

PROJECT PROPOSAL

I. PROJECT PROFILE	
A. Title of the Project	Design, Development, Test and Utilization of Bamboo (<i>Kawayan tinik and Patong</i>)-Laminated Tabletops for Student Desks and other Furniture
B. Proponent	Romblon State University, Office of the VPRED
C. Project Cooperators	Selected bamboo farmers with <i>kawayan tinik</i> and <i>patong</i> stands
D. Project Duration	1 year project implementation 2 years monitoring of outcomes
E. Total Project Cost	<div style="text-align: right;">PhP 938,236.00</div> <div style="text-align: right;">DOST MIMAROPA - PhP 776,600.00</div> <div style="text-align: right;">RSU - PhP 161,636.00</div>
II. PROJECT PROPOSAL	
A. Rationale	<p>Plastic armchairs are now the most common school furniture. These armchairs are probably the cheapest furniture schools could buy at the moment but are not the best furniture for the students. One reason is that the arms are narrow and could not hold much that a student would need like laptops or large notes or ledger books. Second, the position either to the right or left puts the student in an awkward stance that could permanently ruin his/her posture. Third, it is hard to repair when broken and will lie in a trash heap forever.</p> <p>School desks in the past were made of solid wood. The desks in the then Gabaldon Buildings were sturdy, with wide tabletops and allow students to have correct posture. Unfortunately, wood is hard to find now that is why manufacturers turn to alternative materials like plastic.</p> <p>Desks of metal and wood are now common too. Desks with legs made of steel and tops made of solid wood, plywood, particleboards and plyboards have found their way in classrooms. One alternative for tabletops could be bamboo. Strips laminated into a plywood base could increase the thickness of the board thereby making it sturdy without so much expense. One half-inch plywood could be laminated with 1/4-inch bamboo strips to get 3/4-inch boards. Cost for this could be lower as the price for a 3/4-inch plywood is more than double the price for 1/2-inch plywood. Mass production may be done to bring the cost further down. This research proposal intends to come up with bamboo-laminated boards that may be used in school desks. It also intends to determine the physical and mechanical properties of the developed boards to be able to get baseline data that may be used in other researches. Moreover, the research will test the finished product for durability, cost-effectivity and appropriateness as school furniture.</p> <p>Romblon has an undetermined area of bamboo stands. The material, however, is widely used for building houses and for furniture. <i>Kawayan tinik</i> and <i>patong</i> are used generally for the</p>

	<p>purpose. In Odiongan alone there are about 30 furniture makers that deliver their products to the furniture stalls at the market. Odiongan and San Andres have known plantation for Beema bamboo that was intended for biomass production for energy generation. The specie may also be used as parquet for floors. Recently giant bamboo (<i>Dendrocalamus asper</i>) is being introduced in Romblon.</p>
B. Project Description	<p>The research will come up with laminated boards for desks and other furniture. These laminated boards will be made using local bamboo species <i>kawayan tinik</i> and <i>patong</i>. These boards will be used to make student desks so as to comply with Executive Order 879 s. 2010 that states 25% bamboo material should be incorporated in the design of student desks and school furniture. Tests will be made for specimens in conformity with ASTM standards. Tests will also be made on the finished products to measure its strength and durability at DOST-FPRDI. Spin off will be made through the RSU school factory and will be utilized by different delivery units of RSU.</p>
C. Objectives	<p>The general objective of this research is to develop bamboo laminates for use as desktops, tabletops and other furniture. Specifically, it intends to:</p> <ol style="list-style-type: none"> 1. design and develop bamboo plywood laminates from two bamboo species (<i>kawayan tinik</i> and <i>patong</i>) common in Romblon; 2. test the physical and mechanical properties of the developed bamboo laminates and compare these properties with standard plywood, plyboards or fiberboards of the same dimensions at DOST-FPRDI; 3. test the developed desks and tables for durability, cost-effectiveness and appropriateness as school furniture; and 4. determine and standardize the production cost of the developed bamboo plywood laminates.
D. Methodology	<p><i>Material selection and preparation</i></p> <p><i>Kawayan tinik</i> and <i>Patong</i>, two important species locally, will be used for the production of laminated boards. Three-year old mature stands will be harvested for the purpose. Culms will be cut using a cutoff saw into the right dimension of 26 inches to allow for shrinkage and other working processes. The cut culms will be sliced using a bamboo slicer developed by the DOST-FPRDI. The sliced bamboo will then be treated by boiling the sliced bamboo slats in a solution of water and sodium hydroxide with the proportion of 100 liters water to six teaspoonful of sodium hydroxide flakes. This solution had been proven by the author as a good bamboo preservative as the sodium hydroxide renders the cellulose in bamboo unpalatable to the bamboo powder post beetle and other decay vectors. The bamboo slats will then be air-dried. After air drying the bamboo slats will undergo thickness planing. The 1-inch width slats will be thickness planed; first, by taking the protruding nodes with a hand planer, and then, making the noded slats pass through a thickness planer until the slats have all reached the same thickness of 1/4 of an inch. This uniform width and thickness slats will be used in preparing the sample specimens. There will be two types of specimens to be prepared and tested. The first specimen is the tabletop. The tabletop substrates will be made from 16inches x 24inches x 1/2 inch plywood that have been prepared in the woodworking school factory</p>

of the RSU. This dimension is the standard dimension of the student desks manufactured by the RSU woodworking school factory. This 16" x 24" x 1/2" boards will be laminated with bamboo. That had been initially dried. Drying of slats will be made in a drying oven. The moisture content will be checked periodically using 1"x1"x1/4" samples. Rakoll™ hot-setting or cold-setting glue will be the preferred glue for lamination. The glue will be spread evenly on the surface of the slat to be bonded with plywood; it will also be spread evenly on the surface of the plywood to be bonded. The slats will be arranged tightly on the surface of the plywood. If needed, staples or brad nail will be used to fix the bamboo to the board. The bamboo slat and plywood board will then be set in the RSU hot hydraulic press. The hot press with the right temperature will set the glue and evaporate excess moisture and will address the moisture content issue during lamination. Cold pressing may also be done provided that the bamboo slats to be laminated has a moisture content of around 14%. After lamination the laminated boards will be trimmed to get rid of excess bamboo. The board will then be sanded and attached to the metal legs of the school desk. Finishing will then be made. The same production process will be involved during mass production so as to get quality products.

The second specimen samples for physical as well as mechanical tests will also be made. The 1"x1/4"x16" bamboo slat will also be laminated to 1"x3/4"x16" plywood so as to create samples of 1"x1"x14" specimens plus two additional samples of 1"x1"x1" specimens. The same *kawayan tinik* and *patong* samples will be made. For the control specimen, a 1/4" thick plywood with 1"x16" dimension will also be laminated to the 1"x3/4"x16" plywood. This specimen will have an aggregated dimension of 1"x1"x16". The same 1"x1"x14" will be used for mechanical tests while the remaining 1"x1"x1" specimens will be used for physical tests.

Experimental design

A simple analysis and comparison of means will be used using ANOVA. Comparison of mean properties between the *kawayan tinik*, *patong* and plywood laminates will be made. The types of laminate will be the treatments while considering other factors constant. Tests for at least 15 samples of the 1"x1"x14" in each of the treatments will be made. The test will be bending tests where modulus of elasticity, stress at elastic limit, maximum load, modulus of rupture will be compared for each treatment.

Physical tests like density and specific gravity, shrinkage and swelling will also be conducted on the 1"x1"x1" specimens. Comparison of means will likewise be made using a one-way analysis of variance.

Sample tests

The desks will be sent to the laboratory of the DOST-FPRDI for accelerated testing. Accelerated tests for stability, stress and impact loading will be made on the desks. Sample desks for *kawayan tinik* and *patong* will be made and comparison in performance of these two species will be made. A benchmark test would be made for a desk and office table with plywood as tabletop.

The 1"x1"x14" specimens will be tested for their mechanical

	Project proposal review	x						
	Revision, approval and MOA signing		x					
	Fund release		x					
	Procurement of equipment and supplies		x	x				
	Implementation			x				
	Completion & report preparation				x			
	Generation of 6 Ps				x			
	Liquidation				x			
	Report presentation					x		
	Monitoring			x	x	x	x	x
Monitoring and evaluation would be made by the PSTC so that the performance objectives may be assessed.								

G. Budget Breakdown

The following line-item-budget would be followed for the project:

ITEM	DOST-GIA (P)	RSU (P)
MOOE		
Travelling Expenses – local	13,200.00	60,000.00
Training Expenses		
Supplies and Materials	58,000.00	10,000.00
Other Professional Services (@P1400/day x 2 days/ week x 2 weeks/month x 12 months x 2 researchers)	134,400.00	91,636.00
Representation Expenses	12,000.00	
Other Professional Services (Test Fee, FPRDI)	52,000.00	
Representation Expenses	12,000.00	
Transportation and Delivery Expenses	15,000.00	
Equipment Outlay		
1 unit Pole Cutter / Bamboo Cut-Off Saw w/ one extra blade, single phase / Continuous rating Input: 2,000W / Wheel diameter: 355mm (14") / Hole dia.: 25.4mm (1") / No load speed (rpm): 3,800 / Dimensions (L x W x H) / Net Weight: 16.3kg (36lbs) / Compatible Carbon Brush: #153 / Bamboo diameter: Max 6" diameter / Guide plate adjusts 45 degrees / 3 way adjustment for material holding / Quick vise for fast clamping of various size materials	50,000.00	
1 unit Twin Rip Saw, fabricated / motor rating capacity: 3Hp, 1Hp and voltage: 220V, 60Hz / blade: 12" diameter x 40TCT (2pcs) / adjustable blade: 1, 1.5 and 2" / capacity: 1,200 slats/day / length of carriage: 2.4 meters	200,000.00	
1 unit Thickness Planer, Continuous rating Input: 1,650W / Cutting width: 304mm (12") / Cutting depth: Cutting width 0-150 mm : 3mm (1/8") / Cutting width 150-240 mm : 1.5mm (1/16") / Feed rate/min.: 8.5m (27.9ft) / Table size (W x L): 304 x 771mm (12" x 30-3/8") / No load speed (rpm): 8,500 / Dimensions (L x W x H): 483x771x401mm / Net Weight: 28.1kg (61.9lbs) / Compatible Carbon Brush: #153 / Compact and lightweight for easier transport / Automated Head Clamp Eliminates Snipe / Compact with less weight for easy transporting to the jobsite / Engineered for faster, easier blade changes / Low noise (83dB) for operator comfort / 4-post design and diagonal cross supports for stability / Standard Accessories: Socket Wrench, Hex Wrench, Magnetic holder x2	230,000.00	
Existing equipment and facilities at the WSF		(2,200,000)
Total	776,600.00	161,636

The RSU counterpart would be travel of faculty to present the paper and office supplies for preparation of manuscript, reports and liquidation.

H. Project Management	The research will be implemented by the Office of the Vice President for Research, Extension and Development in cooperation with faculty from the RSU-CET. The PSTC Romblon would collaborate with the regional office in the purchase of equipment and in other aspects of project implementation.
I. Expected Output	<p><i>Products.</i> The products that would come out from this research will be the laminated boards that will be used for desks and tables with corresponding specifications as per tests conducted. The documented production process will also be one product so that spinning off of the technology will be facilitated.</p> <p><i>People.</i> One master's degree graduate will be considered for this research. This will come from a faculty co-operator of this research and this will also open opportunities for bamboo farmers in the province.</p> <p><i>Places and partnerships.</i> Partnerships with FPRDI for similar project will be made. Industry partners in the furniture sector will also be tapped.</p> <p><i>Publication.</i> At least one paper for publication in a Scopus- indexed journal will be considered. Another knowledge product that could be copyrighted is the documented process for producing the bamboo laminates.</p> <p><i>Protection.</i> An application for patent, utility model or industrial design, whichever is applicable, for the protection of intellectual property will be made.</p> <p><i>Policy.</i> Once implemented and spun off, a policy for using bamboo as reforestation specie for the national greening program will be lobbied in the local governance. The policy on what specie to plant will be determined largely by the results of this research.</p>
J. Monitoring and Evaluation	Monitoring and evaluation will be made by the DOST PSTC Romblon. M&E will be centered on project deliverables as listed in the expected output.

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