FEASIBILITY STUDY
FOR
WOOD MANUFACTURING PRODUCTS

Presented to
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and the
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Ministry of Economic Development

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1.0 EXECUTIVE SUMMARY

Belize is blessed with magnificent forests of unique and beautiful species of woods, including approximately four million acres of hardwood forests. RDA International was requested to complete an analysis of the potential for forest industries to meet the objectives of the official Government of Belize (GOB) development strategy, which proposes to promote exports as the engine of growth, to diversify exports away from a single product orientation, and to develop import substitutes in an economically efficient manner.

A complete analysis for four wood products was conducted. It was found that plywood manufacture may serve as a useful import substitute if a plant were added on to an existing veneer mill. Strip flooring production also appears feasible as both an import substitute and a new export if added on to an existing sawmill. Wood wool production would not appear to make the best use of scarce resources since there are established industries which provide substitute commodities at prices which would make wood wool production only marginally profitable. Efficient and profitable manufacture of wooden toys was found to be beyond the capacities of current Belizean producers acting alone; it is recommended that furniture manufacturers who may be interested in expanding the scope of their activities collaborate with established foreign toy manufacturers.

The above conclusions were derived from an analysis of the characteristics of of each product, international and domestic markets, the present status of the forest products industry in Belize, production requirements, and the options for GOB to facilitate the growth of healthy industries. This detailed analysis is presented in the following chapters.

2.0 DESCRIPTION OF FOREST PRODUCTS WITH POTENTIAL FOR DEVELOPMENT IN BELIZE

The four products covered by this study are:

1) plywood/blockboard
2) strip and parquet flooring
3) wood wool/excelsior board
4) wooden toys

Of these four products, plywood/blockboard and wood wool are primary products, i.e., they are made directly from the basic raw material - logs. The other two, flooring and toys, are secondary products and are made from lumber. The manufacture of plywood and wood wool is dependent only on the supply of logs for basic raw material; the latter two products are further dependent on sawmills for preliminary processing of their major input. This difference in the chain of supply will affect feasibility of each industry.

2.1 Description of Plywood/Blockboard Characteristics and Manufacturing Processes

Plywood is made from an odd number of multiple sheets of thin wood veneer and glue, put together in a sandwich-like manner and pressed under heat. Plywood comes in sheet form, the standard size being 4' x 8' of varying thicknesses from less than 1/8" to slightly less than 1". Thus the production of plywood involves two separate operations -- production of wood veneer from logs and laying up the veneer sheets with glue and pressing the sandwich under heat. There are two broad categories of plywood -- softwood (made from conifers) and hardwood -- both with several subgroups and grades.

2.1.1 Softwood (or Pine) Plywood

Softwood plywood is used for underlaying siding, roofing, and flooring, and for forming concrete. Many of the building projects in Belize City are using exterior grade (CDX) pine plywood for fencing around construction sites.

A subgroup and better quality pine plywood with both sides sanded smooth (grade A-A Int) is used for interior construction (i.e., kitchen cabinets) and furniture.

2.1.2 Hardwood Plywood

2.1.2.1 **Furniture/Cabinet Grade.** This grade represents one of the major uses of hardwood plywood. The hardwood face is essential for drawer bottoms, kitchen cabinets, and furniture backs.

2.1.2.2 **Paneling.** Paneling is very thin, usually grooved plywood with an overlay of decorative wood grain paper, wallpaper designs, or melamine. It is used to face walls.

2.1.3 Blockboard

Blockboard also comes in sheet form, usually 4' x 8'. It has two plywood faces and a lumber core. Blockboard usually will be a little over 1" thick.

2.1.4 Substitutes for Plywood/Blockboard

There are other sheet materials made from wood such as particle board and fiber or hard board. In some cases, these different boards can be substituted for plywood, but they are not as strong and normally are not used for exteriors.

2.2 Description of Flooring Characteristics and Manufacturing Processes

Very hard wood species are required for good flooring. Floors must withstand repeated pounding resulting from simple daily activities. It is necessary to realize that modern floors receive more stress than most other surfaces. For example, a two-ton car exerts 28-30 p.s.i., an elephant 50-100 p.s.i., but a 125-pound woman in high heels exerts 2000 p.s.i. with each step.

Flooring can be made from a variety of wood species. In North America and Europe, oak predominates. Basketball courts and bowling alleys are usually maple. Other species used to a lesser extent in North America are beech, birch, cherry, and pecan. There are basically three types of flooring: strip, parquet, and laminated (a variation of the other two).

2.2.1 Strip Flooring

Strip flooring is the most common flooring used. The Hardwood Flooring Installation School defines strip flooring as: "Solid boards to be installed in parallel rows now produced in these thicknesses - 1/2", 3/4", 33/32" and these widths - 1 1/2", 2", 2 1/4", and occasionally 3 1/4". The strips are tongue and grooved and end matched. They are for "nail-down" installation directly to wood or plywood subfloors; or over wood screens on concrete slab construction."

Strip flooring is usually sold in bundles of 1-1/4' to 3' in length depending on grade. In oak, the most popular specie, there are four grades: Clear, Select, No. 1, and No. 2 Common. These grades are based mainly on appearance. Plank flooring, a variety of strip flooring is 3/4" thick and comes in widths from 3" to 8".

2.2.2 Parquet Flooring

Parquet flooring is normally sawn from lumber in 6" strips about an inch wide and 5/16" thick. Some flooring manufacturers make up one foot squares of parquet strips ready to lay down with a mastic already attached.

2.2.3 Laminated Flooring

Laminated flooring is made of wood veneer cut from flooring stock and glued to plywood. It is normally produced in one foot squares.

2.3 Description of Wood Wool (Excelsior Board) Characteristics and Manufacturing Processes

Most of the sucessful wood wool operations are based on rather large pine plantations and use pine thinnings and tops for their basic raw material. Wood wool is a combination of one part wood excelsior (thin strips of wood) and two parts cement (by weight). The excelsior come from small billets or roundwood thinnings, 20" long and 4" in diameter. The billet has to be around 4" in diameter or it won't fit into the shredding machine. These billets are debarked, air dried, stripped or shredded into excelsior, and treated with a calcium chloride solution. The excelsior is then mixed with a cement slurry poured into moulds, pressed, and set out to cure. A 2' x 8' sheet, 1" thick, weighs about 38 pounds. A wide variety of dimensions can be made, usually 1" or 2" thickness.

Wood wool panels are used as a building material for low-cost housing, as siding, roofing, flooring, and for concrete forming. It is fire, insect, and decay resistant and has exceptional thermal and soundproofing qualities. Wood wool is much more prominent in Europe than in North America.

2.4 Description of Wooden Toy Characteristics and Manufacturing Processes

According to a United Nations publication, the retail toy market was an 8 billion (US) dollar business in 1976, with wooden toys accounting for 3% or 250 million (US) dollars. Ninety percent of the wooden toys are for preschool-age children and 10% are for older children and adults. The types of wooden toys are:

a) push-pull
b) children's play furniture
c) ride-on toys with wheels
d) put-together toys
e) games, puzzles, and tools

Hard hardwoods are most suitable for wooden toys. Many wooden toys today are made in workshops with a lot of woodworking machinery that can do all kinds of work. Even so, manufacture of toys is heavily labor intensive, and many industries have moved their operations overseas to countries with low labor rates.

3.0 MARKETS FOR THE FOUR INDUSTRIES

3.1 The Market for Plywood: Import Substitution

Statistical records on the volume of plywood imported into Belize are incomplete. The documents arriving at customs contain information on the number of sheets of plywood and their length and width. Many documents do not show thickness. Some documents do give a cubic footage, but this appears to be the cubic footage of the container rather than the plywood itself.

By taking the values of the plywood imports and working back to the volumes based on an assumed average thickness and C.I.F. value (per 4' x 8' sheet of 1/2" plywood -- US$8 for pine, US$11 for hardwood paneling grade, US$13 for hardwood furniture/cabinet grade), the Belizean market appears to be approximately 1 million square feet during the 1980-1985 period. In 1988 the market increased to close to 2 million square feet, comprised of approximately 50% pine plywood, 30% cabinet and furniture grade hardwood plywood, and 20% paneling grade hardwood plywood. Thus, in 1989 there may be a pine plywood market of 1 million square feet or 31,250 sheets, a market of 600,000 square feet or 18,750 sheets plywood of hardwood furniture and cabinet grade, and a market for 400,000 square feet or 12,500 sheets of paneling.

International markets have rigid grading standards which Belize could have difficulty meeting during initial production. Sale prices on the international market are similarly competitive. Since there currently does not appear to be a domestic market constraint, it is not recommended that Belize export at the present time.

3.2 The Market for Flooring: Import Substitution and Export Promotion

3.2.1 Domestic Market

The Belizean market for flooring is estimated at 20% of the total lumber market. Expensive construction uses Santa Maria wood, less expensive uses pine. Local flooring, which is simply tongue and grooved lumber, is usually about 3" in width. Actual price in Belize City runs about BZ$1.00 to 1.20/board foot. Flooring appears to be cheaper in the countryside.

3.2.2 Export Market

The export market for flooring should be of interest. In 1987 the U.S. imported 19 million board feet of flooring from 27 countries with an average price of US$780/MBF (thousand board feet). Of interest to Belize is the fact that other countries in the Western Hemisphere have successfully exported small quantities to the U.S. market. Neighboring countries may have exported Santa Maria wood flooring.

Country	US$/MBF CIF U.S. Port of Entry	MBF
Costa Rica	1677	109
Panama	517	147
Jamaica	730	405
Peru	1076	118
Guyana	726	402
Brazil	699	639

Belizean flooring would also be competing with U.S. domestic production. However, U.S. production has generally been higher priced than imports. In 1988 the U.S. produced 250 million board feet of flooring; 77% was strip, 18% parquet, and 5% laminated.

Oak is the principal species used in the U.S. for hardwood flooring. In most residential use, the better grades of oak flooring are used, such as clear and select. Recent prices, per thousand board feet FOB the mill, were quoted as follows:

		Tennessee	Appalachian
Clear:	white	$1200-1290	$1250
	red	1230-1290	1260
Select:	white	900-1100	1045
	red	1040-1200	1170

3.3 The Market for Wood Wool

A heavy material like wood wool must compete against the lighter materials such as plywood, fiberboard and particleboard for doing the same job. Wood wool has never been produced in Belize. In a UNIDO report of 1977 by A.R. Paddon, 25mm wood wool manufactured in Belize would be competitive with 25mm lumber and 3mm hardboard, but much cheaper than plywood and thicker hardboard, if the sale price were between hardboard and lumber sale prices.

In his report, Paddon listed the prices of various materials used in the construction industry.

Material	Price BZ$/M2	M2 installed cost
wood wool (25mm)	4.65	10.00
lumber (25mm)	4.84	10.00
hardboard (3mm)	3.20	10.00
plywood (13mm)	25.23	29.00

Since these prices are for 1977, it is difficult to say that the relationship of prices has stayed the same. For instance, lumber today would be BZ$8.29/M2 (using a ceiling price of 77 cents per board foot), and U.S.-made 13mm pine plywood retails in Belize at BZ$10.44/square meter (M2).

3.4 The Market for Wooden Toys: Export Promotion

The U.S. is the largest market in the worldwide toy industry, followed by Japan and Western Europe. Because toys are heavily labor-intensive in their manufacture, much production has been moved overseas to countries with low labor rates. Taiwan, Hong Kong, and South Korea are the largest sources of overseas contract production. Recently these countries have lost their General System of Preference (GSP) trade status with the U.S.

The largest market for wooden toys appears to be in the U.S., (2% of total toy market is wooden toys). Wooden toys comprise 5% of the total toy market in West Germany, the United Kingdom and Japan. In 1987 the American toy industry alone imported over $4 billion worth of toys (they also exported $249 million of toys). In 1983 imports amounted to $1.6 billion.

The U.S. toy industry appears to be organized mainly through its association, Toy Manufacturers of America, Inc. (TMA), founded in 1916 and located in New York City. TMA has 250 members and claims its members are responsible for 90% of the total industry sales. Members on an associate basis include toy inventors, design firms, and toy testing labs. Many TMA members subcontract production overseas, while others have manufacturing facilities of their own. Still others simply import toys, warehouse, package, and distribute them. Toys are sold through a number of outlets, with the discount stores accounting for 35% of sales, toy stores 31%, department stores 10%, catalog 5%, variety stores 2%, and all others 17%.

Product safety is a very important aspect of toy production and requires vigilance on the part of the importers as well as companies manufacturing in the U.S. One of TMA's chief functions is working with the Federal Government's Consumer Product Safety Commission to ensure standards. Test criteria for sharp edges and points, small parts which could be swallowed or inhaled, and paint and other surface coating materials, must be met by wooden toys.

The toy industry is extremely volatile and fashionable. The market is a mixture of trendy new toys and traditional toys; it demands constant decisions by manufacturers on tool investments, raw material purchases, plant utilization, labor hiring, pricing, distribution, and inventory commitments. Retailers must decide on shelf space, display aids, advertising, and pricing. In 1977, 70% of the retail toy sales were made in the fourth quarter. In 1988, 60% of the sales were made in the fourth quarter, thus there is a growing trend for year-round sales which is being promoted by the industry.

4.0 OVERVIEW OF PRESENT FOREST PRODUCTS INDUSTRY IN BELIZE AND DEVELOPMENT APPROACH

Belize harvested about 2 million cubic feet of logs in 1988. Primary products made from these logs were lumber, poles, and matches. No plywood or blockboard is made in Belize at present.

Strip flooring is made and used in Belize. One lumber dealer in Belize City estimates that 20% of the lumber sold in Belize is used for flooring. The flooring made in Belize is not the same type or size, nor manufactured completely in the same way, as the standard flooring sold on the North American market. In Belize, Santa Maria is the preferred species, although pine is used in low-cost construction. Six thousand board feet of Santa Maria was exported from Belize to the U.S. last year.

Neither parquet nor laminated flooring is produced in Belize, although production of parquet flooring in Belize is near reality. A complete parquet flooring plant already has been built and expects to be in production before the end of the year. Investment in this secondhand plant was about 15% of the price of a new plant.

Wood wool is not made in Belize. No retail building supply yards in Belize were identified that knew of wood wool or had any idea of how it would sell in competition with other panel products.

Belize has an abundance of hard hardwoods that are suitable for wooden toys. No commercial manufacturer of wooden toys was found in Belize.

4.1 Availability of Wood Resources

Belize is blessed with magnificent forests of unique and beautiful species of woods -- among them, ziricote, mahogany, and rosewood. There are approximately four million acres of hardwood forests in Belize according to the Forest Department. Mahogany is one of the species growing in the hardwood forests intermixed with precious woods and secondary hardwoods. Forests have always been an important resource to Belize. The forest was the reason Belize was settled, for it was the search for logwood to make dye that brought the first settlers to Belize. (Small quantities are still being exported today.) Even the flag of Belize depicts the importance of the forest to the country's history.

Nonetheless, in spite of the presence of many beautiful species, the volumes of wood available are in general too small for today's capital intensive machinery to handle economically.

4.1.1 Mahogany

Mahogany has always been king and probably always will be, both in the domestic and international market. While mahogany was the second species that became commercial for the wood cutters of Belize, it is still very much desired today, perhaps too much so. The mahogany trade flourished, reaching its peak in 1926, after which it declined until reaching the more recent levels of about 25% of the country's annual cut (2 million cubic feet).

Belizean mahogany must compete with Brazilian mahogany and with similar but less valued woods from Southeast Asia. These Asian woods can be substituted for mahogany in the marketplace and this substitution keeps mahogany from reaching the high prices of teak and rosewood.

4.1.2 Pine

There are approximately 240,000 acres of pine forests in Belize. Pine is about the same percentage of the annual cut as mahogany. Pine in Belize is not a cheap commodity. In Belize City, dressed pine dimension lumber sells for BZ$1.10/board foot, compared to U.S. southern yellow pine (a close relative) which sells in the U.S. for the equivalent of BZ$0.48, adjusted for a 16% nominal thickness difference. Belizean pine will have difficulty competing in the North American market or any market served by the North American pine sawmills.

4.1.3 Secondary Hardwoods

Species other than mahogany and pine account for roughly 50% of the annual cut in Belize. A small amount are the precious species (ziricote, rosewood, jobillo, black poisonwood, redwood, and granadillo) selling for more than mahogany. Most of these precious woods are exported at good prices, but the world demand is not large.

The balance is made up of the secondary hardwoods, Santa Maria being the most prevalent. The secondary hardwoods appear to provide the quality of wood required for forest products industry expansion.

4.2 Development Approach

This study is concerned with the possibility of creating in Belize the four previously described forest products industries utilizing secondary hardwoods and lesser amounts of pine and mahogany.

Belize is ill-suited for modern plywood and flooring mills which required high volume of wood through-put for economical operation. Belize has high labor rates and little experience with highly-automated equipment for processing of forest products. Neither the market nor the forest resource of Belize can support the scale of production which these mills generate. For example, one average sawmill in Indonesia cuts the same volume of lumber annually as do all the sawmills in Belize combined.

Appropriate development in Belize would consist of adding on to existing mills the capacities to manufacture new products in addition to the products they are now producing. Specifically, consideration should be given to adding on a plywood manufacturing capacity to the existing veneer mill, and to adding on export quality flooring production to an existing sawmill or woodworking shop. Add-on capacities can be created by using secondhand rebuilt machinery at a cost of 15-50% of the value of new equipment. By producing a number of products at the same location, transportation of raw materials and finished products can be consolidated. Similarly, personnel can be assigned to work on products in highest demand.

4.2.1 Volume of Raw Materials Needed for Minimum-Sized Mills

Given relatively limited raw material supplies, and the inherent risks in undertaking new operations, it is recommended that new projects start with the minimum amount of equipment required for efficient production. Production may also be only part-time or intermittent, depending on material supplies and market demand.

4.2.1.1 **Plywood Mill.** Plywood requires wood veneer as a starting material. To produce a given number of cubic feet of plywood, the same amount of veneer is required, and then 10-15% extra for trim. The suggested add-on plywood mill, operating fifty days per year, would produce approximately 20,000 cubic feet of plywood -- thus requiring 23,000 cubic feet of veneer.

4.2.1.2 **Flooring Plant.** A minimum size flooring plant of one line and operating one shift uses 20,000 board feet of kiln-dried lumber per shift. With one shift per day, five days per week, fifty weeks per year, the annual requirement is 5 million board feet of kiln-dried lumber. If a new full-scale mill were to be put in Belize, it would consume all of the present production of the two largest sawmills which produce Santa Maria lumber. What would be better is for one of these (or any other mill) to add on production of export quality flooring, to share some costs of personnel and equipment with other operations.

4.2.1.3 **Wood Wool Plant.** Most of the sucessful wood wool operations are based on rather large pine plantations and use pine thinnings and tops for their basic raw material. The immediate problem one faces with making wood wool in Belize is that there are no large-scale plantations under intensive forest management regimes where thinnings are coming out every year according to a schedule. Nor are there large-scale clear fellings of final harvest that could provide several hundred tops per hectare. The alternative for Belize would be to use the tops of the trees being harvested by the various sawmill operations. These tops make small logs and are perfect for billets for the wood wool. However, in the logging operations in Belize only a few merchantable pine trees are found per hectare; many hectares must be covered just to get a truckload of these small logs. This increases costs to a point where the cost of the raw material would appear to make the entire operation unfeasible.

4.2.1.4 **Toy Manufacturing Industry.** The wood requirements for different types of toys are extremely diverse. Until a specific line and scale of production is established, it is not possible to discuss wood requirements.

5.0 SPECIFIC DEVELOPMENT RECOMMENDATIONS

The following sections provide a financial and economic analysis of recommended projects for Belize. Unless specified otherwise, all prices are displayed in U.S. dollars. One U.S. dollar equals two Belize dollars.

5.1 Add-On Plywood Mill

Belize has a veneer mill (Belize International Forest Products) at Swasey Creek which will soon be operational. Their veneer will be exported. This mill will have the capability and the trained personnel to add on plywood production. At the present time, it appears to be the only mill capable of economically producing plywood. Diversifying their production will allow them to better adjust to fluctuations in resource supply and market demand, since these two products are not affected by the same factors. Management should consider making cabinet and furniture grade plywood for the local market as a next step. Poor data quality makes it difficult to estimate the product mix presently being used. Demand may range from all 1/2" width (18,750 sheets averaging 4' x 6') to all 1/4" width (37,500 sheets) to a mix of the two. A new mill could be flexible in producing a number of plywood thicknesses.

The main obstacle Belize International Forest Products faces is that they do not hold a lease or title to the land on which the veneer mill sits. They are reluctant to move ahead without a land-use guarantee.

5 1.1 Add-On Plywood Mill Investment Costs

The estimated add-on cost for a plywood mill at Belize International Forest Products' veneer mill will be on the additional capital investment in plant and equipment.

	U.S. $
Imported Equipment Cost (FOB S.E.USA)	$291,550
Crating, Freight & Insurance (13% FOB)	37,902
Transport to Swasey Creek (7% FOB)	20,409
Imported Equipment Cost at Site	$349,860
Local Equipment	10,000
TOTAL EQUIPMENT COST	$359,860
Erection/Engineering (5% total equip.)	17,993
Land and site preparation	15,000
Building - 6000 SF @ $10/SF	60,000
Legal Fees	5,000
TOTAL ESTIMATED INVESTMENT	$457,853
Contingencies (20%)	91,571
TOTAL REQUIRED INVESTMENT	$549,424
Working Capital (6 months)	46,069
START-UP CAPITAL REQUIRED	$595,493

It is recommended that the company procure the following reconditioned second-hand equipment. All items will have to be imported since none are available in Belize.

BREAK-OUT OF IMPORTED EQUIPMENT COST
(Reconditioned Second-hand Equipment)

	US$/Unit	Subtotal/Section
Dry veneer section		
Salvage clipper	4,750	
Jointer	12,000	
Splicer	9,500	
Waste hog	12,500	
		$38,750
Glue section		
Mixer	1,950	
Pump with 5 hp motor	750	
Spreader 53"	10,500	
Extra rolls, re-covered & grooved	2,750	
		$15,950
Press section		
Cold pre-press	32,500	
Hot press, 4' x 6' 10 openings	50,000	
		$82,500
Finishing section		
Panel sizing saw line	35,000	
Wide belt sander (. head)	25,000	
		$60,000
Energy section		
Lighting fixtures	1,500	
Compressor - 50 hp	6,500	
Diesel 255 kw generator	35,000	
Mill exhauster/blower - 50 hp	2,500	
		$45,500
Transfer section		
Conveyors 100' @ $30/ft	3,000	
Rollers, 12" dead roll case; 100 10-foot sections @ $10/section	1,000	
		$ 4,000
Mobile equipment section		
Scissor hoists, 2 tons (new)	2,850	
Forklift, 40 ton, cushion tire	7,500	
		$10,350
Fire equipment, workshop tools		$25,000
Pickup		$ 9,500
TOTAL.....		US$291,550

Depreciation

The building and all plywood mill equipment except that noted below, (including erection, engineering, site preparation, and legal fees) may be expected to have a ten-year life. Fire equipment, the workshop tools and the pick-up should have a five-year life.

5.1.2 Annual Plywood Mill Operating Costs

The plywood mill would be a part-time operation in conjunction with the veneer mill and would use the lower grades of core, backs, and crossbanding veneer which cannot be exported. Special runs may have to be made for face veneer.

For the purpose of this analysis, the plywood mill is assumed to operate 20% of the time, one day per week, fifty days per year. It may be that the plywood mill would be run during periods of slack orders for export veneer or when enough low grade veneer has been accumulated to make a plywood run. The plywood mill will start out as a part-time addition to the veneer mill. The assumption has been made that this is 20% of the time. By keeping capital equipment costs low and using the same personnel to make plywood as are employed in the veneer mill, a furniture/cabinet grade plywood can be made which is acceptable to the Belize market and competitive with imports.

The same personnel that run the veneer mill will make plywood at the rate of 400 4' x 6' 1/4" panels per full day. The selling price of these panels is assumed to be US$15/panel at Belize City.

With fifty days production per year at 400 panels per day, the annual production would be 20,000 panels. At a sale price of $15/panel, the revenue would be US$300,000 per year. However, for the first year, it has been assumed that only 10,000 panels will be made during this start-up period, reducing revenue to $150,000.

SUMMARY OF ANNUAL PLYWOOD MILL OPERATING COSTS

	Year 1 (1/2 yield)	Years 2-10
FIXED COSTS		
Administration & Supervision	19,006	19,006
Building Maintenance @1%	600	600
VARIABLE COSTS		
Manual Labor	13,176	13,176
Fuel & Materials	48,143	83,038
Equipment Maintenance @2%	7,197	7,197
Transport & Sales @5%	4,016	5,761
TOTAL COSTS	US$92,138	$128,778
Equivalent	BZ$184,276	$257,556

Assumptions

50 days of operation per year
400 panels (24 sq. ft. each) per day
$15 Price/panel @ Belize City

Individual costs are calculated on a daily basis as follows:

Administration & Supervision

	Calculated Daily Rate
Expatriate Mill Manager	156.00
Expatriate Millwright	148.72
Accountant	23.40
Production Foreman	15.60
Mechanic	13.00
Electrician	10.40
Clerk	7.80
Guard	5.20
TOTAL	US$380.12

Note: Since it is assumed that Administration and Supervision personnel will be employed full-time between the veneer and plywood mills, the cost of their salaries is prorated for the time actually spent working with plywood.

Manual Labor - Maximum Daily Production

	Skilled	Unskilled	
Glue section			
Mixing	1	1	
Spreading	2	2	
Press section			
Pressmen	2	2	
Finishing section			
Trim saws	2	1	
Sander	2	1	
Packing	1	3	
Fork lift	1		
Energy section			
Power plant	1		
Clean-up		1	
Extra help		3	Total
TOTAL NUMBER OF WORKERS	12	14	26
Wage Rate/Day	US$11.00	US$8.00	
Social Tax Rate	8%	8%	
TOTAL MANUAL LABOR COST/DAY	US$142.56	US$120.96	US$263.52

Fuel & Materials Cost/Day

Veneer	1,296.00	3 sheets/panel; US$0.045 per sq. ft.
Glue	149.76	1.92 lbs./panel; US$0.195/lb.
Fuel	167.00	10 hrs. @ 10 gals./hr; US$1.67/gal.
Other	48.00	Tool cost @ US$0.005/sq. ft.
TOTAL	US$1,660.76	
Year 1 Glue	264.96	Additional US$0.345/lb. cost of imported glue
TOTAL Year 1	US$1,925.72	

During the first year to avoid glue problems, it was assumed that the plant would be using a premixed glue which is more costly. From the second year on, it was assumed that materials will be imported and mixed in the mill.

First Year
Premixed urea formaldehyde (UF).

	US$/lb.
Cost FOB plant U.S. South	0.63
Freight to Swasey Creek	0.08
Unit cost of glue	$0.71/lb. dry weight

Glue is mixed at a ratio of 160 lbs. glue to 50 lbs. water, thus 160 lbs. dry weight glue is equal to 210 lbs. wet glue. Assuming water costs are negligeable, the unit cost of wet glue becomes $0.54/lb. (160 lbs. premix x 0.71 = $113.60; $113.60/210 lbs. wet glue = $0.54)

Second Year
Glue make-up at Swasey Creek:

	US$/lb. (FOB plant U.S. South)	Lbs. per Formulation	US$ Total	
UF resin 65% solids	0.20	100	20.00	
Catalyst	0.315	10	3.15	
Wheat flour	0.100	50	5.00	
		160	$28.15	(FOB)
Freight	0.08	160	12.80	
			$40.95	(CIF)

Using the same ratio as year one (160 lbs. glue dry mix with 50 lbs. water), 210 lbs. wet glue costs $40.95 total or $0.195/lb.

Plywood Mill: Maintenance & Repairs

1% of cost of building, $60,000 x 1% =	600
2% of cost of equipment, $360,461 x 2% =	7,209
Total annual cost	$7,809

5.1.3 Financial Analysis of Plywood Mill

Assuming that the plant will function for ten years, the above cost estimates yield an internal rate of return (IRR) of nearly 23%. Sensitivity analysis shows that if costs increase by 10%, the IRR drops to just over 20%. If revenue drops by 10%, the IRR falls even further, down to below 18%. This indicates that profitability is nearly twice as sensitive to a decrease in price as an increase in manufacturing costs. (Annual cash flow and net present values at different discount rates are presented in Appendix C.).

5.2 Add-On Strip Flooring Plant

The flooring plant has a capacity of running 20 thousand board feet per shift, but will be run only one half shift and use only 10 MBF/half shift of kiln-dried Santa Maria lumber. Even at 10 MBF per day, 250 days would require 2.5 million board feet of lumber per year, a considerable amount in Belize.

5.2.1 Add-On Strip Flooring Plant Investment Costs

Imported Equipment Cost (FOB S.E.USA)	$133,000
Crating, Freight & Insurance (13% FOB)	17,290
Transport to Ladyville (7% FOB)	9,310
Imported Equipment Cost at Site	$159,600
Local Equipment	10,000
TOTAL EQUIPMENT COST	$169,600
Erection/Engineering (5% total equip.)	8,480
Land and site preparation	5,000
Building - 3000 SF @ $10/SF	30,000
Legal Fees	2,500
TOTAL ESTIMATED INVESTMENT	$215,580
Contingencies (20%)	43,116
TOTAL REQUIRED INVESTMENT	$258,696
Working Capital (6 months)	546,265
START-UP CAPITAL REQUIRED	$804,961

BREAK-OUT OF IMPORTED EQUIPMENT COST
(Reconditioned Second-hand Equipment)

Gang rip saw, EXCEL Ripper 12"	7,500
Double sider surfacer, STETSON-ROSS 612, 14 knives	15,000
Flooring matcher (S.A. Woods 502)	45,000
2 end-matchers (S.A. Woods)	35,000
2 crosscut bench saws	2,500
Banding and packaging equipment	5,000
Saw and knife grinders	3,000
Forklift	7,500
Conveyors, rollers, 100' @ $10/10 ft. section	1,000
Lighting fixtures	1,500
Fire equipment, workshop, tools	10,000
TOTAL.....US$	133,000

Depreciation

The building and all flooring plant equipment (including erection, engineering, site preparation, and legal fees) may be expected to have a ten-year life.

5.2.2 Annual Strip Flooring Plant Operating Costs

The staff running the flooring plant would also run the other parts of the workshop. In addition to making doors and furniture, they would run the planing and moulding machines or perform other jobs around the sawmill. Like the plywood mill, production schedule would be flexible and depend on market demand and supply of lumber.

SUMMARY OF ANNUAL STRIP FLOORING PRODUCTION COSTS

FIXED COSTS	
Administration	30,875
Building Maintenance @1%	300
VARIABLE COSTS	
Manual Labor	24,975
Materials	981,139
Equipment Maintenance @2%	3,392
Sales @ 5%	51,849
TOTAL COSTS	$1,092,530

Assumptions

125 days work (may be double number of 1/2 day shifts)
20 thousand board feet (MBF) of lumber used per full-day shift; yield of 67% by volume from lumber to flooring, thus 13.4 MBF flooring produced per day
$700 Price/thousand board feet (MBF) FOB

Individual costs are calculated on a daily basis as follows:

Administration & Supervision

	Calculated Daily Rate
Expat. Mill/Workshop Mgr.	156.00
Accountant	23.40
Millwright	23.40
Production Foreman	15.60
Filer/grinder	15.60
Clerk	7.80
Guard	5.20
TOTAL	$24[illegible].00

Manual Labor - Maximum Daily Production

	Skilled	Unskilled	
Sticker removing		2	
Ripping	1	1	
Double sided planer	1	1	
Defect cutting	2		
Flooring matcher	1	1	
End matchers	1	1	
Graders	2		
Bundling/packing	1	1	
Lift truck	1		
Warehouse/inventory	1		
Clean-up		1	Total
TOTAL NUMBER OF WORKERS	11	8	19
Wage Rate/Day	$11.00	$8.00	
Social Tax Rate	8%	8%	
TOTAL LABOR COST/DAY	$130.68	$69.12	$199.8

Materials Cost/Day

Lumber	7,700.00	Price of $335 + $50 for solar drying per MBF
Electricity	129.11	47 kwh/MBF flooring produced; $0.205/kwh
Other	20.00	Tool cost
TOTAL	$7,849.11	

Flooring Plant: Maintenance & Repairs

1% cost of buildings, 1% of $30,000 =	$ 300
2% cost of equipment, 2% of $170,810 =	3,416
Total annual cost	$3,716

5.2.3 Financial Analysis of Strip Flooring Plant

According to STANCOR, the North Carolina Company that purchased Santa Maria flooring last year, 25 MBF of flooring can be shipped in a 40-foot container. Container rates to New Orleans are approximately $1850; this would land the flooring in New Orleans with less than $75/MBF freight. With additional charges (such as local transport and loading costs) in Belize included, it appears that the flooring could arrive U.S. Gulf ports at around $800/MBF.

In this analysis for FOB price, $700/MBF has been used. Production of 6.7 MBF/day x 250 days = 1,675 MBF x $700/MBF will produce an annual revenue of $1,172,500.

The costs estimated above resulted in an IRR of over 28%, but an increase of costs by 7% would eliminate profitability. On the other hand, a 2% increase in the yield of flooring from lumber increased the IRR to over 38%. This indicates the project should have advance trials to check flooring recovery from lumber and obtain a better grasp of production costs. (See Appendix C.).

5.3 Wood Wool/Excelsior Board

5.3.1 Wood Wool Plant Investment Costs

	US$
Plant (FOB)	145,997
Crating, Freight & Insurance (20% FOB)	29,199
Delivery & Erection (20% FOB)	29,199
Imported Equipment Cost at Site	$204,396
Buildings	56,400
Vehicles	56,400
TOTAL ESTIMATED INVESTMENT	$317,196

*Inquiries to Europe showed no availability of second-hand equipment.

5.3.2 Annual Wood Wool Production Costs

Assumptions

53760 cubic feet annual production equalling 645120 square feet 1 inch thick.

RAW MATERIALS	Quantity	Units	Price	Total $	
Wood	18,080	Ft3	$ 1.04	18,894	
Cement	402	Tons	$84.60	34,009	
Calcium Chloride	8	Tons	$493.50	3,948	
Water	1,459	100 gals.	$0.56	824	
			Subtotal		57,675
PERSONNEL	Quantity		Rate	Total $	
Supervisor/Foreman	1		$4,467	4,467	
Skilled Workers	6		$3,023	18,138	
Semi-Skilled Workers	15		$2,533	37,988	
Unskilled Workers	4		$2,081	8,324	
Driver	1		$2,820	2,820	
Clerical	1		$2,820	2,820	
Additional Labor Charges	0.1		$74,557	7,456	
			Subtotal		82,012
ENERGY	Quantity	Units	Price	Total $	
Electricity	67000	kwh	$0.20	13,735	
Diesel	888	gals.	$1.35	1,199	
			Subtotal		14,934
OTHER COSTS				Total $	
Transportation				56,400	
Product Promotion				5,640	
Spares & Maintenance				8,460	
Contingencies				5,640	
				Subtotal	76,140
			TOTAL OPERATING COSTS		$230,761

5.3.3 Financial Analysis of Wood Wool Production

Harold Whitney, owner of the Whitney Lumber Company, the largest pine sawmill in Belize, estimated it would cost him twice as much to bring out the tops as

the sawlogs he is currently logging. Most of the limbs are on the tops. It is expensive to get all these limbs cut off to prepare the top in the shape of a log to be hauled to the road by a tractor, loaded on a logging truck, and brought to the mill. Earl Green, District Forest Officer at Mountain Pine Ridge, stated it was costing the Forest Department BZ$1.38/cubic foot to log sawlogs. He estimated that it would cost at least 50% more to bring in the tops for firewood or pulpwood. The cost of raw material may prove this product uneconomic.

Unit Cost is $0.36 per square foot or $4.29 per cubic foot. If depreciation is included, Unit Cost is $0.41 per square foot or $4.88 per cubic foot.

Since there is no wood wool panel made or sold in Belize, several prices were projected to determine the net present value (NPV) of this project. The break-even point, assuming the discount rate on the investment were close to zero, would be US$0.41 per square foot. If wood wool were to become a substitute for construction grade plywood, it might sell for a price of US$0.47/SF. At this price, the internal rate of return would be 17.45%. However, if a 10% marketing cost were incurred, which is quite possible since this is a new product in the country, the internal rate of return drops to below 7%. These scenarios are presented below:

Discount Rate	Sale Price	NPV in US$ after 10 Years	
1.00%	$0.41	2,324	(Break-even price with discount rate close
2.00%	$0.41	(13,864)	to zero.)
10.00%	$0.47	98,299	
12.00%	$0.47	65,991	(Most likely sale price.)
15.00%	$0.47	26,262	
17.45%	$0.47	54	
6.86%	$0.43	74	(Assuming marketing costs are deducted from sale price.)

(See Appendix C.)

It is still uncertain whether the Belizean market could absorb 645,000 square feet of wood wool per year. Plywood, fiberboard, and lumber are all substitutes which are already present in Belize. It may not be worthwhile to promote this new product where the advantages are few and very uncertain.

5.4 Wooden Toys

Around the world, versatile woodworking machinery is used in most workshops where wooden toys are made. Belize's furniture shops operate with the simplest of equipment. Several woodworking and furniture shop owners were interviewed. They unanimously were not interested in making wooden toys because, according to their calculations, a BZ$10 wooden toy requires almost the same labor as a BZ$100 chair. For example, two furniture makers had an identical scaled drawing of a complex wooden toy with wheels made in the U.S. The manufacturer had inquired if these two companies would be interested in making this toy. The manufacturer believed it would take 1.2 hours of production time. Both Belizean furniture makers calculated it would take them over five hours of production time. This difference in estimates may be due to the fact that the Belizean furniture makers are not set up with the sophisticated tools of

production that the manufacturer would expect them to use.

The Forest Department at Belmopan has the only workshop in Belize with sophisticated machinery. This workshop is so busy making furniture and doors for the government that there is no interest in producing wooden toys.

Belizeans may wish to find a manufacturer or importer in the U.S. who would be willing to work with a Belizean furniture or woodworking shop. Sophisticated tools of production may be most economically procured if second-hand machinery or reconditioned machinery were found.

6.0 FINAL RECOMMENDATIONS FOR DEVELOPMENT OF FOREST INDUSTRIES

Existing and potential wood products producers should be guaranteed trouble-free leases or titles to the lands on which the mills sit. Title to land may be required to secure loans for start-up operations. The cost of relocating a mill would bankrupt almost any operation. Vigilant follow-up should be done to provide continuous guarantee of land-use rights to producers.

6.1 Plywood

It could well be that Belizean produced plywood will need additional tariff protection for a period of years until the plant has become more efficient and the local market grown. To ensure the profitability of the mill, the GOB may wish to consider raising the tariff on imported furniture and cabinet grade hardwood plywood. Producers must be aware, however, that demand for their product will decline as prices rise, even if their competition is removed. Retaliation by foreign producers could also be experienced.

A special reporting system for plywood should be created in the Customs House or Central Statistics to track the market. Specific information on grades, species, thicknesses, and types should be recorded and results made available to potential plywood producers. This detailed information is necessary to help manufacturers decide which type of plywood they should make, and to help government officials decide which plywood imports should be discouraged in order to protect the local producers (at least during start-up phase), should they decide to provide such tariff protection.

6.2 Flooring

Before adding on flooring capacity, trial shipments of green or kiln-dried Santa Maria should be sent for processing at an existing flooring plant in North America. The Forestry Department or other GOB agencies may wish to underwrite or assist in procuring funds to initiate trial shipments. A cooperative arrangement with a North American flooring producer should be arranged. After the flooring has been made to U.S. specifications, it would be marketed on a trial basis to some of the major flooring distributors.

STANCOR CORPORATION (5604 Departure Drive, Raleigh, North Carolina 27604; telephone 919-881-0368; Lee Norris, Vice President) has expressed an interest in establishing a joint venture with a flooring and door plant in Belize. Another organization that could be contacted is The Frank Purcell Walnut Lumber Company (the former lumber company of Hammermill Paper Company in Kansas City, Kansas; telephone 913-371-3135; Tom McMillan, President). McMillan has been a leader in trying to get people to use other woods for flooring besides oak. He has hired research consultants to investigate the market preference for flooring, including pecan, white hickory, and black cherry. While these are all northern woods, he could be interested in Santa Maria. STANCOR has utilized distinctive promotional packages with samples to generate sales through architects and builders.

6.3 Wood Wool/Excelsior Board

It does not appear that there is any interest in the private sector in building

a wood wool plant in Belize, and it is not recommended that the GOB become involved in such a project. As demonstrated in Section 5, the cost of raw material in Belize does not make this product competitive with its substitutes. Government should concentrate on promoting the veneer, plywood, and flooring industries, rather than promoting this new product (for Belize) which has no apparent comparative advantages at all.

6.4 Wooden Toys

U.S. toy shows provide an excellent overview of different lines of toys produced by a variety of manufacturers. A list of toy shows and companies in the U.S. is appended to this report. A representative from BEIPU and an interested private sector woodworking shop owner should attend at least one show and talk to the wooden toy manufacturers about the possibility of manufacturing the whole toy or components in Belize.

APPENDIX A

LIST OF TOY SHOWS AND FAIRS HELD IN THE USA

CHICAGO Gift Show, January & July
NEW YORK Gift Show, February & August

Organizers: Little Brothers Shows, Inc.
220 Fifth Avenue
New York, NY 10010

INTERNATIONAL TOY FAIR - New York Coliseum, February

Organizers: International Trade Shows
545 Fifth Avenue
New York, NY 10017

NEW YORK - American Toy Fair, February

Organizers: Toy Manufacturers of America, Inc.
200 Fifth Avenue
New York, NY 10010

DALLAS Toy Show, March

Organizers: Dallas Toy Show
2100 Stemmons Freeway
Dallas, TX 75207

ATLANTA Toy Fair, April & October

Organizers: Southern Exposition Management
6065 Roswall Road NE
Atlanta, GA 30328

LOS ANGELES - Western States Toy Show, April

Organizers: Western Toy Representatives
PO Box 15163
Los Angeles, CA 90015

APPENDIX B

LIST OF U.S. WOODEN TOY MANUFACTURERS

A G INDUSTRIES INC.
3832 148th Ave. NE
Redmond, WA 98072

ADICON
P.O. Box 3183
New York, NY 10185

AMKO TRADING CORP.
699 Front St.
Teaneck, NJ 07666

BATTAT INC.
Two Industrial Blvd.
West Circle
Plattsburgh, NY 12901

BEKA INC.
542 Selby Ave.
St. Paul, MN 55102

BINARY ARTS CORP
703 Timber Branch Dr.
Alexandria, VA 22302

CAMBOR ENTERPRISES INC.
P.O. Box 3
Verona, NJ 07044

COUNTRY WOOD SHOP LTD.
P.O. Box 536
14 Mill St.
Develan, NY 14042

COVENTRY ASSOCIATES INC.
Box 214
Allamuchy, NJ 07820

JOHN DAVY TOYS
301 Cameron St.
Alexandria, VA 22314

THE DRUEKE COMPANY
601 Third St. NW
Grand Rapids, MI 49504

EDUCO SERVICES
270 Cree Road
Sherwood Park, AB
Canada T8A 4G8

EUROPEAN TOY COLLECTION
97 Hillcrest Rd. Box 203
Ogden Dunes, IN 46368

FALCON RULE CO.
Falcon Valley
Auburn, ME 04210

G.R. LTD./GLOUCESTER ROCKERS
811 Boylston St.
Boston, MA 02116

GO FLY A KITE INC.
Box AA
East Haddam, CT 06423

R.E. GREENSPAN CO.
10073 Sandmeyer Ln.
Philadelphia, PA 19116

GUIDECRAFT
P.O. Box 324
Industrial Terminal
Garnerville, NY 10923

IQ AMERICA
2310 Upper Farms Road
Bainbridge Island, WA 98110

IMPORT TOYS
P.O. Box 92455
Los Angeles, CA 90009

KATHY ANN DOLLS
51054 Wallbridge Rd.
Northwood, OH 43619

KINDERWORKS
P.O. Box 1441
Portsmouth, NH 03801

KNOHL-ADAMS INC.
431 Fifth St.
Brooklyn, NY 11215

LUNDBY OF SWEDEN
14120 I/J Sulleyfield Circle
Chantilly, VA 22021

MASTER WOODCRAFT INC.
One Hanson Place
Brooklyn, NY 11243

NATURAL SCIENCE IND. LTD.
15-17 Rockaway Beach Blvd.
Far Rockaway, NY 11691

NOROK TOY CO.
256 Neiffer Rd.
Schwenksville, PA 19473

NOVELTOYS INC.
531 East Dallas Highway
Canton, TX 75703

PALO IMPORTS
184 Greenwood Ave.
Bethel, CT 06801

PLAY GROUP INC.
11 Huron Dr.
Natick, MA 01706

THE PLAY MILL INC.
RFD 3 Box 89
Foxcraft, ME 04426

SCHOWANEK OF AMERICA INC.
19 W 24th St.
New York, NY 10010

SCHYKLLING ASSOC. INC.
1 Peabody St.
Salem, MA 01970

TENSEGRITY SYSTEMS CORP
Station Hill Rd.
Barrytown, NY 12507

TRANS-TOYS
13267 Yorba Ave #5
Chino, CA 91710

WALNUT HOLLOW FARM
Rt. 2
Dodgeville, WI 53533

WELLINGTON LEISURE PRODUCTS
P.O. Box 244
Madison, GA 30650

WELSH CO.
1535 S. 8th St.
St. Louis, MO 63104

APPENDIX C

CALCULATIONS FOR INTERNAL RATES OF RETURN

Plywood Mill - Base Case

Discount Rate	NPV
10.00%	340,263
12.00%	262,572
15.00%	166,900
20.00%	49,110
22.79%	40
25.00%	(32,417)

Year	0	1	2	3	4	5	6	7	8	9	10
Costs	549423	92138	128778	128778	128778	128778	173628	128778	128778	128778	128778
Revenues		150000	300000	300000	300000	300000	300000	300000	300000	300000	300000
Cash Flow	-549424	57861	171221	171221	171221	171221	126371	171221	171221	171221	171221

Plywood Mill - Costs increased by 10%

Discount Rate	NPV
10.00%	271,356
12.00%	200,527
15.00%	113,470
20.38%	78
25.00%	(66,856)

Year	0	1	2	3	4	5	6	7	8	9	10
Costs	549423	101352	141656	141656	141656	141656	141656	186506	141656	141656	141656
Revenues		150000	300000	300000	300000	300000	300000	300000	300000	300000	300000
Cash Flow	-549424	48647	158344	158344	158344	158344	158344	113494	158344	158343	158344

Plywood Mill - Revenue decreased by 10%

Discount Rate	NPV
10.00%	199,188
12.00%	135,856
15.00%	58,189
17.83%	27
25.00%	(101,591)

Year	0	1	2	3	4	5	6	7	8	9	10
Costs	549423	92138	128778	128778	128778	128778	173628	128778	128778	128778	128778
Revenues		136363	272727	272727	272727	272727	272727	272727	272727	272727	272727
Cash Flow	-549424	44225	143949	143949	143949	143949	99099	143949	143949	143949	143949

Flooring Mill - Base Case

Discount Rate	NPV
12.00%	172,457
13.00%	155,080
14.00%	138,979
15.00%	124,048
16.00%	110,187
28.36%	48

	0	1	2	3	4	5	6	7	8	9	10
Costs	258696	1092530	1092530	1092530	1092530	1092530	1092530	1092530	1092530	1092530	1092530
Revenues		1172500	1172500	1172500	1172500	1172500	1172500	1172500	1172500	1172500	1172500
Cash Flow	-258696	79969	79969	79969	79969	79969	79969	79969	79969	79969	79969

Flooring Mill - 2% increase in yield of flooring from lumber

Discount Rate	NPV
12.00%	289,049
13.00%	266,059
14.00%	244,725
15.00%	224,908
16.00%	206,481
38.28%	37

	0	1	2	3	4	5	6	7	8	9	10
Costs	258696	1092869	1092869	1092869	1092869	1092869	1092869	1092869	1092869	1092868	1092869
Revenues		1195950	1195950	1195950	1195950	1195950	1195950	1195950	1195950	1195950	1195950
Cash Flow	-258696	103081	103081	103081	103081	103081	103081	103081	103081	103081	103081

Wood Wool Production Cash Flow with varying sale prices

Year		1	2	3	4	5	6	7	8	9	10
Costs	317,196	230,761	230,761	230,761	230,761	230,761	230,761	230,761	230,761	230,761	230,761
Revenue @$0.41	0	264,499	264,499	264,499	264,499	264,499	264,499	264,499	264,499	264,499	264,499
Cash Flow	(317,196)	33,738	33,738	33,738	33,738	33,738	33,738	33,738	33,738	33,738	33,738
Revenue @$0.47		299,981	299,981	299,981	299,981	299,981	299,981	299,981	299,981	299,981	299,981
Cash Flow	(317,196)	69,220	69,220	69,220	69,220	69,220	69,220	69,220	69,220	69,220	69,220
Revenue @$0.43		275,642	275,642	275,642	275,642	275,642	275,642	275,642	275,642	275,642	275,642
Cash Flow	(317,196)	44,881	44,881	44,881	44,881	44,881	44,881	44,881	44,881	44,881	44,881

APPENDIX D

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