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ADVANCING ENHANCED WOOD MANUFACTURING INDUSTRIES IN LAOS AND AUSTRALIA

NUoL research facility upgrade – interim report

Written by Adam Redman - July 2018

VALTIP 3

This publication has been compiled by Dr Adam Redman of Department of Agriculture and Fisheries

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Introduction

This report is a component of VALTIP 3 Activity 3.1 of Objective 3 (Enhancement of NUoL research facility and capability for manufacturing and training in EWPs) in the ACIAR co-funded aid project FST/2016/151 *Advancing enhanced wood manufacturing industries in Laos and Australia*. The aim of this interim report is to update ACIAR and project members on the status of the facility upgrade including building of infrastructure, new equipment purchasing, installation and commissioning, and production of standard operating procedures for the equipment.

Previous research conducted during ACIAR co-funded aid project: FST/2008/039 *Enhancement of veneer products from acacia and eucalypt plantations in Vietnam and Australia,* in Vietnam, identified spindleless-lathes as the most likely evolutionary technology to improve the productivity of processing small plantation-logs in Lao PDR. Subsequently, the nucleus of the NUoL research facility was established under ACIAR Laos project FST/2010/012 *Enhancing Key Elements of the Value Chains for Plantation-Grown Wood in Lao PDR* (VALTIP2) with the installation of a BSY brand log debarker/rounding machine, spindle-less lathe, veneer clipper and knife sharpener. This enabled research to be conducted on the production of veneers from small diameter timber (10-40 cm). This current project includes provision of additional equipment to enable the production and testing of a range of engineered wood products (EWPs) produced from sawn timber and veneers. The objective of such an endeavour is for NUoL to be the pivotal point for interdisciplinary research and training in wood processing and manufacturing of appearance and structural wood products.

VALTIP 2 facility upgrade overview

The site chosen for the VALTIP 2 veneer peeling facility was an existing building located next to the dry wood sawmill and kiln building at the NUoL Faculty of Forestry campus. Prior to the facility upgrade, the building was being used as a storage area for old equipment and to park student motorbikes (Figure 1a). Significant refurbishment of the building was required to house the veneer processing equipment and included: increasing the slab thickness by a further 15 cm, installation of three-phase power, junction boxes, a reliable earth, safety switches, lighting and re-painting (Figure 1b).

(a) (b)

Figure 1. Veneer processing facility building before (a) and after (b) refurbishment

Veneer-processing machinery was selected by Queensland Department of Agriculture and Fisheries (DAF) and NUoL staff who visited and shortlisted a number of veneer-processing machine manufacturers in China, finally deciding on the BSY Industry Group

(http://www.bsywoodworking.com/) based on a combination of reputability, design quality, cost and technical support. Subsequent purchase, installation and commissioning of veneer production equipment consisting of a 4 ft. (1.2 m) log-rounding machine (Figure 2a), 4 ft. veneer spindleless lathe (Figure 2b), veneer clipper and conveyer (Figure 2c), and a knife sharpening machine (Figure 2d).

(a)

(b)

(c)

(d)

Figure 2. Veneer processing equipment consisting of log debarking/rounding machine (a), spindleless lathe (b), clipper and conveyer (c) and knife sharpener (d)

The official opening of the 'Veneer Processing and Production Center' at NUoL was held on 11 November 2015. The opening was attended by Vice President of the NUoL Assoc. Prof. Dr Saykhone Saynasine, Australia's Ambassador to Laos Mr John Williams, Tony Bartlett from ACIAR and other officials (Figure 3).

Figure 3. Official opening of the 'Veneer Processing and Production Centre' at NUoL

VALTIP2 project industry companies, NUoL researchers and students have been trained in the use and maintenance of the veneer machinery. The NUoL research team are now able to run the machinery autonomously and, during the two years, have performed their own peeling trials using eucalypt, acacia and teak logs.

VALTIP 3 workshop expansion

Due to size and foundation limitations, the veneer-processing facility needed to be expanded to house equipment required for veneer-based product production.

Floor plan

After a number of iterations the final floor plan for the new workshop was decided as shown in Figure 4. The floor plan shows the new workshop area (i), joining the VALTIP 2 veneer-processing workshop (ii) and the NUoL original dry-mill workshop (iii). The plan includes a covered veneer drying area (iv) and finished product showroom (v). Note the removal of the VALTIP 2 workshop wall (vi) to allow workflow into the new workshop.

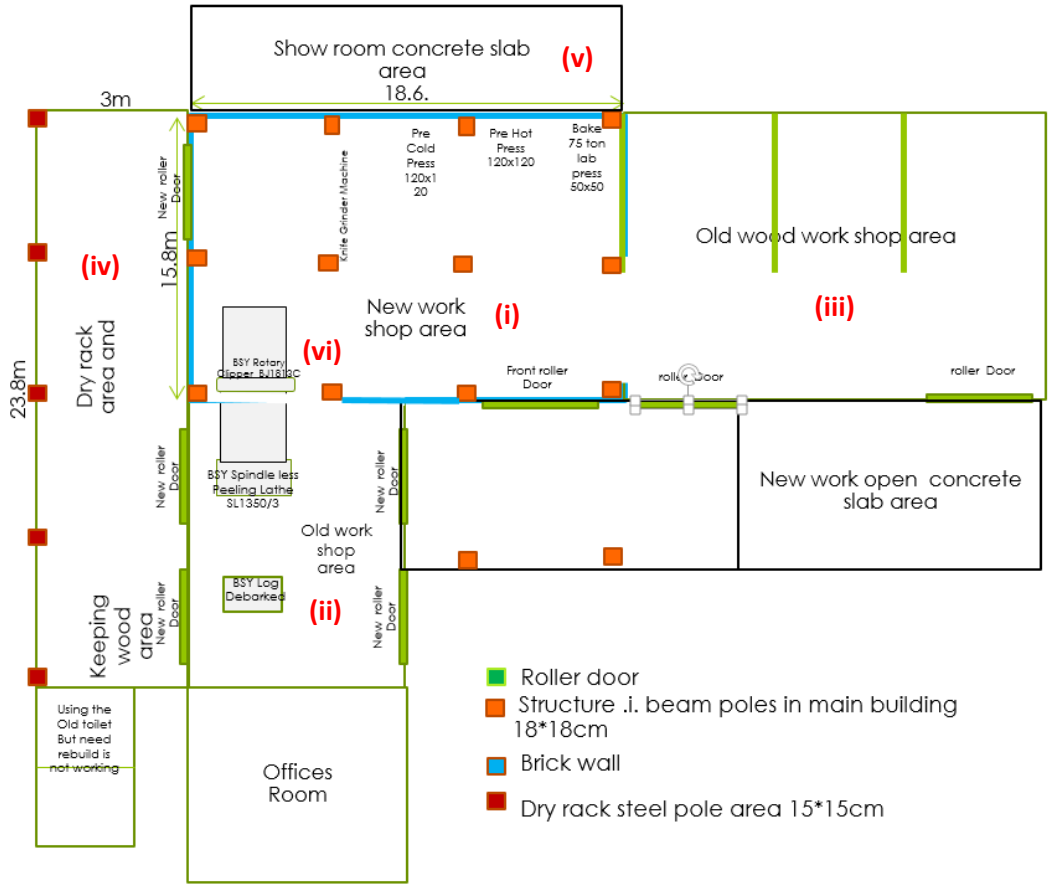


Figure 4. Floor plan for new work shop area (i), joining the VALTIP 2 veneer-processing (ii) and original dry-mill workshops (iii). The plan also includes a covered veneer drying area (iv), and product showroom (v). Note the removal of VALTIP 2 workshop wall (vi) to adjoin the new workshop.

Building specifications

VALTIP 3 project staff drafted up detailed building specifications for the expansion of the facility. Concrete slab thickness requirements were determined through consultation with construction-company civil-engineers based on the expected weight specifications of veneer-based product production equipment. Initially a 3-dimensional image of the facility was constructed using SketchUp 3D modelling freeware (Figure 5). Subsequent technical drawings were drafted (Figure 6) followed by a detailed description of the building specifications (Table 1) used to obtain quotes from Lao PDR production companies.

Figure 5. SketchUp 3-dimensional model of the expanded facility (orange building)

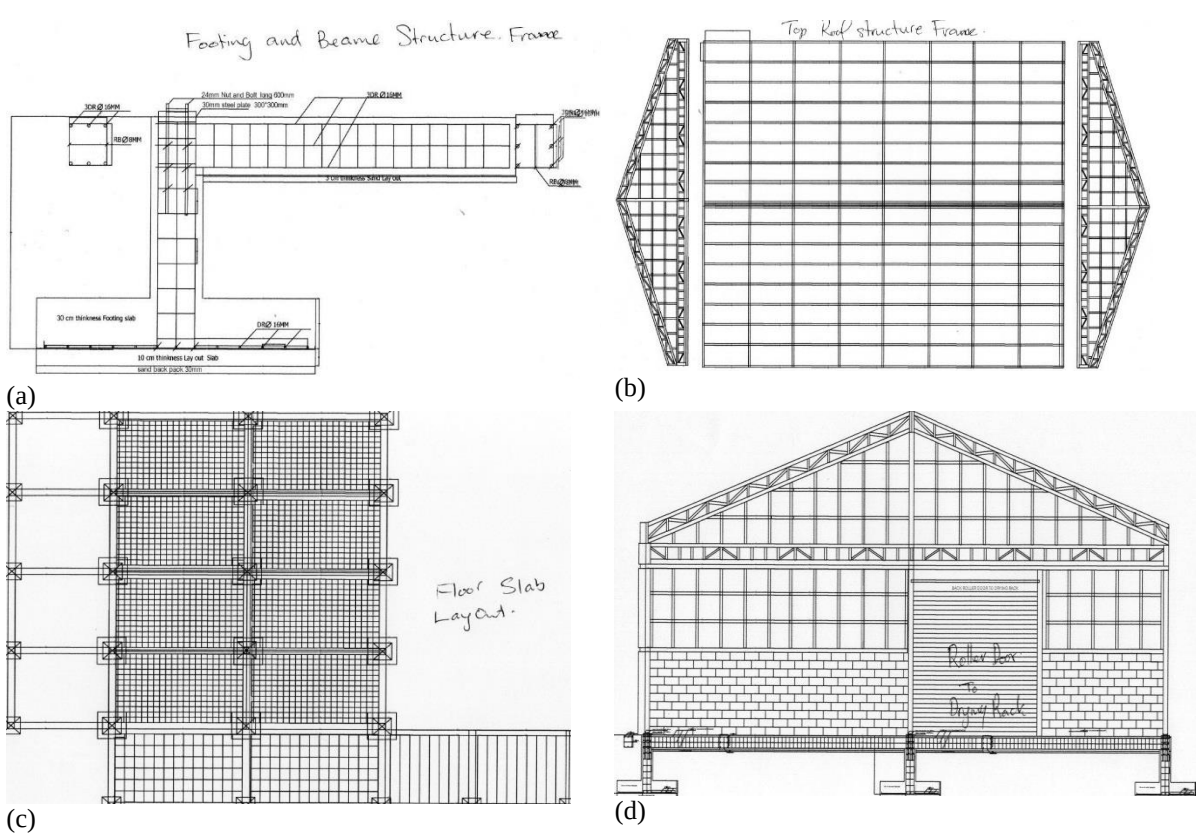


Figure 6. Examples of technical drawings including the foundation pier and beam structure (a), roof structure (b), foundation post and reo-bar structure (c) and a side wall (d).

Table 1. List of building specifications

Bill No	Description	Unit	Quantity
D1	**Earthworks and foundations**		
D1-1.	Site clearing and lay out setting	**m2**	**505.00**
D1-2.	Soil excavation for footings poles (below the ground)	**m3**	**12.00**
D1-3.	Hard fill compaction under the foundation up to the level as indicated on the drawings	**m3**	**99.00**
D1-4.	Backfill inside the building with sand/gravel watered with anti-termite production	**m3**	**99.00**
D2	**Poles footing and beam structure frame including reo-bar steel**		
D2-1.	Concrete slab for pole footing layout using class B cement	**m3**	**12.00**
D2-2.	Build pole footing structure up to level as in the drawing 70cm*70cm*30cm thickness	**m3**	**2.00**
D2-3.	Build pole structure up to level as in the drawing 25cm*25cm*100cm height	**m2**	**12.00**
D2-4.	Build beam frame structure as in the drawings size 25cm*25cm	**m2**	**119.00**
D2-5.	Build beam frame structure outdoor dry rack area as in the drawings size 18cm*18cm	**m2**	**31.00**
D3	**Concrete flooring slab structure frame including reo-bar steel**		
D3-1.	Concrete floor slab inside the workshop in 12cm thickness *18.60*15.80 using concrete Class A	**m3**	**36.00**
D3-2.	Concrete floor slab outside the drying rack area in 8cm thickness *300*23.80	**m3**	**6.00**
D3-3.	Concrete floor slab outside in the drive way in 10cm thickness *3.50*20.00	**m3**	**7.00**
D3-4.	Concrete floor slab in show room shop in 6cm thickness *4.00*18.60	**m3**	**5.00**
D4	**Build steel pole structure in (I-beam) and wall frame in steel square tube**		
D4-1.	Installation I-beam poles in the main building as a size of standard drawings 18*18*4m	**m**	**48.00**
D4-2.	Building roof structure frame in the size as a standard drawings including aluminium roof sheet	**m2**	**293.00**
D4-3.	Build main building wall structure frame in still square tube as standard drawings including	**m2**	**138.00**
	Wall aluminium roof sheet		
D4-4.	Build wall in brick and completed in plaster	**m2**	**138.00**
D5	**Front door roof structure and aluminium roof sheet**		
D5-1.	Install square box poles in the front door area as a size of standard drawings 15*15*3.5m	**m**	**7.00**
D5-2.	Build roof structure frame including aluminium roof sheet as in the standard drawings	**m2**	**40.00**
D6	**Show room and workshop offices**		
D6-1.	Instillation square box poles in the show room area as a size of standard drawings 15*15*2.8m	**m**	**12.00**
D6-2.	Build roof structure frame including aluminium roof sheet as in the standard drawings	**m2**	**75.00**
D7	**Remove brick masonry structure wall**		
D7-1.	Remove the old wall in the connect to offices building and replaster	**m2**	**18.00**
D7-2.	Remove the wall in the workshop that can connect to new workshop building	**m2**	**20.00**
D8	**Roller Door**		
D8-1.	Front roller door have motor to open the roller door 4*3.5m (1 set)	**m2**	**14.00**
D8-2.	Back roller door to drying rack area in new building and old building 4*3m (1 set)	**m3**	**12.00**
D9	**Electrical works**		
9-1.	Supply and install fluorescent lamps 2x40w (ceiling type with reflector) including cable	**set**	**10.00**
	Main board and all the cable has to be run by yellow PVC pipe		
D10	**Painting works**		
D10-1.	painting works in side and outdoor only on wall including paint	**m2**	**178.00**

Construction company selection

Via local knowledge of NUoL staff, five construction companies in Vientiane city were selected to provide quotes for construction of the new facility and each were provided with the building specifications and technical drawings. Companies were also asked to provide a visual example of previously completed construction projects.

A selection panel formed to make the selection of the company to perform the construction. The panel consisted of Associate Professor Latsamy Boupha (NUoL FoF Dean), Mr Tony Sayavong (NUoL Enhanced Wood Manufacturing Research Centre Workshop Manager), Professor Barbara Ozarska (UoM, Project Leader), Dr Benoit Belleville (UoM, Senior Scientist) and Dr Adam Redman (DAF, Senior Scientist). The selection was based on the cost of quotation as well as reputability displayed by each company's portfolio of construction projects.

The PML Construction Company was unanimously selected. The company signed the contract to construct on 8 January 2018 (Figure 7).

Figure 7. PML Construction Company sign the construction contract

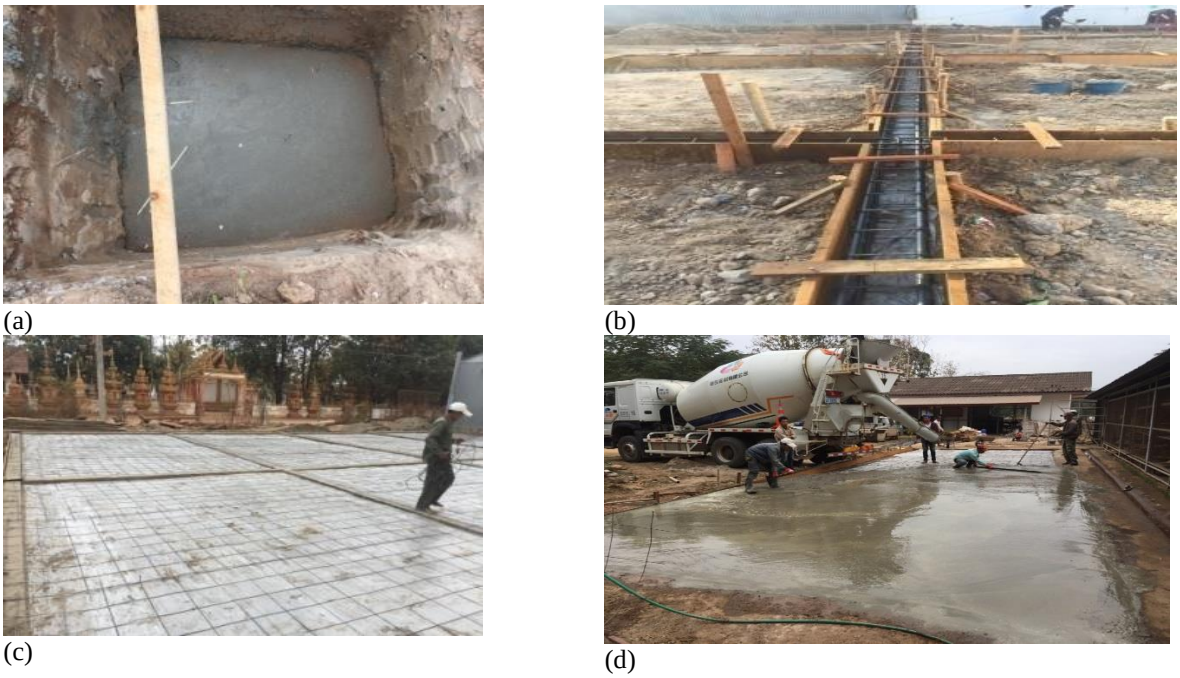
Workshop construction

The construction began on 10 January 2018 with the demolition of the old security guard house and levelling/filling the ground between the two existing workshops (Figure 8)

(a) (b) (c)

Figure 8. Demolishing old security guard house (a & b) and levelling the construction site (c)

Once the site was prepared, footings were dug and the reo bar floor beams were constructed, followed by placement of the slab reo bar and slab concrete (Figure 9).



(a) (b) (c) (d)

Figure 9. Preparation of the footings (a), reo bar floor beams (b) and slab reinforcement (c), and concrete slab.

Structural posts were constructed allowing subsequent construction of a strip of decorative brickwork wall, roof trusses and braces (Figure 10).

(a) (b)

(c)

(d)

Figure 10. Construction of structural posts (a), brickwork (b), trusses (c) and braces (d)

Final construction included adding aluminium roofing, wall cladding and flashing, removing the wall between the VALTIP 2 veneer peeling facility, rendering and painting the brickwork, and installing electrical lighting and three-phase power (Figure 11). Construction was completed on 22 March 2018 taking approximately 2.5 months.

(a)

(b)

(c)

(d)

Figure 11. Construction of aluminium roofing (a), cladding and flashing (b). Removing internal wall between workshops (c) and final rendering and painting of brickwork (c), and light installation (d).

New equipment installation

During the development phase of this project, a list of equipment was identified as required to implement the project objectives of producing semi-industrial scale veneer and agricultural-waste-resource based engineered-wood-products (EWPs). The list of equipment is provided in Table 1.

Table 2. List of desired equipment developed during project development

Pre (cold) press
Hot press
Glue spreader
Conditioning chamber
Guillotine and table
Drying racks (for veneer)
Clamping system (for blockboard and LVL)
Shredder
Panel sander
Compressor
Table saw
Radial-arm saw
Chainsaw
Ancillary equipment and installation

Due to the nature of the project budget, the purchase of equipment for this project will occur over two periods: the first during year one of the project and the second during year 3. The first phase will concentrate on core equipment required for the production of veneer-based panel products, and the second will concentrate on the production of agricultural waste panel products.

Veneer-based panel-production equipment

The core equipment identified for veneer-based panel production were:

- Cold press: used for (a) pre-pressing panels prior to hot pressing to improve adhesive penetration and (b) pressing panels which use cold-set adhesives.
- Hot Press: used for the production of panels using hot-set or thermosetting adhesives.
- Guillotine: used for trimming veneer sheets to desired dimension prior to panel manufacture.
- Table (panel) saw: Used to trim manufactured panels to desired dimension.

Based on the maximum length of logs that the veneer peeling lath can handle (1250 mm), the maximum pressure requirements of the presses (approx. 2 MPa) and the source of energy onsite (electricity), the following specifications for each of the pieces of equipment were designed:

Hot Press

- Pressure: 2000 kN
- Size of platens: 1300 x 1300 mm
- Openings: 1
- Minimum opening : 100 mm
- Max. Operating temperature: 210 deg C
- Heating media oil/electricity

Cold Press

- Pressure: 2000 kN
- Size of platens: 1300 x 1300 mm
- Openings 1
- Minimum daylight opening: 500 mm

Guillotine

- Allow for 1300 x 13000 mm veneer sheets

Guillotine

- Allow for 1300 x 13000 mm veneer sheets

Table saw

- Allow for 1300 x 13000 mm panels
- Sliding table
- Angled cutting

Two Chinese companies and one Taiwanese company were identified as most likely suppliers of the necessary equipment, particularly with the ability to custom make presses to the desired specification, and provided quotations accordingly.

A selection panel formed to make the selection of the company to supply the equipment. The panel consisted of Associate Professor Latsamy Boupha (NUoL FoF Dean), Mr Tony Sayavong (NUoL Enhanced Wood Manufacturing Research Centre Workshop Manager), Professor Barbara Ozarska (UoM, Project Leader), Dr Benoit Belleville (UoM, Senior Scientist) and Dr Adam Redman (DAF, Senior Scientist). The selection was based on the cost of quotation as well as ability to meet our specifications and the overall dimension and weight of the presses.

The panel decided on the BSY Industry Group, the same company who supplied the veneer processing equipment. This decision had the added benefit of continuity with equipment and one point of contact for maintenance and supply.

The equipment order was made on 14 December 2017. Manufacture of the equipment was completed on 27 March 2018 and delivered to NUoL on 18 May 2018. The machinery was unloaded using a crane (Figure 12).

Figure 12. Unloading equipment at NUoL

From 5-8 June 2018, the machinery was installed, connected to power, commissioned by a visiting BSY engineer who also provided basic training to key NUoL research staff (Figure 13).

Figure 13. Installation and commissioning of machinery: moving into place using skates (a), electrical and hydraulic connection (b), NUoL staff receive training from BSY engineer (c), final installation (d).

Ancillary equipment

As part of the resource characterisation component of this project, three pieces of second-hand and refurbished (onsite) pieces of equipment were purchased to provide strategic research and safety features to the facility. These are:

- Mobile dust extraction unit. Can be connected to existing panel saw, board thicknesser and circular rip sawing machines providing relative sawdust free conditions when using these machines.
- Horizontal bandsaw for breaking down logs for resource characterisation sawing studies and to produce blockboard for intended EWP production.
- Bandsaw blade sharpener so sharpening can be done in-house.

Training in the use of the horizontal bandsaw and bandsaw blade sharpener (Figure 14) has now been added to the NUoL curriculum.

(a)

(b)

Figure 14. Horizontal bandsaw (a) and bandsaw blade sharpener (b)

Acknowledgements

The author would like to acknowledge the following individuals whom have made this upgrade to the NUoL facility possible:

- Dr Henri Bailleres (Team Leader, DAF) whose is the visionary behind the initial VALTIP 2 veneer processing facility and subsequent VALTIP 3 upgrade.
- Ms Rica Minnett (Technician, DAF) whose years of experience in plywood manufacture equipment sales was invaluable in providing contacts in China and Taiwan for equipment selection.
- My Tony (Outhit) Sayavong (Facility Manager, NUoL) whose practical knowledge of the construction industry in Laos, building practices, electrical connectivity and communications skills made the construction of the facility flow seamlessly.
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