

# Statistical Determination of Factors for Best Marketing Practices of Urban and Reclaimed Wood as Raw Material

Determinación estadística de factores para mejores prácticas de mercadeo de madera urbana y reciclada como materia prima

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## Keywords

Urban wood utilization; reclaimed wood utilization; factorial analysis; marketing practices.

## Abstract

This research is about statistical determination of factors indicated as benefits and barriers, regarding the urban and reclaimed wood in United States market. Through literature review was identified 14 and 8 variables cataloged as benefits and barriers respectively, to conform an initial model, which was consulted to 390 companies of this market for the measurement of the importance level of each variable based on company's experience. This was made through a survey as research tool, validated by methodologic triangulation (surveys experts, academic area experts and industry experts). The initial model was reduced into a management model with 6 and 4 factors for benefits and barriers respectively, containing the correlated variables.

For current situation diagnosis was confirmed that this market is relative new, on its majority is the reclaimed wood more used as raw material than urban wood, and that there is a low percentage of benefits variables on company's advertising. Solutions to proposed problems are a management model and a propose for best marketing practices, which can increase incomes that could generate 60% of net profit. Conclusions are that is possible condense the variables found on literature into a simpler model, which can work as a validated source of information to better marketing strategies, and the recognition of the barriers for this raw material utilization.

## Palabras clave

Utilización de madera urbana; utilización de madera reciclada; análisis factorial; prácticas de mercadeo.

## Resumen

Esta investigación trata sobre la determinación estadística de factores catalogados como beneficios y barreras, sobre la utilización de madera urbana y reciclada en el mercado estadounidense. Mediante revisión de literatura se identificaron 14 y 8 variables catalogadas como beneficios y barreras respectivamente, para conformar un modelo inicial, el cual se sometió a consulta a 390 empresas que forman parte de este mercado para medir el nivel de importancia de cada variable basados en su experiencia. Esto se realizó por medio de una encuesta como herramienta de investigación, validada mediante triangulación metodológica (expertos en encuestas, del área académica y de la industria). Se redujo el modelo inicial en uno con 6 y 4 factores para los beneficios y barreras respectivamente, conteniendo las variables que se correlacionan entre sí.

Para el diagnóstico de la situación actual se confirmó que este mercado es relativamente nuevo, que en su mayoría se utiliza la madera reciclada contra la urbana y que se da un bajo porcentaje de utilización de las variables en sus mensajes promocionales. Las soluciones a los problemas planteados son un modelo de gestión y una propuesta para mejores prácticas de mercadeo, el cual puede significar un aumento de ingresos que generen 60% de utilidad neta extra. Se concluye indicando que es posible resumir las variables dadas por la teoría en un modelo más simplificado, funcionando como fuente de información válida para la elaboración de planes de promoción más eficaces y el reconocimiento de las barreras para la utilización de esta materia prima.

## Introduction

Urban trees are those which grows within areas with more than 2500 people [1], are concentrated in parks, sidewalks, backyards, etcetera and either for natural, security or health reasons, those trees are going to be eventually removed. When this happens, wood waste with great quality and a lot of historical value is generated, and usually goes to landfills or are destined for low quality products. There is also the reclaimed wood, which comes from old buildings, barns or houses that are going to be demolished because of their antiquity or no utilization [2] [3] and it has an important potential as a cheap and great quality source of raw material for wood products.

In spite of the mentioned benefits regarding the utilization of these kinds of wood, there is barriers that does not let the wood companies to take advantage of this material, like logistics, lack of knowledge about their benefits or marketing strategies, lack of support from local governments, among others [4] [5] [6].

With this, considering the benefits and barriers that carries the utilization of urban and reclaimed wood it is unknow about what are the significant factors from the wood companies' perspective based on their experience concerning the use of this kind of material to sell their products within the United States of America market.

This research was developed at Bioproducts and Biosystems Engineering Department, University of Minnesota, for the Forest Products Management Development Institute. The Institute, which aims to provide industry and overall public, seminars, workshops, programs and research to increase knowledge regarding forest resources, environment and wood products.

## Methodology

### Literature review

With the purpose of recollecting relevant information and understanding the context of the urban and reclaimed wood, a literature review was made. Through this was understood the concepts of for example urban trees, reclaimed wood, the value of this wood, the variables identified as benefits and barriers of its utilization, and the development of its market.

The benefits variables and barriers identified are shown in tables 1 and 2.

**Table 1.** Benefit variables found in literature review.

Code	Benefit variables
P1	To appeal to consumer demand for more sustainable and local products
P2	To capitalize on a supply of wood otherwise being underutilized or wasted
P3	To capitalize on a supply of low-cost raw material
P4	To acquire raw materials with unique characteristics (e.g., aesthetics, strength)
P5	Higher profit margins by using urban/reclaimed wood
P6	To differentiate from the competition
P7	To support local economies
P8	Quality
P9	Customization
P10	Emotional value
P11	Aesthetics
P12	Sustainability
P13	Historical significance
P14	Local/domestic sourcing

**Table 2.** Barrier variables found in literature review.

Code	Variable barriers
N1	Lack of consumer awareness on urban or reclaimed wood
N2	Difficulty finding raw materials in the right quantity and/or quality
N3	Difficulty working with non-traditional raw materials (embedded metal, invasive pests, paint, etc.)
N4	Lack of storage space for urban and reclaimed wood raw materials
N5	Lack of financial resources
N6	Poor relationships with suppliers, including municipalities or firms
N7	Lack of market research and poorly identified target markets
N8	Under-performing or insufficient marketing efforts

Note: Each variable was coded for a simple way of its representation for the statistical analysis.

### Sample selection and companies search

The target population for the research is the companies that belongs to the market of manufactured products with reclaimed and urban wood. The sample was selected by the quota sampling method, which is used often in marketing and opinion researchers, a determined quota is set for each fraction from the target population [7]. In this case the number of fractions is 50, because of the 50 states that conforms the United States, trying to get 10 samples by each state to reach the 500 samples, this because the historical response rate that has had the Institute in past researches (10%), also this number because the factorial analysis, which is going to be explained later, that needs at least 50 samples.

The companies were collected using Google and directories, using keywords like “urban wood companies”, “reclaimed wood companies” and its synonyms, for example “urban lumber”, “urban wood waste”, “antique wood/lumber”, “recycled lumber”.

### Design of a survey as research tool

A survey was designed through Qualtrics software, which contains not only the needed questions for the statistical analysis, but also items to recollect information about demography and current marketing practices.

### Research tool validation

The validation was made through Methodic Triangulation, this offers the possibility of seeing the problem from different angles, and by this increase the validity and consistency of our findings [8]. The parts that participated in the triangulation for this research were an expert on surveys, an academic expert on forest and wood topics and experts from the wood industry.

### Apply of the research tool

With a final and validated version of the survey, was proceeded the application of the survey, sending it to all the complied companies being implemented a guide where a first email is sent with the invitation to these companies to fill out the survey, if after a week there is no response, a second email is sent remembering the invitation, then, after another week all the data is downloaded for the analysis [9].

## Data analysis

The items of the survey that are treated through statistical analysis are those that contains the variables identified as benefits and barriers of the utilization of the urban and reclaimed wood, these to identify the correlation between the variables through factorial analysis.

The respondent answered these items through Likert scale, which is the scale with five, seven or nine points used for surveys where according with a level of agreement or disagreement, the respondent answer the question with its perception [10]. For this case was selected the Likert scale with five points, because there is evidence saying that there is no more reliability using a seven or more points scale, and by this way the respondent has a more easy or simple survey to fill.

Obtained the answers, was used the principal components analysis and factorial analysis, which are tools to summarize the data in a few dimensions, condensing a big number of variables into a smaller number of factors which only contains the significant ones [11]. The factorial analysis needs at least 50 responds to have valid conclusions [12].

Additionally, to check the validity of the answers from the Likert scale, was implemented the statistical analysis Cronbach's alpha, which it is a simple and reliably way for checking the existing correlation between the items that are part of the survey, where a Cronbach's alpha obtained greater than or equal to 0.7 indicates a good internal consistency for the scale [13].

## Results and conclusions

The results from the statistical analysis were compared against the statements about the variables found at the literature and through this concluding which ones are corelated.

## Objectives

### Overall objective

Determine statistically the significant factors that benefit and obstruct the utilization of urban and reclaimed wood for the identification of best marketing practices of companies in the United States of wood products that use this kind of raw material.

### Specific objectives

- Create, validate and apply a research tool for the measurement of perception from the urban and reclaimed wood processing companies regarding the variables that influence the utilization of this kind of wood as raw material.
- Compose a list of significant factors about the benefits of urban and reclaimed wood utilization for being used as a best a marketing practices reference.
- Recognize the significant factors regarding barriers of urban and reclaimed wood utilization.

## Currently situation diagnosis

### Characteristics and profile of complied companies.

Was selected 390 companies, which 80% are located in 21 from the 50 states of the United States, these states are Wisconsin, Virginia, California, Texas, Florida, Georgia, Washington, New York, Montana, Michigan, Illinois, Pennsylvania, Massachusetts, Minnesota, Oregon, Tennessee, Maryland, Utah, Arizona, Missouri y Louisiana. Regarding these 390 companies, 60.8% indicated just reclaimed wood, 34.6% just urban wood, and 4.6% both type as raw material.

### Marketing strategies currently implemented.

Of the 14 variables found through literature review identified as benefits, just 7 have been used in the companies' advertising, presented in table 3.

**Table 3.** Currently variables used for advertising.

Variable	Synonyms	Reclaimed	Urban	Both	TOTAL	(%)
To support local economies	Locally, originally, domestic.	13	25	2	40	10
Quality	-	28	11	2	41	11
Customization	Unique, different,	9	11	0	20	5
Emotional value	Love, family.	1	1	0	2	1
Aesthetics	-	1	4	0	5	1
Sustainability	Green, environment.	51	35	5	91	23
Historical significance	History, old, antique.	84	4	0	88	23

## Data form the survey

As was indicated in the last section, 390 companies were selected for the research, but from those, was obtained only 117 valid responses, so next results are going to be analyzed based on these number of responses.

The table 4 shows the period of time that these companies have been in the market.

**Table 4.** Number of companies by time period of existence.

Period (years)	Number of companies	Percentage
Less than 1	3	3%
Between 1 & 4	14	12%
Between 5 & 9	34	29%
Between 10 & 15	25	21%
More than 15	41	35%

From companies that responded, 65% have been in the urban and reclaimed wood market less than 15 years, proving with this, the recently peak on this market.

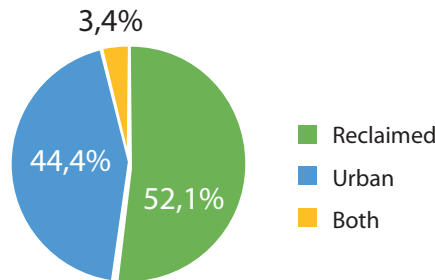
Also, these companies responded regarding which regions are the ones where they mainly sell their products, see table 5.

**Table 5.** Number of companies by region.

Region	Companies
Exportation	59
Northwest	58
Southwest	50
Southeast	44
Midwest	35
Northeast	22

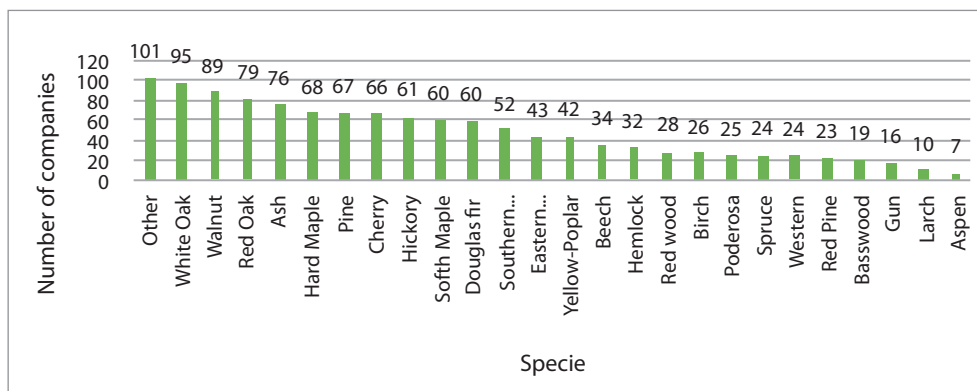
This information is important for these companies so that they can know what regions they have more or less competition in and they can use that information to lead to more potential clients.

Remains a greater percentage for reclaimed wood utilized by these companies than urban wood as raw material compared with the initial data from the 390 companies, as figure 1 shows.



**Figure 1.** Type the wood percentage used by the companies.

The companies also indicated which wood species do they use for the productions of their products, as can be seen in next figure, the most utilized specie is white oak, and the least is aspen, see figure 2.



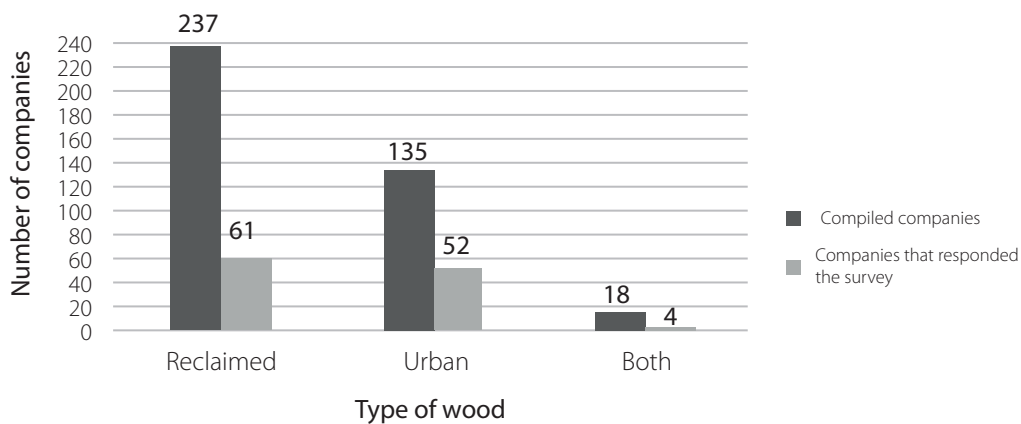
**Figure 2.** Species utilized as source of wood.

Table 6 shows specifically what products are made with these wood species.

**Table 6.** Products and number of companies that produce them.

Products	Number of companies
Furniture	92
Mantels	89
Slabs	81
Lumber	79
Beams	70
Flooring	62
Millworks (paneling, trim, etc.)	59
Stair parts	56
Doors	40
Byproduct (sawdust, chips, etc.)	38
Cabinets (kitchen and bathroom)	36
Accessories (games, trinkets, etc.)	21
Windows	21
Tableware (kitchen utensils, bowls, etc.)	19
Other	8

Lastly, the distribution between the number of companies compiled and the number of companies that responded to the survey are compared, regarding the type of wood that they indicated as raw material, this can be seen in figure 3.



**Figure 3.** Initial data compared to final data distribution.

Based on the figure above, the initial and final data show the same trend. Also, is indicated that the response rate obtained was 31,3% which is greater than the department's historical rate (10%). This value and the way that it was calculated is show in table 7.



**Table 7.** Calculation of response rate.

Initial sample	390
(-) Undeliverable and failed emails	6
(-) Companies that declined to participate	0
(-) Incomplete questionnaires	10
Adjusted sample	374
Usable responses	117
Adjusted response rate (117/374)	31,3%

## Data analysis

### Cronbach's alpha analysis

The obtained Cronbach's alpha for each type of variable can be found in table 8.

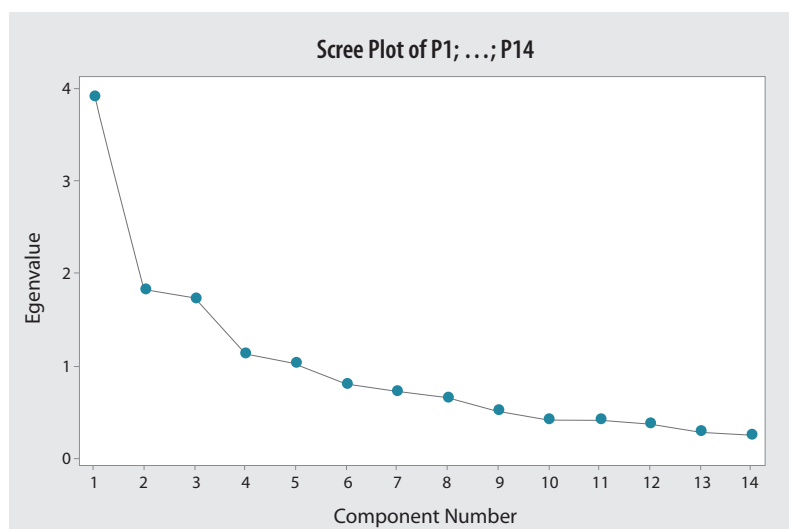
**Table 8.** Obtained Cronbach's alpha.

Variables	Cronbach's Alpha
Benefits	0,7667
Barriers	0,7792

For both cases, Cronbach's alpha is greater than the reference value (0.7) [14] and with this is allowed to indicate that between the survey questions and the Likert scale exists the correlation for affirm that is given the level of needed internal uniformity in the items for the measure of the same characteristic.

### Principal components analysis

Figure 4 shows the scree plot for principal components analysis for benefit variables.



**Figure 4.** Scree Plot for benefits variables

From figure 4, it can be seen that starting from component 6, the trend of the line starts to flatten and therefore the variability is small, with this, the number of components would be 5.

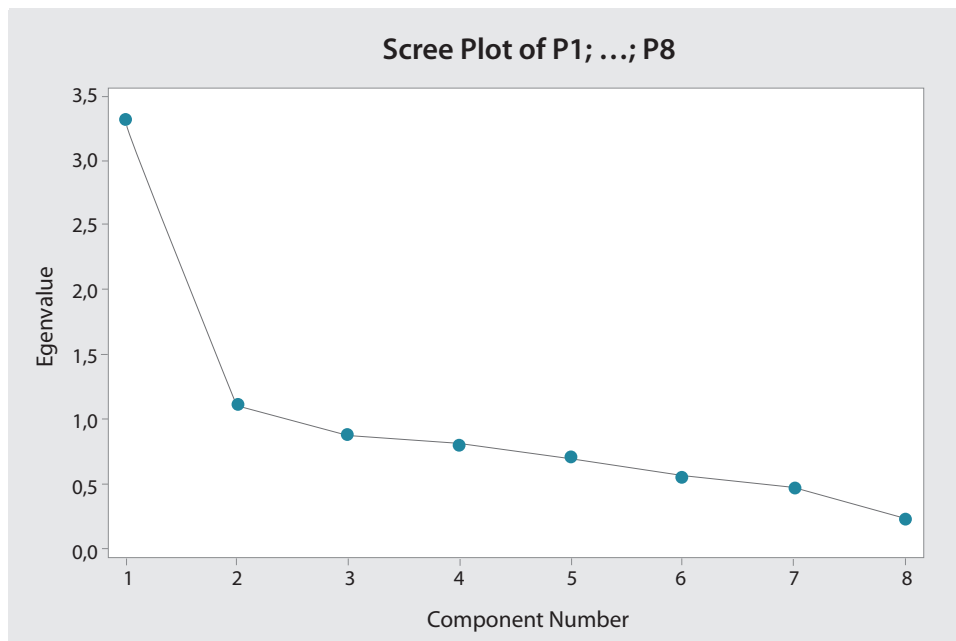
This can be confirmed taking as decision reference the eigenvalue and the accumulated variability calculated for each component, these can be found in table 9.

**Table 9.** Eigenvalue and accumulated variability for benefits variables.

Eigenanalysis of the Correlation Matrix										
Eigenvalue	3,9129	1,8190	1,7294	1,1262	1,0198	0,7945	0,7220	0,6494	0,5052	0,4153
Proportion	0,279	0,130	0,124	0,080	0,073	0,057	0,052	0,046	0,036	0,030
Cumulative	0,279	0,409	0,533	0,613	0,686	0,743	0,795	0,841	0,877	0,907
Eigenvalue	0,4099	0,3700	0,2775	0,2491						
Proportion	0,029	0,026	0,020	0,018						
Cumulative	0,936	0,962	0,982	1,000						

So according with the eigenvalue that has to be around 1, the number of components would be 5, but this number explains only 68.6% of accumulated variability. To get an accumulated variability greater than or equal to 70% [15] is needed to take 6 components in this case.

The same analysis is made for barriers variables, see figure 5.



**Figure 5.** Scree Plot for barriers variables

From figure 5 can be seen that starting from component 3 the trend of the line starts to show flat and therefore the variability is small, with this, the number of components would be 2.

This can be confirm taking as decision reference the eigenvalue and the accumulated variability as well, calculated for each component, these can be found in table 10.

**Table 10.** Eigenvalue and accumulated variability for barriers variables.

Eigenanalysis of the Correlation Matrix								
Eigenvalue	3,2877	1,0970	0,8721	0,8002	0,6938	0,5573	0,4696	0,2223
Proportion	0,411	0,137	0,109	0,100	0,087	0,070	0,059	0,028
Cumulative	0,411	0,548	0,657	0,757	0,844	0,914	0,972	1,000

Again, according with the eigenvalue, the number of components would be 2, but this number explains only 54,8% of accumulated variability. To get a accumulated variability greater than or equal to 70% the number of components to choose would be 4.

### Factorial analysis

This analysis was made using as extraction method the Principal Components technique with Varimax rotation type, examining the influences pattern that make each factor in each variable.

**Table 11.** Factorial analysis values for benefits variables.

Rotated Factor Loadings and Communalities							
Varimax Rotation							
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
P1	0,174	-0,734	-0,041	0,075	0,043	-0,121	0,593
P2	0,221	-0,224	-0,129	-0,096	0,188	-0,800	0,799
P3	-0,177	-0,020	-0,730	-0,088	-0,140	-0,451	0,796
P4	0,752	-0,023	-0,318	-0,075	0,048	-0,058	0,678
P5	0,094	0,004	-0,890	0,021	0,046	0,050	0,805
P6	0,185	-0,552	-0,485	0,012	0,413	0,258	0,811
P7	-0,005	-0,731	-0,004	-0,214	0,047	-0,067	0,587
P8	0,153	-0,596	0,106	-0,255	0,009	-0,474	0,680
P9	0,812	-0,208	0,007	-0,088	0,063	-0,082	0,721
P10	0,816	-0,015	0,237	-0,163	0,050	-0,087	0,759
P11	0,310	0,001	-0,171	-0,050	-0,056	-0,009	0,823
P12	0,151	-0,180	0,162	-0,695	0,354	-0,156	0,714
P13	0,084	-0,094	0,008	-0,179	0,915	-0,140	0,905
P14	-0,164	-0,527	0,008	-0,600	0,210	-0,147	0,730
Variance	2,2205	2,1463	1,8020	1,7438	1,2501	1,2392	10,4017
% Var	0,159	0,153	0,129	0,125	0,089	0,743	0,743

From table 11 are grouped the variables that have an influence value close to 1, in absolute value, for each factor. The mentioned grouping is shown in table 12.

**Table 12.** Variables grouping for benefits variables.

Factor	Variable (Code)
1	P10
	P9
	P4
2	P1
	P7
	P8
3	P5
	P3
4	P11
	P12
	P14
5	P13
6	P2

Now the factorial analysis for barriers variables is made, see table 13.

**Table 13.** Factorial analysis values for barriers variables.

Rotated Factor Loadings and Communalities					
Varimax Rotation					
Variable	Factor 1	Factor 2	Factor 3	Factor 4	Communality
N1	0,250	0,286	0,158	0,220	0,218
N2	0,194	0,303	0,238	0,149	0,208
N3	0,199	0,287	0,911	0,220	1,000
N4	-0,041	0,195	0,162	0,571	0,392
N5	0,310	0,041	0,072	0,701	0,594
N6	0,128	0,705	0,189	0,127	0,566
N7	0,592	0,561	0,114	0,093	0,687
N8	0,948	0,197	0,197	0,156	1,000
Variance	1,5032	1,1466	1,0298	0,9851	4,6648
% Var	0,188	0,143	0,129	0,123	0,583

By the same way that benefits variables were grouped, was defined next groups in table 14.

**Table 14.** Variables grouping for barriers variables.

Factor	Variable (Code)
1	N8
	N7
2	N6
	N2
	N1
3	N3
4	N5
	N4

## Solutions to proposed problem

### Definition of an urban and reclaimed wood management model

Defined the number of factors and variables that conforms each one is made next model. Each factor is named based on the variables that contains replacing the codes for its respective variable. This can be found in table 15 and 16.

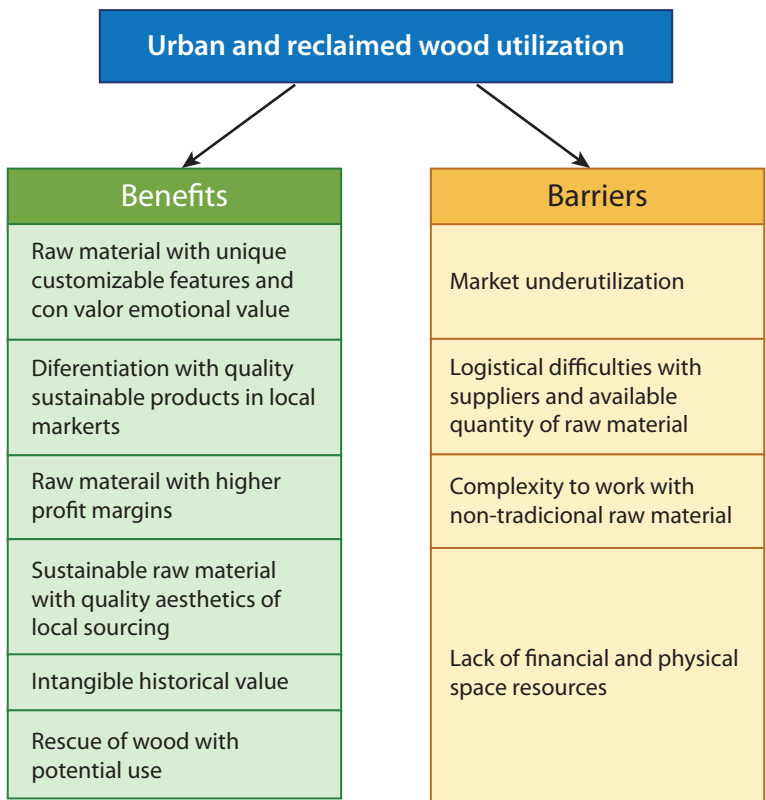
**Table 15.** Given name for each factor regarding the benefits variables that contains.

Factor	Variable
Raw material with unique customizable features and con valor emotional value	Emotional value
	Customization
	To acquire raw materials with unique characteristics (e.g., aesthetics, strength)
Diferentiation with quality sustainable products in local markets	To appeal to consumer demand for more sustainable and local products
	To support local economies
	Quality
	To differentiate from the competition
Raw material with higher profit margins	Higher profit margins by using urban / reclaimed wood
	To capitalize on a supply of low-cost raw materia
Sustainable raw material with quality aesthetics of local sourcing	Aesthetics
	Sustainability
	Local/domestic sourcing
Intangible historical value	Historical significance
Rescue of wood with potential use	To capitalize on a supply of wood otherwise being underutilized or wasted

**Table 16.** Given name for each factor regarding the barriers variables that contains.

Factor	Variable
Market underutilization	Under-performing or insufficient marketing efforts
	Lack of market research and poorly identified target markets
Logistical difficulties with suppliers and available quantity or raw material	Poor relationships with suppliers, including municipalities or firms.
	Difficulty finding raw materials in the righth quantity and/or quality
	Lack of consumer awareness on urban or reclaimed wood
Complexity to work with non-tradicional raw material	Difficulty working with non-tradicional raw materials (embedded metal, invasive pests, paint, etc.)
Lack of financial and physical space resources	Lack of financial resources
	Lack of storage space for urban and reclaimed wood raw materials

This model can be represented graphically in figure 6.



**Figure 6.** Graphic representation of management model.

The model above has a statistical base, that groups each variable as a lineal function of these adjacent factors, for a simpler interpretation regarding the benefits and barriers of these type of wood.

### Proposal for a new marketing strategy implementation.

As was indicated in the marketing strategies currently implemented section, the percentage of companies that uses the variables identified as benefits their marketing strategies is low (23%), this is an opportunity for the rest of companies regarding the implementation of this, and by this way increase the demand of its products. An example of a companies that uses these variables is shown in figure 7.



**Figure 7.** Marketing strategy implementation.

The last two figures shows advertising from web pages that uses sentences like “sustainable sourced”, “story to tell”, “reclaimed and sustainable wood”, been this, a good way of attracting the attention of potential clients that found these characteristics as important.

### Proposal’s economic impact

Since this is a relative new industry segment, there is no specific studies regarding the economic effects that carries this kind of marketing strategies, however there is studies in general. Digital advertising is already impacting companies incomes between a 30% and 60% of increase, this according with Federico Isuani, Socialand’s CEO, a consulting company of digital strategies. [16]

With this, next is developed an example about a simplified annual balance sheet and income statement of a company that makes products using urban and/or reclaimed wood. These examples have two scenarios, the first one where there is no marketing strategy applied and another one where it is applied in table 17.

**Table 17.** Simplified annual balance sheet example.

	Without marketing strategy (USD\$)	With marketing strategy (USD\$)
Sales	100.000	130.000
Sales cost	25.000	25.000
Gross profit	75.000	105.000
Operation cost	30.000	30.000
Net profit	45.000	75.000

So, for a company that has an annual income of USD\$ 100.000 would earn USD\$ 45.000 of net profit, this without the marketing strategy. By the other hand if it is applied the marketing strategy and with the minimum percentage of increase indicated (30%), this company would earn USD\$ 75.000, a difference of USD\$ 30.000, or it can be seen as a 60% of difference about the net profit as well. It is import to indicate that this numbers do not include the respective cost from the application of the marketing strategy.

## Conclusions

It is determined that there is an important geographic concentration of the compiled companies, with an 80% of these in 21 of 50 states that has the United States, which the majority works with reclaimed wood compare to urban wood, aspect to considering regarding the local competition level.

Also, there is a sub-utilization of attributes available for of the demand, in a market where there is an important competition for selling similar products.

There is sureness that the statistical treatment of data and the conclusions made are appropriated due to the utilization of a validated research tool, capable of the measurement of the needed characteristics, with the required correlation and internal uniformity.

Through principal components analysis and factorial analysis was possible to develop a management model by condensing a big number of variables that literature expresses as benefits (14) and barriers (8) for the utilization of urban and reclaimed wood into a smaller number of factors (6 and 4 respectively). Mentioned model can be a valid source of information for implementation of a more effective marketing strategy, which can increase at least a 30% of income that means a 60% of net profit.

Finally, it is determined which are the barriers that implies the utilization of this kind of wood, so that in parallel to a good marketing strategy, companies can concentrate their resources and energy for overcoming this obstacles and success in this market segment.



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