Factors Behind Construction Companies Wood Products Purchasing Decisions: Supplier Market Impact

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Abstract

Companies in the construction industry have a wide range of suppliers to choose from to meet their building material needs. Local (in-state) suppliers within key southern states in the United States face challenges gaining market share within the construction sectors. Construction companies often outsource their purchase of wood products from a different state or country, which adversely affects the local economy as a result of loss of revenue. However, if companies were limited to in-state supply it would affect trade across states and countries; but the focus was to improve local wood products supplier market impact. Companies within the states of Georgia, Texas, Oklahoma, South Carolina, Florida, and Virginia were interviewed by phone and in person to determine how companies chose wood product suppliers and what factors affected their purchasing decisions. Key factors included cost, quality, delivery, flexibility, location, relationship, and payment options. A survey of construction companies was conducted after the interviews were concluded. Important factors highlighted by responses included cost, quality, relationship, and lead time in choosing a supplier. Suppliers were asked to differentiate their products using information the construction companies highlighted as factors they emphasized. In-state wood product suppliers have an opportunity to gain market share within the construction industry using the factors those construction companies favored in interviews and survey results.

Private spending in the construction industry in the United States reached approximately US$992 billion in 2018. By 2022, new construction projects are forecasted to reach >US$1.53 trillion. The U.S. gross domestic product totaled US$19.5 trillion in 2017, and construction contributed US$781 billion to that total (Simonson 2019). Nonresidential spending in the United States totaled US$748 billion in 2018, with $435 billion in private construction and $295 billion in public construction (Simonson 2019).

After the 2008 recession, construction projects in the United States that had initially stalled dramatically increased during the recovery. This increase was due to positive trends in the residential market following the recession (Fig. 1; Wang 2019).

Market opportunities for U.S. forest products expanded, and traditional forest products have seen more growth than alternatives such as concrete and steel (Goergen et al. 2013). The construction industry (engineers, architects, and builders) have positive feedback regarding more sustainable options such as wood in numerous projects and is gaining traction from the general public over steel concrete (Franzini et al. 2021).

The life cycles of certain building materials can affect the environment during their useful life and after they have been used for their purpose. The life-cycle inventory impact assessment also evaluates potential environmental impacts of certain materials used within buildings (Falk 2009). This

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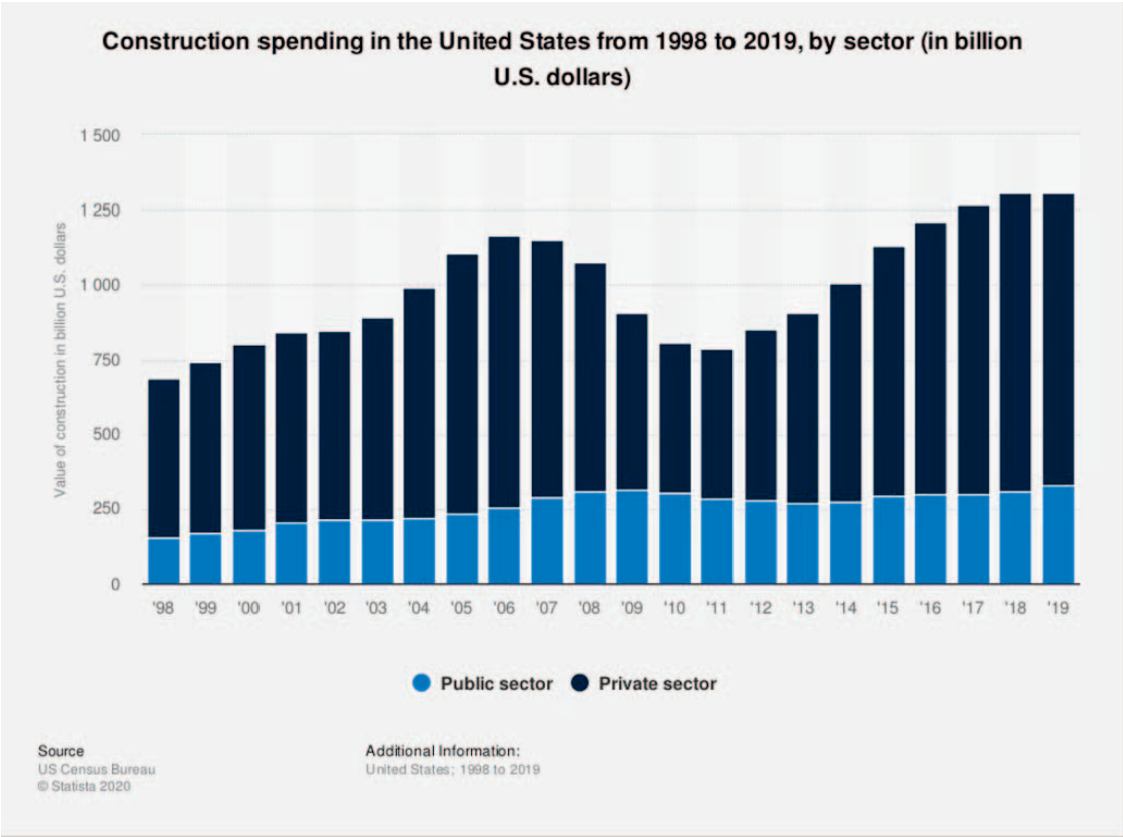


Figure 1.—Spending in the United States construction industry by sector (Wang 2019).

assessment determines the average life span of a material. The idea is to promote the use of more sustainable building materials such as wood, and engineered wood products as opposed to products such as steel and titanium. Wood materials tend to be more environmentally friendly, and help to reduce energy consumption compared with traditional building products such as steel and concrete (Lippke et al. 2004). Carbon emissions are important to consider when deciding the sustainability of building materials, as well as the life cycle of certain materials (Birdsey and Lewis 2002).

This project investigated the drivers behind construction company wood purchases in selected states in the Southeast region of the United States. Understanding these drivers is important not only for supporting the local economy but also for increasing the use of renewable construction materials such as wood products.

Literature Review

Forest products marketing

Mater et al. (1991) stated that companies have the capacity to turn wood into value-added products with a small investment. Wood can be used to fabricate numerous products such as lumber, oriented strand board, fiber board, furniture-based products, etc. This makes forest products marketable to various sectors. However, wood products producers must find ways to differentiate their products. Price is a differential advantage commonly used in marketing industrial and construction products (Mater et al. 1991). Hansen and Juslin (2005) indicated that commodity, special, and custom-made products are three strategies that can also be used to market or sell wood products. The strategy of producing specialized products has increased in the wood products industry. The specialized products are more marketable than nonspecialized products. Differentiating a product to the point that it is recognized as its own brand can be crucial to wood products manufacturers and suppliers. For example, the ability that wood products producers have to use forest certification to promote sustainable forest management may depend in part on the extent to which managers of forest products companies perceive a market-based incentive to supply certified products (Stevens et al. 1998). The forest certification program helped produce better marketing opportunities for some companies. Suppliers can promote what their product does well, how it is different from competitors, and how it looks in order to market their company and products.

The supply chain in the construction industry

Bayazit et al. (2006) defined priorities of logistical performance when selecting suppliers in the construction industry (Table 1). Logistical performance, commercial structure, and production highlight the needs of construction companies. According to Bayazit et al. (2006), price was the highest factor under the cost analysis branch and lead time was the highest factor for delivery performance for construction companies. The numbers represent the priority of a certain characteristics for a supplier to deliver upon. For instance, lead time and price from the secondary subcriteria

Table 1.—Priorities of logistical performance criteria (Bayazit et al. 2006).

Major criteria	Logistical performance 0.364 priority factor				
Subcriteria	Delivery performance 0.159 priority factor		Cost analysis 0.841 priority factor		
Secondary Subcriteria	Quantity 0.233 priority factor	Lead time 0.767 priority factor	Price 0.766 priority factor	Terms of payments 0.165 priority factor	Cost-reduction assistance 0.069 priority factor

are higher priorities, although delivery performance was not emphasized as much as cost analysis.

Vrijhoef and Koskela (2000) defined four prominent roles of supply chain management in construction (Fig. 2). These four roles are critical to understand how suppliers can connect with customers and vice versa.

Xue et al. (2005) defined another model of the construction industry supply chain in Figure 3. This model shows what is involved in all parts of the construction industry supply chain. An owner interacts with various suppliers to acquire materials. The owner produces funds to meet demands of a designer for the project. The designer uses the funds for various designers to produce sketches of the project. The owner and general contractor interact with each other when the designer relays the sketches back. The general contractor has suppliers as well as subcontractors, which have their own suppliers to produce the materials needed for the project. This model is important for understanding the complexity of the supply chain in the construction industry.

Ultimately, the overall goal of the supply chain is to reduce costs relating to logistics, lead time, and inventory. Transferring activities from the construction site to the earlier stages of the supply chain help avoid inferior conditions found on the site. It also helps streamline activities. Focus on integrated management and improvement of the supply chain and site production integrates clients, suppliers, and contractors.

A summary of several peer-reviewed papers on factors affecting supplier selection is shown in Table 2. These results show that cost, quality, and delivery are the three most important factors when selecting a supplier. There was no evidence in the literature showing whether these factors are also applicable to supplier selection in the construction industry.

Methodology

The goal of this project was to determine the main factors affecting the purchase of wood products by construction companies. The project included two phases. In phase 1, several construction companies in six states (Virginia, South Carolina, Georgia, Florida, Texas, and Oklahoma) were contacted over the phone for an interview (2/state). Companies were also visited to conduct onsite personal interviews and tour construction projects (2/state). The companies that returned calls and were visited were produced from a master list of 10–12 construction companies/state, which state utilization representatives involved in the study put together as suggestions for interviews. Questions asked during the visits and phone interviews were designed based on a literature review. The second phase consisted of the design and implementation of a questionnaire to survey a larger number of industries based on the results of the literature review, visits, and phone calls to the companies in phase 1.

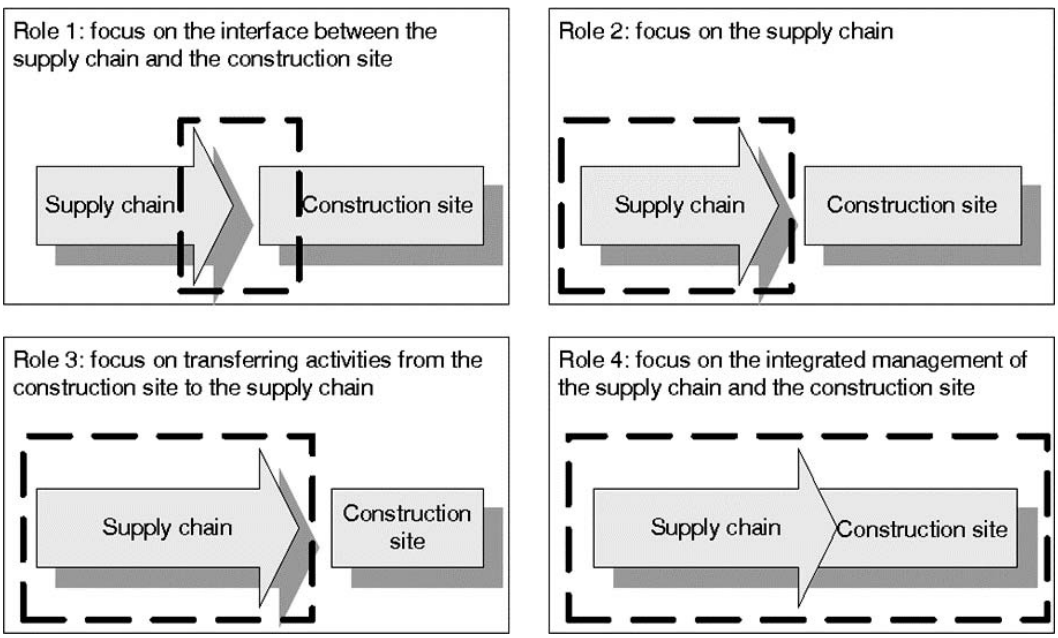


Figure 2.—The four roles of supply chain management in construction (Vrijhoef and Koskela 2000).

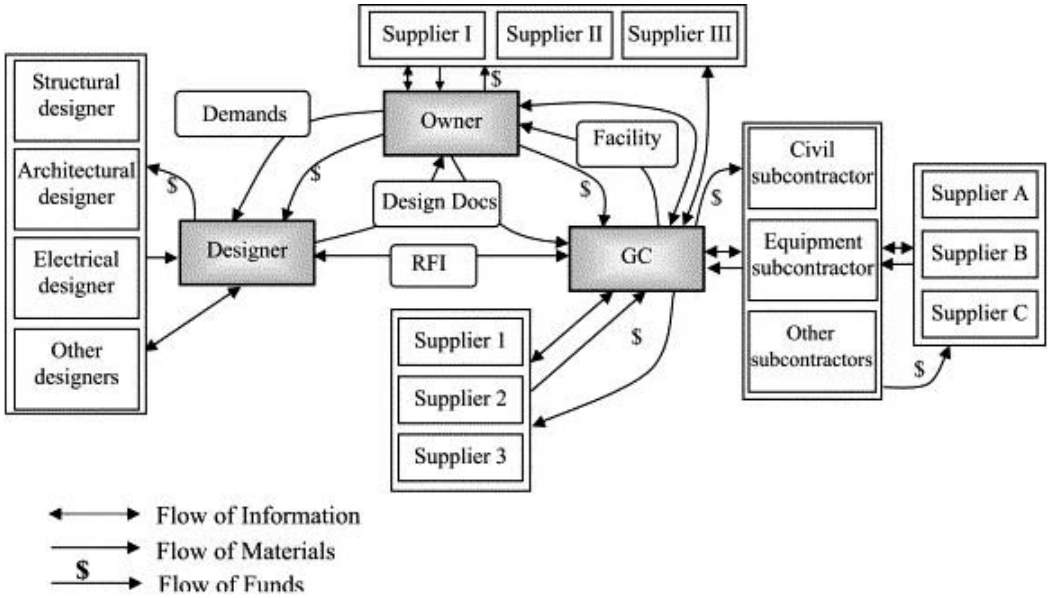


Figure 3.—Model of construction supply chain (Xue et al. 2005).

Industry selection

Individual state's forest-products-utilization market specialist were contacted to gather initial information on aspects affecting the construction industry and to identify potential sources of industry listings. After input from the state representatives was evaluated, a collection of potential web listings to identify companies for phone and onsite visits was drafted (Table 3). This table shows different sources that were used to develop an industry directory for the six participating states.

A list of 10–12 companies for each state was generated to be contacted for a visit or phone interview regarding their supplier selection process. The questionnaires and the procedure to contact the industries were submitted to the Internal Review Board at Virginia Tech for review and approval. The goal was to secure $\geq$2–3 interviews/state, including phone and in-person interviews.

Interviews and phone calls

The interview questions for the selected construction companies were based the literature review and input from the state marketing and utilization specialists (Table 4). The variables included production capacity and flexibility, technical capabilities and support, information and communication systems, financial status, innovation, and research and development.

Table 2.—Analysis of peer reviewed articles.

Factors in supplier selection	Definition	No. of times mentioned	Authors
Cost	Price contractor must pay supplier for product	12	Dickson 1966; Verma and Pullman 1998; Ting and Cho 2008; Ordoobadi 2009; Lu and Geyao 2010; Schramm and Morais 2012; Saf et al. 2014; Galankashi et al. 2015; Cengiza et al. 2017; Alayeta et al. 2018; Kannan 2018; Navarro et al. 2018
Quality	Percentage of product that meets specified requirements	11	Dickson 1966; Perçin 2006; Ting and Cho 2008; Ordoobadi 2009; Schramm and Morais 2012; Galankashi et al. 2015; Cengiza et al. 2017; El Mokadem 2017; Alayeta et al. 2018; Kannan 2018; Navarro et al. 2018
Delivery	Agreed upon time it will take for supplier to deliver whole order to contractor and type of method of transportation that delivers product to agreed location	8	Dickson 1966; Verma and Pullman 1998; Ting and Cho 2008; Ordoobadi 2009; Saf et al. 2014; Galankashi et al. 2015; Cengiza et al. 2017; Navarro et al. 2018
Flexibility	Ability of supplier to maintain resilience after orders need to be adjusted or a problem occurs	5	Perçin 2006; Ting and Cho 2008; El Mokadem 2017; Kannan 2018; Navarro et al. 2018
Location	Distance between contractor and supplier	3	Perçin 2006; Galankashi et al. 2015; Navarro et al. 2018
Relationship	How easy it is to communicate, coordinate, and cooperate with a contractor at the tactical and operations levels. Supplier performs in accordance with agreements.	3	Perçin 2006; El Mokadem 2017; Navarro et al. 2018
Payment options	Flexible payment options and scheduling	1	Cengiza et al. 2017

Table 3.—Discovering companies for each state.

State	Comments	Helpful websites and contacts
Virginia	• Looked on AGC (Associated General Contractors) Virginia member index, researched companies found • Went to ABC (Associated Builders and Contractors), only for members • Viewed list of 2018 executive club members	• www.nxtbook.com/naylor/VGCD/VGCD0018/index.php#/42. • https://www.abcva.org/Membership/Membership-Directory
Florida	• Florida Building Association and other suggested websites, no access to company names. • Found link to Associated General Contractors of America website, was able to find and use a huge list of members	• http://fhba.com/membership/local-hba/ • https://directory.agc.org/
South Carolina	• Called Building Industry Association of South Carolina, was told to go to website member page • Was able to view company profiles	• http://www.biaofcentralsc.com/
Oklahoma	• Found many companies on Oklahoma directory and Certified Builders Website and on Associated General Contractors of America website	• https://www.oshba.org/current-certified-builders. • https://www.webuildoklahoma.com/pages/membership-search.asp. • https://directory.agc.org/
Texas	• Found many companies on Texas Builders Website and on Associated General Contractors of America website	• https://directory.agc.org/ • http://www.texasbuilders.org/membership/member-directory.html#bf_dirFrame_2831.
Georgia	• Associated General Contractors of Georgia (AGCGA) website was not as helpful as the Construction Association website (AGC)	• https://www.agcga.org/web/Copy_of_Find_Members/web/eCommerce/Directories/Public_Organization_Search.aspx?hkey=f738821c-2137-49d3-b1f9-66f5076ef240 • https://directory.agc.org/

These questions provided insight into a construction company's purchasing decisions, as well as brief information about their company. Primarily, the questions focused on how companies buy wood products, their preference for buying from local suppliers, and other important factors when considering suppliers.

In-person interviews with construction companies were conducted in the targeted states to gain further understanding about their practices. The questions were in depth because the in-person setting allowed for more complete answers, as well as a better discussion regarding company practices. The questions asked are shown in Table 5, as well as a short description of the type of question. The bolded questions indicate questions asked previously in phone interviews as an umbrella to the questions underneath it.

Survey

The results of the literature review, input from state marketing and utilization specialists, phone calls, and onsite industry visits were used to design a questionnaire to conduct the industry survey in the selected states. The introduction of the questionnaire was designed to discuss the purpose of the survey and the reason the research was being conducted. The first section, ''Business Information'' helped gather basic information about the company being surveyed, such as the status of the company, sales made, title of person filling out the survey, etc. This section provided data on how big a company was and where they operated. The next section, ''Wood Materials used in your Company'' asked questions about the types of materials the company used in their projects, from where they got their materials, and if they knew whether the materials they purchased came from in-state suppliers. The ''Wood Products Supplier Selection'' section of the questionnaire asked detailed questions about how the company chose their suppliers, whether they focused on factors such as cost, quality, relationship, lead times, etc., as well as how they searched for their suppliers. The final section, ''Wood Products Supplier Evaluation,'' evaluated how well their current suppliers performed and asked for general advice for local suppliers. An online version of the questionnaire was provided as well.

Table 4.—Questions asked of construction companies in a phone interview.

Question	Type of question asked
What are the most important aspects in selection of wood products suppliers?	Supplier selection
What is your purchasing process? Describe.	Purchasing
Who are your key suppliers' home centers, distributors, direct sales from manufacturers?	Supplier information
What is important in the relationship with your suppliers?	Supplier relationship
How many wood products suppliers do you have?	Supplier information
Do you require bids/multiple quotations?	Purchasing
Do you have a preference for purchasing from local suppliers?	Supplier selection
What wood products do you use that are purchased within your state?	Purchasing
What is the size of your company?	Company information

For generating companies for the questionnaire, a third-party website was used to compile a randomly generated list of companies under specific Standard Industrial Classification codes. The companies were in the following categories: general contractors, home builders, construction companies, building contractors, and home improvement. Information gleaned from literature and company interviews was used to form the survey questions.

The first emailing of the questionnaire was sent out the week of March 2, 2020. The reminder to complete the questionnaire was sent out the week of March 30, 2020. The second emailing of the questionnaire was going to be sent out the week of April 13, 2020 and the questionnaire was going to close the week of May 11, 2020. However, in response to the COVID-19 pandemic, a decision was made postpone it until the week of May 25, 2020 because it was

Table 5.—Questions asked of construction companies during in-person interviews.

Question	Type of question asked
What are the most important aspects in selection of wood products suppliers?	Supplier selection
Why does your company focus on factor X (cost, quality, etc.)?	Supplier selection
For these factors, how do you think your suppliers can improve?	Supplier selection/improvement on process
What is your purchasing process? Describe.	Purchasing
Is there any place in this process where your company can give feedback to the supplier?	Purchasing/feedback
What is the hardest part of the purchasing process and why?	Purchasing
Is there any way to improve the process on both ends?	Purchasing/improvement on process
What is the structure of the procurement process?	Purchasing
How does your company purchase wood products?	Purchasing
Who are your key suppliers?	Purchasing/supplier information
Can new suppliers enter the market and would you be interested in what they have to offer?	Purchasing/supplier selection
What do the key suppliers do well to maintain your company's business?	Supplier relationship
What is important in the relationship with your suppliers?	Supplier relationship
How can the relationship be improved?	Supplier relationship/improvement on process
What do these suppliers do well to maintain the relationship?	Supplier relationship
Do you have any advice for smaller, local suppliers to try to get their product considered by companies such as yours?	Advice/supplier selection
Is there supplier training involved in the buying process?	Purchasing
How many wood suppliers do you have?	Supplier information
Does the number of lumber/OSB/etc. suppliers change seasonally?	Purchasing/supplier information
Is the number of lumber/OSB/etc. suppliers constant, or does it increase/decrease when your demand increases/decreases?	Purchasing/supplier information
Do you require bids/multiple quotations?	Purchasing
Is there any way for one supplier to raise itself above another?	Supplier selection
Do you have a preference for suppliers who have better business relationships?	Supplier relationship
Do you have preference for purchasing from local suppliers?	Supplier selection
What is the rough percentage of local to not local suppliers?	Company information
Why do you have no preference for local suppliers/have more preference for local suppliers?	Supplier selection
What could local suppliers do to get more of their product purchased by the company?	Supplier selection/advice
What wood products do you use that are purchased within your state?	Company information/wood product information
Have you looked into other wood products and their uses?	Wood product information
What would you say is the best product you purchase and why?	Wood product information
What is the size of your company?	Company information
Does the size change seasonally (i.e., are there temporary employees)?	Company information
Do you think the size of your company affects the relationship between you and smaller, more local suppliers?	Supplier relationship
Sales wise, how big is your company and does the demand for lumber affect the relationship of your company with suppliers?	Company information/supplier relationship

not known whether companies were doing business during that time period. The survey was closed July 6, 2020, but low response rates dictated that a smaller set of questions from the original questionnaire be asked later through phone calls.

Data analysis

The survey results were put into a statistical software called JMP, from SAS an analytical software company. The results were categorized by wave one, wave two, paper, online, and phone calls. Statistical techniques, such as Chronbach's Alpha Test and contingency tests, were used to compare the methods in order to ensure the data could be combined.

The results of the survey were compared with what was seen in the literature, as well as the phone interviews and in-person interviews that were conducted. This process was implemented to see if the data collection results corresponded to what was seen in the literature regarding supplier selection and purchasing. The interviews and literature also aided in drafting the survey. The survey was used to gain a broad understanding of construction company purchasing practices and supplier selection. The combined data of the surveys and the phone interviews, as well as the survey questions that were not combined, provided insight into construction company decision-making within the southeastern United States.

Based on the combined results from the survey and the phone interviews, guidelines and recommendations were made for suppliers. The recommendations were based on responses and results from those companies involved in the construction industry under the categories of general contractors, home builders, construction companies, building contractors, and home improvements.

Results

Initial phone calls and industry visits

Table 6 summarizes responses from telephone interviews with construction companies. Two to three construction

Table 6.—Summary of responses from phone interviews with companies.

State	Company	Important factors	Key suppliers	Relationship importance	No. of wood suppliers	Require bids	Preference for local suppliers	Size of company by employees
Florida	1	Cost, quality, reputation	Direct sale from manufacturers, distributors	Reputation, reliability	2	Yes	Yes	500
Florida	2	Cost, distribution, chain of custody	Distributor, home center	Proximity, communication, availability	2	Yes	No	40
Florida	3	Cost, efficiency	Distributors	Availability, ease	3	No	Yes	40
Georgia	1	Cost, availability	Distributors	Reliability	5	Yes	Yes	90
Georgia	2	Quality, cost	Distributors	Communication	40	Yes	No	55
Georgia	3	Cost, availability, reliability	Distributors	Communication	6	Yes	Yes	15
Oklahoma	1	Cost, availability, reliability	Distributors	Communication, information	2	Yes	Yes	16
Oklahoma	2	Service, cost, distribution	Distributors	Service	2	Yes	No	15
South Carolina	1	Cost, represent company values, service	Home centers, distributors	Service	2	No	Yes	4
South Carolina	2	Cost, service, availability, quality, lead time	Distributors	Trust, reliability, availability	6	Yes	Yes	10
Texas	1	Cost, relationship	Distributors	Reliability, established credit	2	Yes	Yes	110
Texas	2	Cost, reliability	Distributors	Trust, communication	45	Yes	Yes	33
Virginia	1	Cost, service, distribution	Direct sale from manufacturers	Reliability, service	4	No	No	5200
Virginia	2	Cost, distribution	Direct sale from manufacturers	Reliability	4	No	No	5000
Virginia	3	Cost	Home centers, distributors	Proximity, communication	3	No	No	90

companies from each state responded to telephone interviews. Cost, service, and distribution were mentioned as important factors for supplier selection. The companies often indicated that key suppliers were distributors. Communication, reliability, and service were emphasized regarding the relationship importance with the suppliers. The companies responded that they had fewer suppliers rather than a large number. Companies listed that they had $\leq$6 suppliers. Most companies indicated that they required bids for their purchasing process, and preferred local suppliers. The size of the company by number of employees varied greatly

Table 7 summarizes responses from in-person interviews with construction companies. The in-person interviews used the questions asked during the telephone interviews and expanded upon them. Companies responded that factors such as cost, service, and quality were important for their suppliers. For questions pertaining to how the companies purchased wood products, companies often responded they had a bidding process for their suppliers to follow. Key suppliers were distributors or lumber yards. Home centers were mentioned as well. Construction companies emphasized trust, service, and delivery time in regard to the relationship with the supplier. As seen with the telephone interviews, companies replied that they had small numbers of suppliers, usually two or three. Companies tried to have more preference for local suppliers because it was cheaper and made for easier logistics. Companies responded that they buy all types of wood products, such as lumber, engineered wood products, millwork, etc. Lumber was emphasized as being purchased often. The company size described as according to the employee number was varied. The in-person interviews had similar responses to the telephone interviews, these responses were used to draft the survey questionnaire.

Survey results

Twenty-four companies responded during the first mailing and 35 after the second, for a total of 59 responses. To increase response rate, a selected number of questions from the questionnaire were posed by phone to 46 more businesses, which increased the total sample size to 105. A nonparametrical statistical test was used to compare industry characteristics of the two mailings and phone calls in order to find out whether there were any differences among the groups. The responses of the two mailings were compared against each other and the mailings and phone calls were compared against each other (Fig. 4).

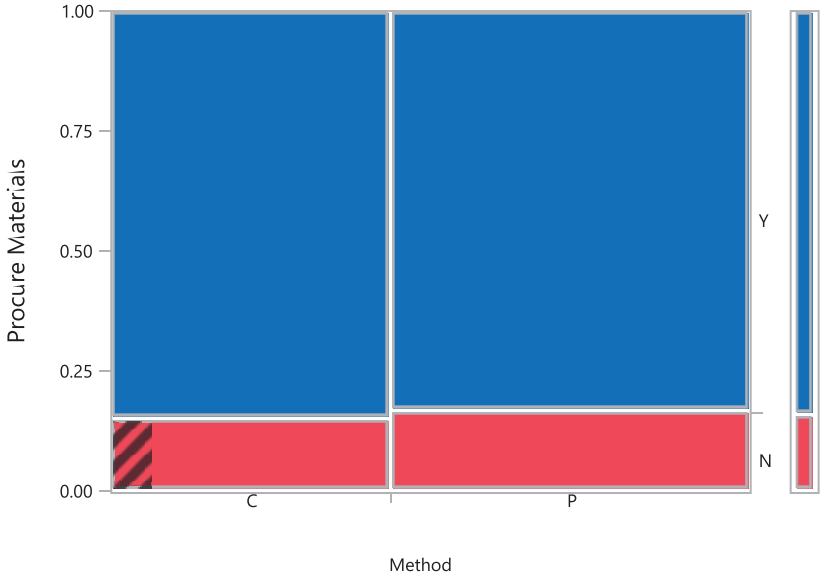
The null hypothesis (H_o) was that the proportion of the data was the same, and the alternative (H_1) was that the proportion of the data was different. The *P* value for Likelihood Ratio was 0.8107, and for the Pearson test it was 0.8111. The *P* values were both greater than the alpha value of 0.05, so the null hypothesis is not rejected, so the proportion of phone responses was the same as survey responses. A Wilcoxon test was conducted for both groups to determine whether the data were statistically different. Results indicated that the groups were the same (alpha level of confidence of 0.05). Therefore, the results of the two waves and the phone calls were merged.

Demographics.—Of the 6 states, Virginia was the state with most responses (23), followed by Florida (21), Georgia (20), Oklahoma and South Carolina (15 each), and Texas (11). In regard to industry size, 81 companies indicated that they

Table 7.—Summary of responses from in-person interviews.

State	Company	Important factors	Purchasing process	Key suppliers	Relationship	No. of wood suppliers	Local suppliers' preference	Wood productinformation	Company size
Virginia	1	Not going to take cheap route, will pay for quality, billing can be a struggle	Bidding if new supplier, constant communication, complicated process, data-driven	Looking for new suppliers in the market, key suppliers deliver on: price, product and service. Offer good service	Improve on: price, performance, quality, value components. Good communication	No. does not change seasonally, tries to have even flow so does not have to lay off employees	Labor is more local than supplier, big company tends to strain relationship with smaller, local suppliers	Always looking at new wood products and different wood products for their uses	Big sales for company, have temporary employees for labor
Virginia	2	High volume production with low margin, lead time, price and quality go hand-in-hand	Bid 6 months ahead, share bids with multiconstruction, lumber yards buy from middle-man	Have constant suppliers, always looking at new leads	Good relationship key, information as well, reliable sourcing	Pretty constant supplier source	No big preference, whoever is going to work well	All types of wood products, but mainly deal with lumber	Cannot really say, does not have information
South Carolina	1	Biggest is price, relationships are there but not made without price	Quarterly process to put out bids, place to give feedback	Big distributors tend to be big suppliers, always want to look at new leads	Customer service, transparency	Around six suppliers	No preference, majority of suppliers are nonlocal	Nominal lumber, pressure treated, engineered wood products, oriented strand board	Around 2,000 homes per year, size sometimes affects relationship with smaller suppliers
South Carolina	2	Service, responsive sales, next is price	Before job start estimate is done, lead times are difficult	Three different companies with lumber yards, possibly interested in new suppliers	Honesty, communication, competitive pricing	Three local lumber yards, nos. do not change seasonally	More preference for local, makes for easier logistics	All wood products, lumber, millwork, trim-work, etc.	Small company, three employees, around US$6 million/year for sales, no stress over demand
Georgia	1	Cost, supply, quality for company	Bidding process, tries to have feedback loop during entire process	Big distributors	Communication and accurate lead times, good pricing	Hard to say, around 40 suppliers	No preference, have contracts with bigger distributors	Lumber, engineered wood products	Around 55 employees, tries to have steady workflow
Georgia	2	Cost, availability	Bidding process, feedback during it	Home centers and distributors	Trust and reliability, good communication	5–6 keep the number constant	Preference for local to make logistics easier	Lumber	90, steady workflow
Florida	1	Cost, delivery time	Bids, want to have better communication	Big distributors, some smaller yards	Communication, product stands out	10 constant suppliers	No preference, nonlocal suppliers have better pricing for company	Lumber and engineered wood products	60, constant size
Texas	1	Cost and quality	Quoting	Lumber yards	Service, delivery time, honesty	2–3, stays constant	Preference due to good service	Spruce–pine–fir lumber	Subcontract 50 employees
Texas	2	Price, time, service	Calls certain people	Small distributors	Service, trust, speed	2–3, constant	Tries to buy local, cheaper	Everything needed for houses	5 employees, stays constant

Mosaic Plot



Contingency Table

Method By Procure Materials

Count Total % Col % Row %	N	Y	Total
C	7 6.67 41.18 15.22	39 37.14 44.32 84.78	46 43.81
P	10 9.52 58.82 16.95	49 46.67 55.68 83.05	59 56.19
Total	17 16.19	88 83.81	105

Tests

N	DF	-LogLike	RSquare (U)
105	1	0.02867759	0.0006

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.057	0.8107
Pearson	0.057	0.8111

Figure 4.—Contingency analysis for survey method by procuring own materials.

have between 1 and 50 employees, 15 indicated between 51 and 100, and 2 indicated between 101 and 150 employees. There were 5 respondents that mentioned having >201 employees. By sales volume, 23 industries had sales between US$1 and $5 million, 15 had sales between US$5 and $20 million, and 14 had sales <US$500,000 per year. There were four industries that had sales >US$50 million/year.

In regard to the type of construction the sampled industries performed, 35 were in the residential construction sector, 21 in residential and commercial, and 12 in the public sector. The rest of the respondents belonged to a mix of different industry sectors. Finally, 84 of the surveyed industries had operations in 1 state, 20 in multiple states, and 1 declined to respond.

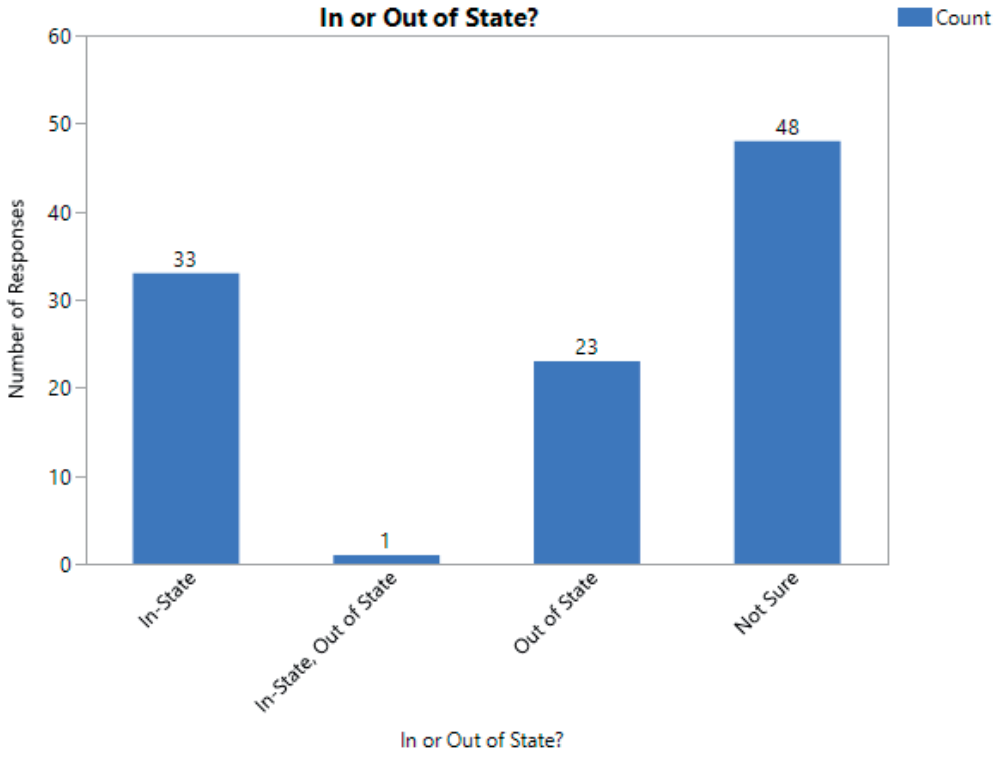


Figure 5.—Number of responses indicating that the company mainly purchased in or out of state.

Wood sourcing.—A majority of the companies responded that they were not aware ($N = 48$) of where their wood product purchases came from (Fig. 5). The second most frequent response ($N = 33$) was that the companies purchased in-state. This indicates that construction companies are mostly unaware of where the products they purchase come from. A majority of companies ($N = 81$) responded that they were not aware whether a product was manufactured within their own state. A product that was purchased within the home state does not necessarily mean that the product was manufactured within that state. Nonetheless, companies were unaware of where the product was purchased or where it was manufactured.

Purchasing decisions.—This question about purchasing factors was not asked during the phone interviews, so only the survey data were recorded. Companies primarily responded that they never used purchase orders for purchasing wood products. Suppliers had their invoices ready most of the time or always on time, and suppliers had the required licenses needed to conduct business. Companies sometimes or rarely searched for new suppliers often, companies sometimes or most of the time used an internal pool of suppliers rather than open sources, and companies purchased in-state most of the time or always purchased in-state.

Results in Table 8 show purchasing factors. Results show only companies that responded in wave 1 or 2 ($N = 59$). For this question, companies responded that they sometimes or most of the time had a flexible lead time with products, and they responded that they focused on quality over the cost of the product most of the time or sometimes. Construction companies responded they rarely or sometimes prioritized higher production over lower production, and they responded they sometimes or most of the time had preference for local suppliers when searching for a new supplier.

A vast majority of companies responded that they purchased more often from a supplier if they had a better business relationship most of the time, and companies responded that they sometimes or most of the time prioritized loyalty over other factors. Based on the literature review, initial phone calls, and industry visits, it was hypothesized that larger companies had better communication with suppliers. Therefore, a nonparametric statistical test (Wilcoxon or Kruskall–Wallis) was conducted to test whether the size of the company (5 levels) had an effect on communications with supplier. This test was used because

Table 8.—No. of responses for purchasing factors a company made.

Factor ranking	Flexible lead time	Focus quality over cost	Prefer higher production over lower production	Preference for local suppliers when searching for new suppliers	Purchase more often if better business relationship	Prioritize loyalty over other factors
1	1	1	6	9	2	1
2	8	2	11	7	3	2
3	28	26	27	13	11	27
4	17	22	8	25	30	19
5	1	5	2	1	8	6

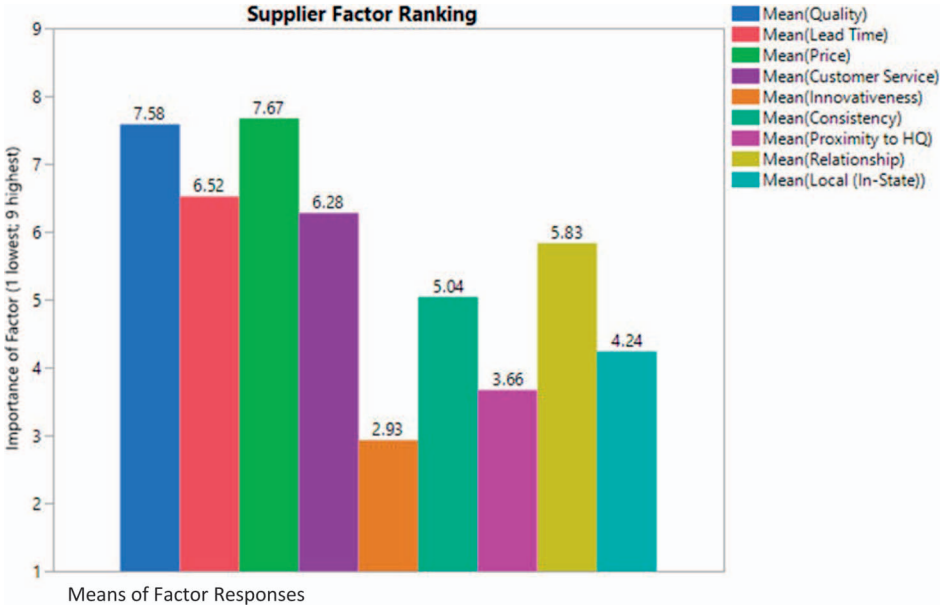


Figure 6.—Means of supplier factor ranking (1 = Lowest; 9 = Highest).

the data did not meet the assumptions of an Analysis of Variance test. The test indicated that the size of the company does not have an effect on communications with suppliers (alpha level of confidence 0.05).

A total of 37 companies responded that they already had a previous working relationship with their suppliers and 24 indicated they found suppliers through relationships from sales representatives. For suppliers to break into the market or have more of an impact, having a previously established relationship would benefit them. Suppliers could also contact the construction company to try to establish this relationship. Sales representatives also had an impact on the construction company finding its suppliers.

Supplier evaluation.—Respondents stated that the most important factors for construction companies when selecting a supplier were price, quality, lead time, and relationship (Fig. 6). This was highlighted in literature as well as interviews with construction companies, but the survey and phone interview data showed these results as well. Companies were asked what they looked for in suppliers in open-ended questions. Again, price, quality, service, time, delivery, and relationship were highlighted as factors in the open-ended responses (ee Word-Cloud analysis in Fig. 7).

Discussion and Conclusions

The preliminary work conducted through interviews with state forestry marketing and utilization specialists and phone calls and visits to a selected group of industries was fundamental for the design of the questionnaire. In addition, the literature review was important for identifying factors affecting selection of suppliers in other industries.

There were a lot of unknowns regarding where the company purchased their various wood products, with most answering they were unaware whether a product was manufactured within their own state. It was odd to observe that even with smaller companies, purchases were made out of state or the company did not know from where the purchase came. An explanation could be that most respondents to the survey were not involved in purchasing;

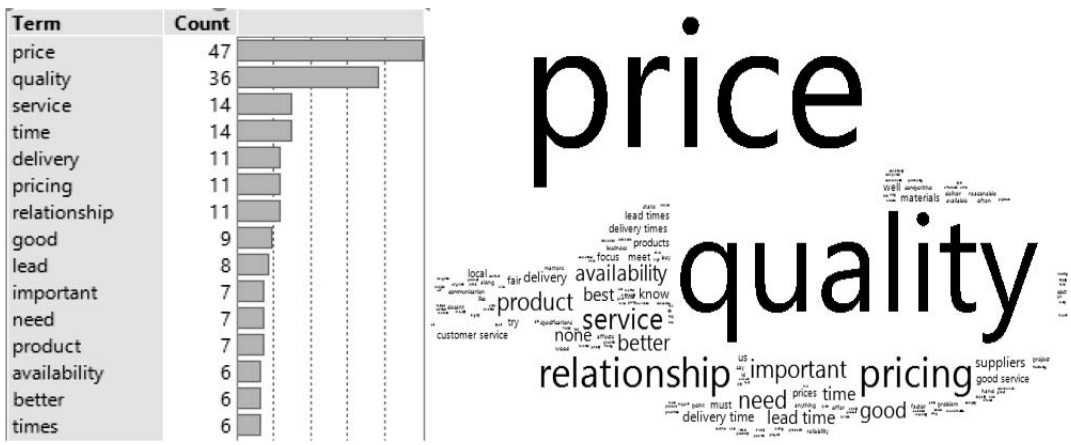


Figure 7.—Common phrases and criteria for a company to purchase local wood products.

however, there were unknowns still involved. It is possible that the construction companies did not know whether national chain stores could be considered as local and thus were unsure whether or not to define a purchased product as 'local'. During interviews companies indicated that they subcontracted some of their work out, so another possible explanation could be that the companies had subcontractors purchasing materials and doing the project work. These results highlighted the need for better knowledge of suppliers within the state. With this knowledge, transportation costs and perhaps product costs could be reduced.

According to construction companies, the most important factors for supplier selection, in order of most important to least important, were price, quality, lead time, and customer service. Business relationship was not far behind customer service in terms of average ranking. Based on the open-ended responses, price, quality, service, lead time, and relationship were highlighted as well. These factors were the most important to construction companies when looking for new suppliers as well as how well their current suppliers were performing. Another phrase that was common in the open-ended questions was that suppliers were not aware of market pricing. The construction companies were looking for suppliers that paid attention to these factors, and those suppliers were more likely to see increased business.

Based on the results, suppliers should strive for fair pricing on their products as well as having a high-quality product. Additionally, on-time arrival and having good service and communication were quite important to construction companies. It would be difficult to focus on every factor highlighted, but it is important to emphasize one or two of the factors. For instance, to set a certain supplier apart from the rest, they could focus on having the best quality product while also having good delivery times. This would mean the price would probably be more of a premium, but companies appear willing to pay that price in return for better quality and the product arriving on time. Prioritizing a few factors rather than all of them could differentiate a supplier.

Suppliers should focus on differentiating their products based on several factors highlighted by construction companies. For instance, the suppliers could focus on producing higher quality products that might cost more but would be more in line with what the construction company was looking for. Another example could be a supplier delivering the products faster to help reduce wait time on the project site by the construction company. Differentiation of products and companies helps suppliers gain market share within the construction industry. It did not matter whether a company was large or small (in terms of employee size and sales volume) in regard to their communication with suppliers; therefore, suppliers have an opportunity to market their products to the entire industry. Narrowing their vision in terms of products while having an open communication system with construction companies would help suppliers gain more market share. Local wood products producers also need to increase promotion to local contractors.

The recommendations were forwarded to the South Carolina Forestry Commission (the entity funding the project) as a part of a comprehensive report based on the project. The South Carolina Forestry Commission has planned to release the survey data as well as the report to help further the relationship between suppliers and construction companies. The suppliers will be able to use the recommendations to help gain market share and promote products.

Conclusions

- Construction companies are unaware of wood products suppliers that are located in-state, which can lead to higher transportation costs because the companies pay more to transport material over a greater distance.
- Cost, quality, relationship, lead time, and service are the most important factors cited by construction companies when selecting suppliers.
- Local suppliers may also provide benefits such as better business relationships, and better-quality wood products.
- Wasted costs include materials, production times, increased lead time, and increased freight costs.
- Suppliers should follow the factors highlighted by construction companies in order to obtain greater market impact.

Recommendations for future research

- A specific study should examine purchasing from manufacturers of wood products versus suppliers of wood products; there is a difference between a product that is manufactured within the state and a product that is sold within the state.
- Can subcontractors influence the location or companies from which construction companies purchased their wood products? It is possible that some construction companies let the subcontractors purchase the wood products. Research on subcontractor purchasing would be interesting.
- More research is needed on construction company size—many responses for this study came from smaller companies, so getting a broader picture of the industry would be helpful.
- Research is needed on how wood products suppliers sell their products; the main focus of this study was from a buyer's perspective, so a seller's perspective could produce more insight.

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