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Low-Cost Opportunity for Small-Scale Manufacture of Hardwood Blanks

Bruce G. Hansen
Philip A. Araman

The Authors

Bruce G. Hansen, economist, received a B.S. degree in economics from Concord College, Athens, West Virginia, in 1968, and a M.B.A. degree from Virginia Polytechnic Institute and State University in 1978. He is currently engaged in research on analysis of international trade for hardwood forest products at the Northeastern Forest Experiment Station's Forestry Sciences Laboratory, Princeton, West Virginia.

Philip A. Araman is a research forest products technologist at the Northeastern Station's Forestry Sciences Laboratory at Princeton, West Virginia. He received a B.S. degree in wood science and technology from North Carolina State University and a M.S. degree in forest products from Virginia Polytechnic Institute and State University. He has conducted studies on the use of hardwood lumber to make furniture and dimension stock, and currently is engaged in research on hardwood exports.

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Abstract

We analyzed the manufacture of standard-size hardwood blanks from lumber on a relatively small scale by conventional processing. Requiring an investment of just over $200,000, the conventional mill can process 500 M bf (thousand board feet) of kiln-dried lumber annually. The study focused on the economics associated with manufacture of blanks from four species—northern red oak, black cherry, hard maple, and yellow-poplar. Assuming a tax rate of 46 percent, returns ranged from 31 percent for hard maple to 38 percent for yellow-poplar. Plots were developed relating raw material input cost to blank prices necessary to achieve specified levels of return.

The blanks investment seems suited to someone wishing to enter the wood business on a small scale, to sawmill operators wishing to upgrade and expand their product offering, and to small furniture and cabinet manufacturers wanting more control of their raw material situation.

Introduction

All those in the hardwood lumber business recognize the advantages and ready market for high-quality hardwood lumber. However, nearly 87 percent of all sawlog timber is Log Grade 2 and below[1] (McLintock 1983). As a result, at least 60 percent of the hardwood lumber produced is grade No. 2 Common or lower—grades normally passed over in the manufacture of furniture and cabinet dimension stock. Considerable benefit could result from upgrading some of this low- and medium-grade material. In this paper we discuss a low-capital-outlay manufacturing facility in which medium (No. 1 Common) and low (No. 2 Common) grade kiln-dried lumber is used to make standard-size blanks (Araman 1983)—a product developed for furniture and cabinet manufacturers.

Previously we designed and described the operation of a full-scale hardwood blanks mill (Araman and Hansen 1983) that is based on conventional technology. This mill could profitably convert a log-run mix of northern red oak lumber into standard-size hardwood blanks. The mill described required an initial investment of about $3 million (1980 dollars) to process 16 M bf (thousand board feet) of lumber into 9.6 M bf of edge-glued blanks per shift. By contrast, this study examines the manufacturing of blanks on a much smaller scale, and looks at the manufacture of four species rather than one. Also, a schedule of blank prices needed to achieve specific levels of return for a broad range of raw material input cost has been developed.

[1] USDA Forest Service grade rules.

Processing System

Table 1 includes a detailed description of equipment and building costs for the facility (Fig. 1) in our analysis. Although other designs are possible, our design relies on conventional processing techniques, including crosscutting first followed by random-width ripping. The estimated initial capital cost for the plant facility, including 3 acres of land, is just over $200,000.

The plant is assumed to operate one shift, 250 days per year, processing 500 M bf of lumber into 300 M ft^2 (4/4 basis) of red oak, black cherry, or hard maple blanks, or 325 M ft^2 (4/4 basis) of yellow-poplar blanks annually.

The plant employs six people at a cost of $84,000 annually. This assumes an hourly rate of $7—$5.40 in wages plus $1.60 in mandatory fringe benefits. In addition, an administrative and management staff of two is allocated $70,000 annually for salaries and office expenses. Another $20,000 covers annual costs for utilities, supplies, and maintenance. Selling expenses were set equal to 1 percent of gross revenue.

Table 1.— Facility requirements and estimated costs for the standard-size blanks plant

Facility requirements	cost[a]
	Dollars
Forklift (2 ton)	11,000
Crosscut saw with table	9,900
Ripsaw with laser guide light	17,600
Abrasive planer (37-inch top machine)	27,500
Clamp carrier (8-1/2 feet wide, 20 sections)	16,390
Glue pump and applicator	5,060
Factory trucks (25)	9,240
Compressed air unit	5,500
Dust system	5,500
Office equipment and furnishings	11,000
Land (3 acres)	33,000
Building (40 by 85 feet, preengineered, $15.40/$ft^2$)	52,360
Total	204,050

[a] 1980 prices increased by 10 percent,

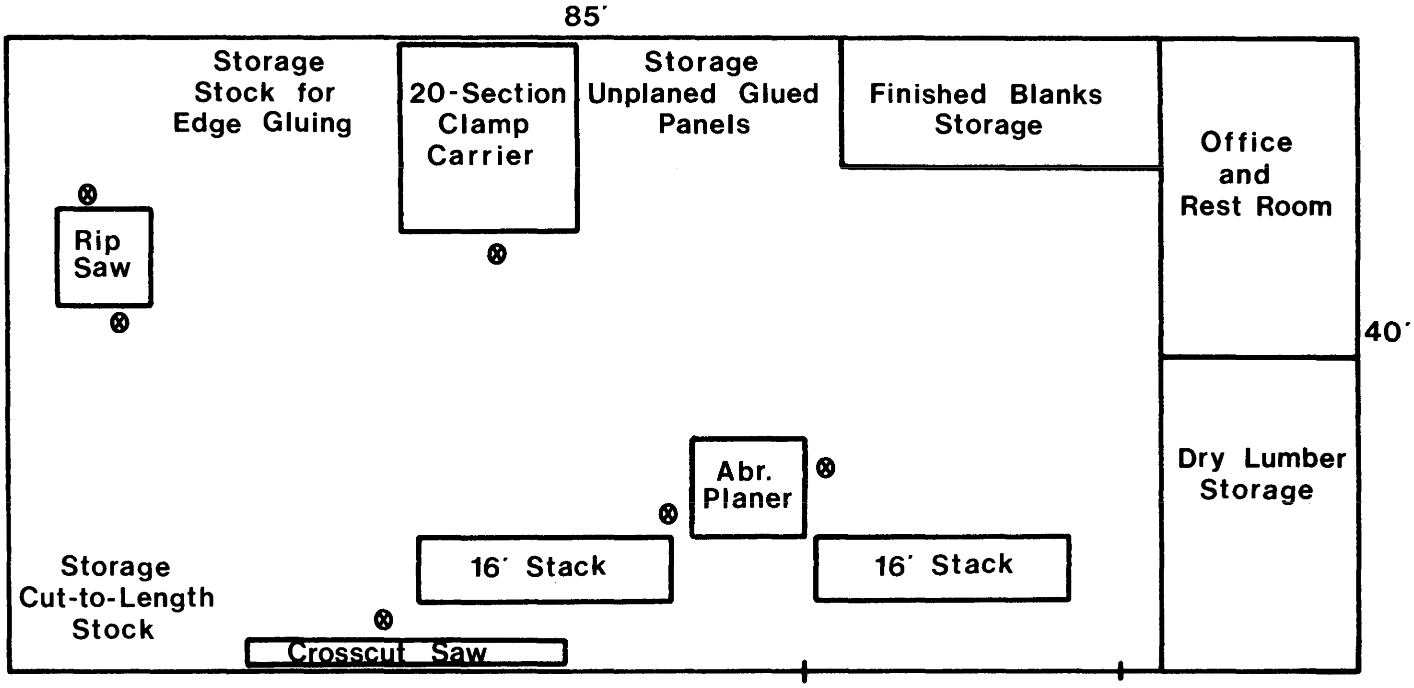

Figure 1.—The blanks manufacturing facility.

Lumber is kiln dried and either purchased delivered or transferred at market price from another division of an ongoing firm and stored for cut-up in the rough mill. Lumber is made into edge-glued panels by a conventional rough plane, crosscut-rip-salvage rough mill. After planing, up to 12 standard lengths are cut at the crosscut saw. Random-width cuttings are ripped from the cut-to-length boards. Pieces containing defects are salvage crosscut into shorter standard length cuttings. Clear cuttings are matched for color and grain, put into panel sets, and edge-glued. After gluing, blanks are rough planed and placed into inventory. Blanks are sold in standard sizes or they can be remanufactured into specific size parts.

Raw Material and Product Yields

The following are raw material and yield assumptions used in the analyses.

- Only 4/4 lumber is used.
- The grade mix of lumber used in manufacturing blanks consists of 60 percent No. 1 Common and 40 percent No. 2 or No. 2A Common.
- Costs for red oak, black cherry, hard maple, and yellow-poplar were obtained for 4/4 No. 1 Common and No. 2 or No. 2A Common from the April 7, 1984, Hardwood *Market Report.* Additional charges were added for kiln drying and transportation in deriving input cost per M bf at the mill.

Species	*Prices No. 1 C*	*Prices No. 2C or 2AC*	*Weighted average*	*Kiln costs*	*Trans-portation*	*Total*
	Dollars/M bf					
Red oak	615	255	470	100	40	610
Black cherry	605	305	485	75	40	600
Hard maple	342	215	290	100	40	430
Yellow-poplar	260	170	225	65	40	330

- A 60-percent yield in blanks was assumed for red oak, black cherry, and hard maple. Yellow-poplar was assumed to have a 65-percent yield. Yield assumptions were calculated using FPL-118 (Englerth and Schumann 1966) yield tables, and by adjusting these to allow for a 6-percent lumber shrinkage, a 60/40 lumber grade mix, and standard-blank size requirements. These requirements were determined after an extensive survey of manufacturers of solid furniture and kitchen cabinets (Araman et al. 1982). Although thousands of different part sizes were reported in the survey, it was found that relatively few standard blank sizes could meet the industries' varied requirements.

- The standard blanks are Cl F (clear-one-face), 7/8 inch thick, and 26 inches wide (edge-glued) with lengths predominantly between 15 and 40 inches, though some are as long as 100 inches. Market price assumptions for blanks were developed from estimates of edge-glued product prices obtained from conversation with dimension manufacturers since market price reports for panel products are not available. The prices used in this analysis were:

Species	*DollarslM ft*^{2}
Red oak	2300
Black cherry	2300
Hard maple	1900
Yellow-poplar	1700

Economics

The economic discussion focuses on construction of the net present value (NPV) and internal rate of return (I RR) discounted cash flow measures. These measures best account for the relationship among cash flows (that is, the initial investment, operating costs, and revenues) throughout the entire life of the investment, giving explicit recognition to the timing of cash flows, foregone opportunities, and capital costs.

Table 2 provides summaries of the cash flows expected during the

Table 2.—Cash flow summaries for red oak, black cherry, hard maple, and yellow-poplar (tax rates of 30 and 46 percent)

Year	Facilities and working capital investment	Gross revenues	Operating costs	Depreciation	Net after-tax cash flow 30%	Net after-tax cash flow 46%
			Thousands of dollars			
			RED OAK			
0	243				– 243	– 243
1	18	345	330	22	– 1	0
2		690	486	33	153	126
3		690	486	32	152	125
4		690	486	27	151	123
5		690	486	27	151	122
6		690	486	4	144	112
7-9		690	486	3	144	112
10		690	486	3	248	216
			BLACK CHERRY			
0	243				– 243	– 243
1	18	345	327	22	1	2
2		690	481	33	156	128
3		690	481	32	156	127
4		690	481	27	155	125
5		690	481	27	154	125
6		690	481	4	147	115
7-9		690	481	3	147	114
10		690	481	3	251	218
			HARD MAPLE			
0	238				– 238	– 238
1	13	285	284	22	– 6	– 2
2		570	395	33	133	110
3		570	395	32	132	109
4-5		570	395	27	131	107
6		570	395	4	124	96
7-9		570	395	3	124	96
10		570	395	3	217	190
			YELLOW-POPLAR			
0	235				– 235	– 235
1	10	275	259	22	8	9
2		553	345	33	156	128
3		553	345	32	155	127
4-5		553	345	27	154	125
6		553	345	4	147	114
7-9		553	345	3	147	114
10		553	345	3	234	201

10-year investment period for each of the four species. In all examples, full production is not achieved until the second year of operation, so revenues in year 1 are half those thereafter. Except for raw material costs and selling expenses, however, first-year costs equal those under full production.

The derivation of the net after-tax cash flows in most years is straightforward. To begin, operating costs and depreciation were subtracted from revenues, taxes were computed, and then depreciation was added to the after-tax income. However, there are instances where other considerations affect the net after-tax cash flows. First, as the plant moves to full production in year 2, additional working capital is required. Harpole's (1978) program increases working capital automatically using the relationship between initial working capital outlays and operating costs. Second, the program allows for complete writeoff of depreciation in the year it occurs whether or not there is sufficient income from the project itself. In such instances, it is implicitly assumed that there is additional income for the investor, allowing the complete and immediate write-off to occur. This treatment enhances the net after-tax cash flow only to the extent of the tax benefit derived from depreciation. Third, proceeds from the assumed sale of land and from real assets in an amount equal to their remaining book value, plus the return of working capital, are added to the operating cash flows at the end of year 10.

Depreciation allowances were calculated using Accelerated Cost Recovery System schedules. Accordingly, building expenditures were depreciated over 15 years; all equipment, with the exception of 25 factory trucks, in 5 years; and the 25 factory trucks in 3 years. In keeping with general practice, assets not fully depreciated in 10 years are assumed to be sold at the end of the tenth year at a price equal to their remaining book value. investment tax credits were not considered.

In discounted cash flow analyses, initial working capital outlays are a part of the initial investment. Subsequent outlays are thought to derive from after-tax cash flows in the year preceding their use. These outlays are required to cover expenditures for raw material, work in process, finished goods inventories, and to cover sales where credit terms are extended to the buyer. We allow for working capital to cover approximately 10 days' inventory of raw material plus 25 days' output of finished product. Working capital requirements vary in relation to the value of the species being manufactured.

While individual investor circumstances, capital costs, tax rates, and alternative investment opportunities will ultimately dictate investment decisions, our results indicate that the blanks manufacturing option for small-scale investment should be of considerable interest. Assuming that the corporate maximum tax rate of 46 percent applies, investment performance after taxes as measured by the IRR ranged from a low of 31 percent for the manufacture of hard maple blanks to a high of 38 percent for the manufacture of yellow-poplar blanks. The NPV, given a discount rate of 15 percent, ranged from $213,000 to $298,000 for hard maple and yellow-poplar, respectively.

For those whose effective tax rate lies below 46 percent, the returns are even better. For instance, given a tax rate of 30 percent, the IRR ranged from 37 percent to 45 percent. Corresponding improvement in the NPV also is evident. Table 3 contains performance measures for all species assuming effective tax rates of 46 and 30 percent.

Table 3.—internal rate of return (IRR) and net present value (NPV) for blanks manufacture of selected species assuming effective tax rates of 46 and 30 percent

Species	Tax rate			
	46 percent		30 percent	
	IRR	NPV	IRR	NPV
	Percent	*Thousands of dollars*	*Percent*	*Thousands of dollars*
Red oak	35	277	42	399
Black cherry	36	290	43	415
Hard maple	31	213	37	314
Yellow-poplar	38	298	45	422

Raw Material Cost/Blank Price Relationship

To this point our efforts have focused on evaluating performance for specific species. While investment seems quite promising, these analyses have failed to provide information as to the potential return for still other species or for changes in the relationship between the cost and price for the species already investigated. Recognizing this, we have plotted "generic" cost/price relationships, for 20-, 30-, and 40-percent return on investment. Plots have been constructed for tax rates of 30 and 46 percent (Figs. 2-3). The cost/price plots account for raw material costs from $200/M bf to $1,000/M bf and for blank prices ranging from about $1,200/M ft^2 to about $3,200/M ft^2.

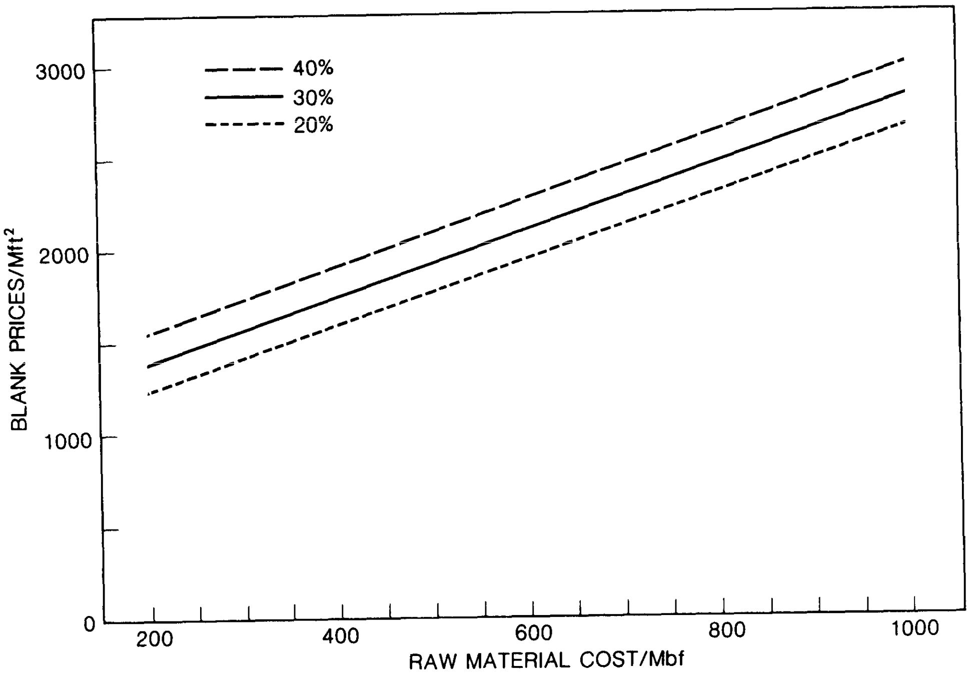

Figure 2.—Cost/price relationship for a 20-, 30-, and 40-percent return on investment (tax rate = 30 percent).

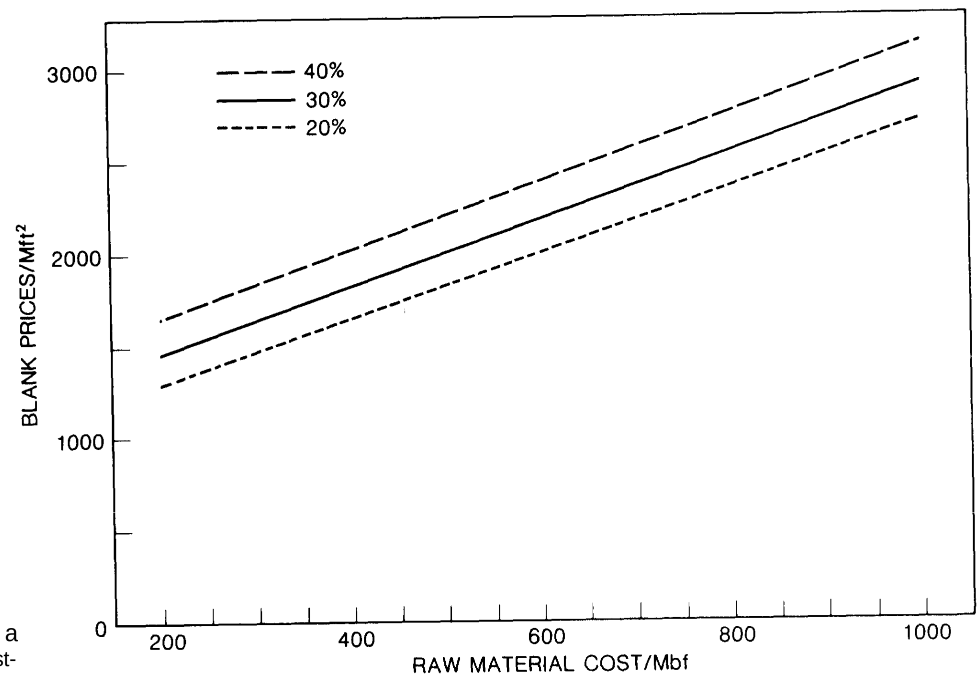

Figure 3.—Cost/price relationship for a 20-,30-, and 40-percent return on investment (tax rate = 46 percent).

These plots can be used to evaluate the price of blanks necessary to earn a particular return given a certain cost for lumber. For example, using Figure 3, a 20-percent return could be earned given an input material cost of $600 if blanks were priced at $2,000/M ft^2. To achieve a 40-percent return, the price would need to be increased about $400 to about $2,400/M ft^2.

The plots can be used in still another situation. That is, where the price for blanks is given and an investor wishes to know what he can pay for raw material and still achieve a desired level of return. Returning to Figure 3, it can be seen that a blanks' price of $2,600/M ft^2 would allow about $710IM bf to be paid for raw material if a return of 40 percent is to be made. If a 20-percent return were acceptable, the price paid for raw material could be increased about $230/M bf to $940/M bf.

Discussion and Conclusion

While the plant described would be attractive in allowing someone not otherwise in the wood business to enter the wood business on a small scale and then possibly expand, it seems particularly suited for investment by sawmill operators. Small furniture and cabinet manufacturers, too, would realize several benefits by including blanks manufacture in their operations.

Sawmillers would benefit by having a means to use some of their medium- and low-grade lumber (No. 1 and No. 2 Common) in the manufacture of a higher valued product. Too, they would put more value added into their expanded product offering. Since FAS (Firsts and Seconds) or Select grade material is not needed, these grades would still be available to command the highest premium the market has to offer.

Small furniture and cabinet manufacturers either producing or purchasing blanks would be better able to control their raw material situation. Since production often is on a job-shop basis, few parts of any one size are ordinarily required at one time. Because panels can be inventoried and parts cut to size almost immediately, blanks seem ideally suited to the job-shop environment. Additionally, this group would enjoy the same advantages enjoyed by the sawmiller in being able to use more No. 2 Common than is customary in the production of fine furniture.

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