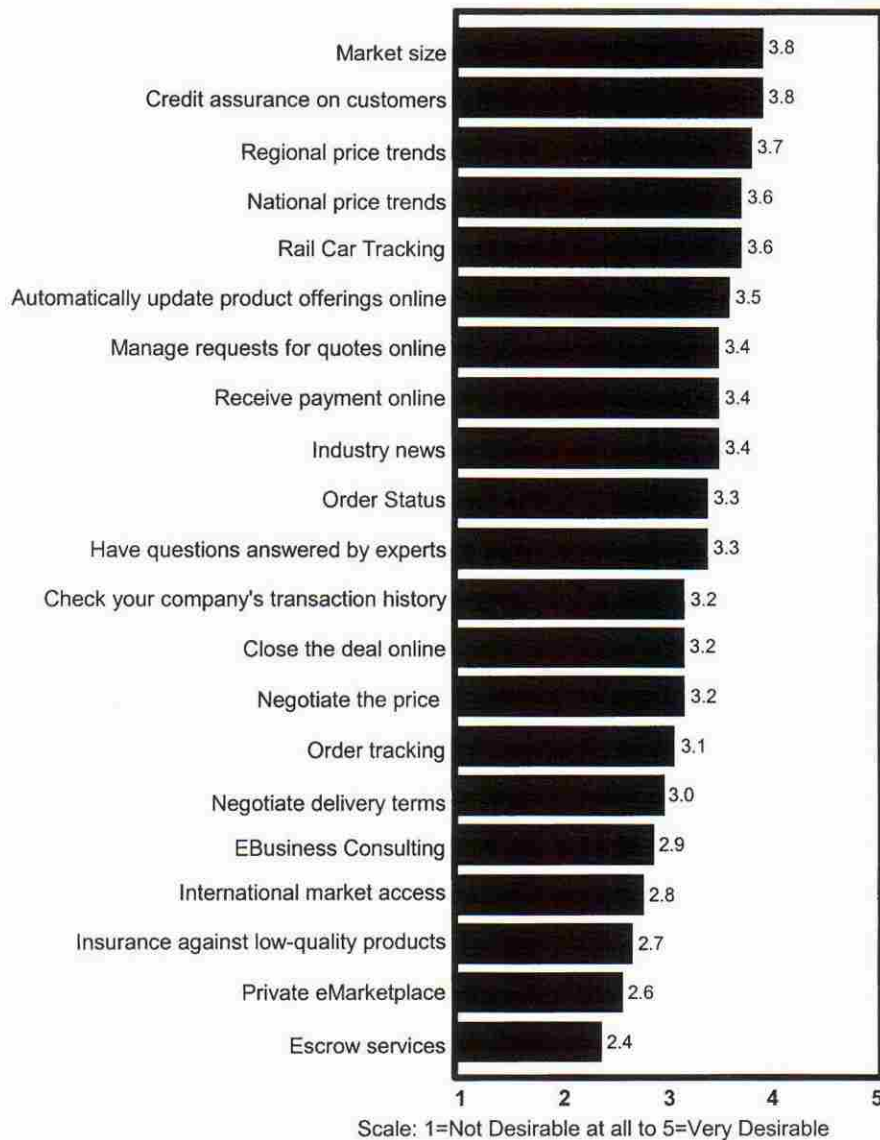


Figure 7. — Ratings of features and services that third party exchange websites could provide (n = 55).

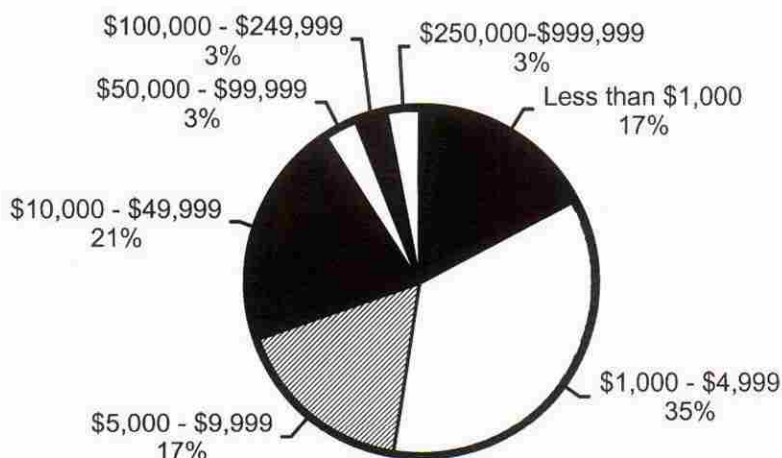


Figure 8. — Cumulative investment made to date on company website (n = 290).

willing to let a TPE link to their back office systems. An additional 16 percent were somewhat willing and 20 percent were indifferent. Over 50 percent of respondents were either somewhat or very unwilling to go to this level of eBusiness. Willingness to let TPEs link back office systems was significantly and positively correlated to company size.

One of the most important batteries of questions in the study deals with TPE features and services that respondents find desirable. On a 5-point scale (1 = not desirable at all; 5 = very desirable), the highest ranking features (customer credit assurance and market size information) had a score of only 3.8 (Fig. 7). Price trends, both regional and national, were ranked next, followed by on-line rail car tracking.

Next ranked, in order, was the ability to update product offerings, manage RFQs, receive payment on-line (electronic funds transfer), and receive industry news. Features ranked below 3.0 (neutral), included delivery negotiating, eBusiness consulting, international market access, assurances against low-quality products, a private marketplace, and last, escrow services. Rail car tracking, closing deals on-line, and order tracking were statistically and positively correlated to respondent company size.

Using two-tail t-tests, mean scores for six of the features/services listed in Figure 7 were found to be significantly different from the neutral point (3.0) of the 5-point scale at the 0.05 level of significance: ability to check your company's transaction history, ability to negotiate price on-line, ability to negotiate delivery terms online, order tracking, eBusiness consulting, and international market access.

A maximum likelihood factor analysis was conducted on services and features TPEs might offer (Table 3). An iterative process resulted in a reduction from seventeen retained items to three underlying factors. Factor loadings greater than 0.50 were used as separation criteria to reduce the data to three distinct factors. Each of the three factors identified were interpreted and assigned a scale name: eBusiness, Market Information, and Logistics. These three factors represent 68 percent of the variance in the seventeen items. In this case, these factors could help forest products manufacturers in their thinking on

third-party participation. TPE service providers can also better understand the marketplace and package their offerings accordingly.

Respondent websites. — Sixty-one percent of respondents had a website and 100 percent of these companies had registered domain names. Website development was a fairly recent phenomenon, with 65 percent of respondents developing their sites in the 2-year 1999-2000 period. Larger companies were found to have developed websites earlier than smaller companies. Larger, more complex companies also invested more than smaller companies to develop and maintain their websites (Fig. 8). Over half of respondents with websites spent less than \$5,000 to date, while 6 percent of respondents spent \$100,000 or more. Only 14 percent of respondents believed they paid an excessive amount for their websites, with over a third saying that what they spent was a very good value.

Overall, respondent website functionality was rudimentary in 2000. Promotion/advertising was the only significant website function (93% of respondents). Customer service followed at 7 percent of respondents, and operational functions at 3 percent. Although 61 percent of respondents had a website, not one said they were using their website for eCommerce. Only 18 percent used the Internet to sell products (the sales were being conducted using e-mail).

Website establishment was nearly evenly split between in-house and outside the company, at 57 and 43 percent of respondents, respectively. Similarly, 53 percent of respondents said that they maintained their website in-house, while 47 percent relied on an outside company. Fifty percent of respondents planned to develop or improve their website in the next 12 months.

CONCLUSION

This study achieved the objectives of examining the current and potential uses of the Internet in one segment of the forest sector industry in the western United States. Sixty-one percent of respondents had a website and 18 percent were using the Internet to sell products using e-mail. No respondents were actually doing any in-depth eCommerce.

Perceived benefits of doing business using Internet based technology were varied. Highest ranked benefits were ex-

TABLE 2. — Factor analysis of perceived benefits from using the Internet.^a

	Existing business	Potential business	Information
Increased customer retention	.851	.276	.001
Increased value to my customers	.832	.266	.101
Faster delivery to customers	.808	.158	.281
Improved service to customers	.771	.233	.264
Lower costs of doing business	.722	.299	.228
A preferred way to sell products	.593	.411	.155
Lower prices to customers	.582	.319	.117
A lower cost to promote my company's products	.573	.157	.363
Ability to search for new customers	.254	.811	.055
Greater access to my company by potential customers	.461	.707	.180
Increased sales for my company	.455	.666	.083
Greater exposure to potential customers	.365	.620	.403
Increased access to industry information	.368	.047	.874
Timeliness of information exchange	.085	.181	.803

^a Extraction method: maximum likelihood; rotation method: varimax kaiser normalization. Boldface indicates factor groupings.

TABLE 3. — Factor analysis of services and options third-party exchanges could provide.^a

	eBusiness	Market information	Logistics
Ability to negotiate delivery terms online	.871	.261	.300
Ability to negotiate the price online	.816	.404	.243
Ability to close the deal online	.728	.494	.206
Private eMarketplace	.715	.143	.401
Escrow services	.642	.148	.373
eBusiness consulting services	.585	.321	.305
Ability to manage requests for quotes online	.583	.571	.289
International market access	.560	.119	.228
Ability to check your company's transaction history	.541	.461	.309
Regional price trends for the products of your interest	.239	.892	.088
National price trends for the products of your interest	.172	.886	.175
Market size for the products of your interest	.252	.724	.269
Ability to have specific questions answered by industry experts	.470	.569	.196
Industry news	.141	.559	.239
Order tracking online	.351	.232	.855
Check order status online	.250	.283	.818
Railcar tracking online	.360	.118	.579

^a Extraction method: maximum likelihood; rotation method: varimax kaiser normalization. Boldface indicates factor groupings.

posure to customers and access to industry information. Lesser ranked benefits had to do with actual business transactions (eCommerce) and applications within the company (eBusiness).

Finally, the level of importance of services and features potentially offered by third-party Internet market exchanges were examined. These potentially significant components of the eBusiness

equation in the forest sector can offer a wide variety of services ranging from information in the discovery phase of business processes, to business transaction facilitation, to providing logistics services and support.

One limitation to the study is that there may have been a statistically significant difference in responses to the survey questions based on those firms

listed in the *Random Lengths Big Book* relative to those firms that were not listed in this directory and never surveyed. As a result, the study can be considered as being exploratory in nature. This study should be replicated using a true census of the 450 primary forest products companies estimated to be operating in this region.

To be able to effectively conduct business on the Internet, forest products industry members must ascertain if costs could be reduced and service levels increased by establishing an Internet channel for their companies. Another question is whether it will be a competitive disadvantage if competitors provide eBusiness capabilities to customers first.

In summary, the driving forces behind digitalization are so powerful that they will inevitably challenge almost all aspects of business. To be successful, the primary wood products industry will have to marshal its competences to integrate its business effectively into Internet-based information networks and respond rapidly to changing customer perceptions of value.

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