TIMBER TECHNOLOGY BULLETIN

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# REVIEW ON SIX TYPES OF LOG CUTTING METHODS IN VARIOUS APPLICATION: PART 2

SS How[1], A Siti Zaliha[1] & CY Goh[2]
[1]*Forest Research Institute Malaysia*
[2]*Bakti Malaysia Sdn. Bhd.*

## INTRODUCTION

In log conversion, sawmillers are always concerned about volume and value recoveries. The former refers to the usable volume of sawntimbers recovered from log conversion while the latter relates to the total monetary value derived. High volume recovery may not always warrant high return in profit because the values derived also depends on other factors such as dimension and quantity of boards derived, their quality (grade) and market demand.

This paper examines six cutting methods commonly and potentially used in our country, the description of which was elaborated in How *et al.* (2007). Based on some practical assumptions, both volume and value recoveries with respect to the above cutting methods are then presented.

## DIFFERENT LOG CUTTING METHODS

A total of six different log conversion methods are dealt with here. They are:

(a) Live sawing
(b) Sawing with a breaking cut
(c) Quarter sawn

} Currently practised in the country

(d) Turn around at $90^0$
(e) Turn around at $180^0$
(f) Flat sawn

} Less practised in the country.

Note: Details as found in How *et al.* (2007)

## ASSUMPTIONS AND COMPARISONS

For the comparison of volume and value recoveries between different methods of conversion, a regular and an irregular sample log with diameter of 24" (55.88 cm), length of 6 ft (176.4 cm) were arbitrarily chosen as it represents the average medium size logs obtained commercially. As an illustration, comparisons were made based on prices quoted for a local Medium Hardwood species as of August 2008 for different commercial dimensions of boards available. Various cutting methods were applied onto the sample logs as shown in Appendix 1. Besides, in the illustration, virtual 'growth rings' (not conspicuous in most tropical hardwoods) were drawn to facilitate demonstration of sawn type. In addition, the following assumptions were also applied.

(i) All logs illustrated are sapwood-free;
(ii) Sizes cut according to standard size practiced by a local sawmiller;
(iii) Defects were removed. Any other defects appear on timber are treated as acceptable pinholes;
(iv) All prices are based on the average export price per tonne according to the respective dimensions;
(v) Quarter-sawn timbers and other 12"-width and ups timbers are usually cut upon special request. An additional of 10 and 50% surcharge is assumed applicable to 12" width and ups and quarter sawn, respectively (How *et al.* 2007).

## SUMMARY OF RESULTS

The results obtained are summarized in the following tables.

The recovery of sawn timbers was calculated based on simulated cutting patterns as depicted in pictures A-1 to A-6 (denoting cutting patterns for typical round log) and B-1 to B-6 (for an irregular log) in Appendix 1.

Value recovery (Tables 1 and 2) was calculated based on price per tonne while volume recovery was based on total green timber volume obtained from cutting. Volume recoveries in Tables 3 and 4 were further broken down into sub-categories of:

- 'Expected sawn' – Percentage of the desired/ requested sawn type (e.g. quarter sawn, flat sawn, etc.) of the targeted dimensions recovered.
- 'Recovered Sawn' – Percentage of those other than the requested sawn type (e.g. quarter sawn, flat sawn, etc.) and sawn dimensions recovered including those which did not fulfill the applied assumptions.
- 'Total Recovery from Log' – Percentage of desired sawn and recovered sawn.

**Table 1** Comparison in **Value Recovery** between cutting methods 1 to 6 for **Round Logs** (in Ratio)

| Ratio | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 1.00 | 1.01 | 1.38 | 1.01 | 0.89 | 0.96 |
| 2 | 0.99 | 1.00 | 1.37 | 1.00 | 0.88 | 0.95 |
| 3 | 0.72 | 0.73 | 1.00 | 0.73 | 0.65 | 0.70 |
| 4 | 0.99 | 1.00 | 1.37 | 1.00 | 0.89 | 0.95 |
| 5 | 1.12 | 1.13 | 1.55 | 1.13 | 1.00 | 1.08 |
| 6 | 1.04 | 1.05 | 1.44 | 1.05 | 0.93 | 1.00 |
| Ranking | 4 | 2 | 1 | 3 | 6 | 5 |

**Table 2** Comparison in **Value Recovery** between cutting methods 1 to 6 for **Irregular Logs** (in Ratio)

| Ratio | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.98 | 1.45 | 0.97 | 0.99 | 0.95 |
| 2 | 1.02 | 1.00 | 1.48 | 0.38 | 1.01 | 1.02 |
| 3 | 0.69 | 0.68 | 1.00 | 0.76 | 0.68 | 0.69 |
| 4 | 0.95 | 0.93 | 1.38 | 1.00 | 0.94 | 0.95 |
| 5 | 1.01 | 0.99 | 1.47 | 1.24 | 1.00 | 1.01 |
| 6 | 1.00 | 0.98 | 1.45 | 1.11 | 0.99 | 1.00 |
| Ranking | 3 | 6 | 1 | 5 | 2 | 4 |

**Table 3** **Volume Recovery** between cutting methods 1 to 6 for **Round Logs**

| Cutting Methods | Expected Sawn (%) | Recovered Sawn (%) | Total Recovery from Log (%) |
|---|---|---|---|
| 1 | 51.90 | 10.15 | 62.05 |
| 2 | 51.69 | 13.59 | 65.29 |
| 3 | 50.84 | 7.05 | 57.89 |
| 4 | 51.30 | 14.25 | 65.56 |
| 5 | 42.69 | 17.02 | 59.71 |
| 6 | 52.83 | 9.71 | 62.54 |

**Table 4** **Volume Recovery** between cutting methods 1 to 6 for **Irregular Logs**

| Cutting Methods | Expected Sawn (%) | Recovered Sawn (%) | Total Recovery from Log (%) |
|---|---|---|---|
| 1 | 45.46 | 7.18 | 52.65 |
| 2 | 44.31 | 10.53 | 54.84 |
| 3 | 46.09 | 4.36 | 50.45 |
| 4 | 45.25 | 9.40 | 54.65 |
| 5 | 45.82 | 8.73 | 54.55 |
| 6 | 46.88 | 4.83 | 51.71 |

(i) Ratio numbers : 1-Live sawing or through-and-through; 2- Sawing with a breaking cut; 3- Quarter sawing; 4-Turning around at 90°; 5-Turning around at 180°; and 6- Flat-sawn.
(ii) Value in cells indicates ratio of value for method listed in row (numerator) over column (denominator).
(iii) Highest recovery  Lowest recovery

## INDUSTRIAL IMPLICATIONS

Interesting implications could be deduced from the above analysis for the six cutting methods discussed. They could be summarized as follows:

### (A) Round logs

In the commercial practice, good and rounder logs are often taken up by the plywood industries which are able to pay a little better premium compared to the sawmilling industries. Furthermore, in the case of plantation grown species, they are generally smaller in size compared to the forest trees, less mature hence made up of more juvenile stocks which are less 'stable' in nature. This often leads to bowing and twisting of sawntimbers upon conversion, which undoubtedly affects their recoveries. In order to minimize such defects, methods such as Method 4, *Turning around at 90°*; and Method 5, *Turning around at 180°* become necessary. Having taken these points into consideration, the following implications could be drawn:-

(i) 'Quarter-sawn' method (Method 3) and 'turn around at 180°' (Method 5) represents methods with the highest and lowest **value** recovery, respectively (Table 1), with the average value of former approximately 40% more than the latter. The differences between other cutting methods were less significant. Since the production of quarter sawn timber is based on special order, the application of 'sawing with breaking cut' (method 2) is in common practice, which is found to be slightly lower in value recovery than that of 'quarter sawn' (method 3). However, this is true for regular shape logs and if a surcharge of 50% applies to the latter. For a different price difference, fresh comparison has to be made again.

(ii) The highest total timber **volume** recovered was 'Turn around at 90°' (method 4) while the lowest being 'Quarter-sawn' (method 3). In term of value recovery, turning around 90° method acquires value recovery slightly lower than breaking cut method. This illustrates the point that value is not always directly proportional to the output volume. It is thus necessary to consider both factors in any cutting decisions. Total volume recovery from round logs does not vary much, ranging from 58 to 66% for the cases demonstrated (Table 3).

### (B) Irregular logs

As more and more logs of irregular shapes and of smaller diameter emerged in the market, the implication drawn in this context becomes more relevant. Among them are;

(i) 'Quarter-sawn' (method 3) exhibited the highest value recovery (Table 4) for logs with irregular shape, about 45% more than that of 'Sawing with a Breaking Cut' (method 2) which produces the lowest. On the contrary, the breaking cut method produces the highest volume recovery compare to that of quarter-sawn which in turn produces the lowest. The total volume recovery in irregular logs ranged closely from 50 to 55% (Table 4) which is quite a narrow range for the case illustrated.

(ii) In the cases of 90° and 180° cuttings, i.e. methods 4 and 5, the results showed that value recovery in those of 180° is higher than 90° as claimed (How *et al.* 2007). However, this was only true for the irregular logs case demonstrated.

(iii) There is specific interest in the comparison of Quarter Sawn and Flat Sawn which is tabulated below.

**Table 5** Recovery of quarter sawn and flat sawn versus recovery sawn

| Cutting type | Recovered sawn type | Volume recovery of round log (%) | Volume recovery of irregular log (%) |
|---|---|---|---|
| Quarter sawn | Quarter Sawn: | 50.84 | 46.09 |
| | Recovered Sawn: | 7.05 | 4.36 |
| | Total: | 57.89 | 50.45 |
| Flat sawn | Flat Sawn: | 52.83 | 46.88 |
| | Recovered Sawn: | 9.71 | 4.83 |
| | Total: | 62.54 | 51.71 |

- In general, the volume recovery of quarter- and flat-sawn type was higher in round logs, at 50.84 and 52.83% respectively, as compared to 46.09 and 46.88% for irregular logs respectively.
- Merely 46.09% from irregular logs were pure Quarter sawn but it seems to be more promising in round logs where 50.84% can be derived (excess of 4.75%). Similarly, the recovery of pure Flat Sawn was greater in round logs (52.83%) than irregular logs. The record showed marginally lower quarter sawn recovery than flat sawn for both round and irregular logs. However, the claim is expected to vary with the shape and diameter particularly of the irregular log chosen.
- Nevertheless, millers shall bear in mind that as long as the niche market is willing to pay at a higher price, which is higher than the expected margin, it is still worth cutting quarter sawn (refer to Table 2)

## CONCLUSIONS

Comparisons of round and irregular logs between volume and value recoveries have been elaborated and tabulated in the form of ratios for general comparison. It is essential for sawmillers to understand that high volume recovery does not always guarantee attractive profit return. Cutting of logs is somehow an art which requires ample experience and soft-skills to determine the type of cutting pattern to be exercised for different shape, size and condition of logs with respect to market demand and pricing. In short, processing of forest logs should not be practiced in a robotic and routine manner. Instead, it may require the art of artificial intelligence particularly when mass production is concerned.

## ACKNOWLEDGEMENTS

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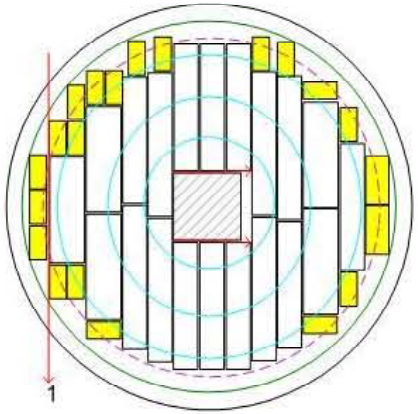
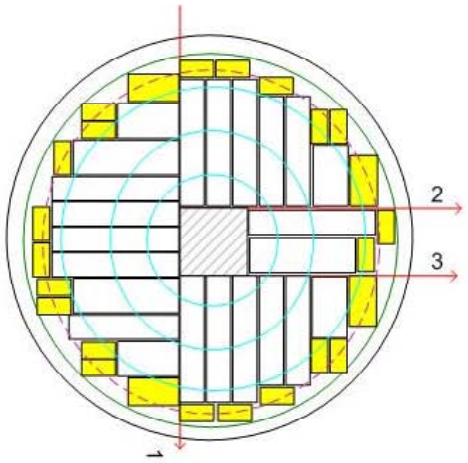
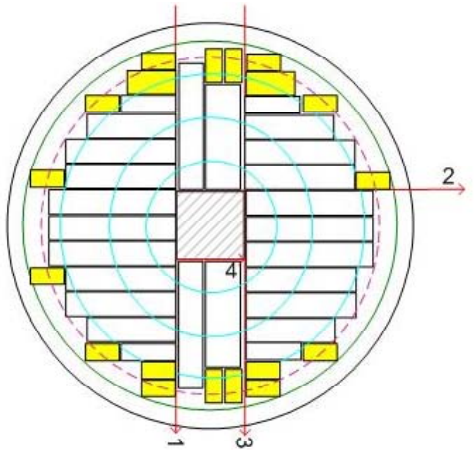
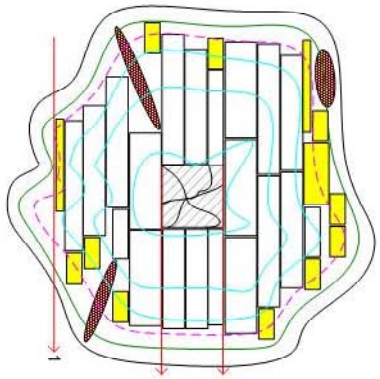
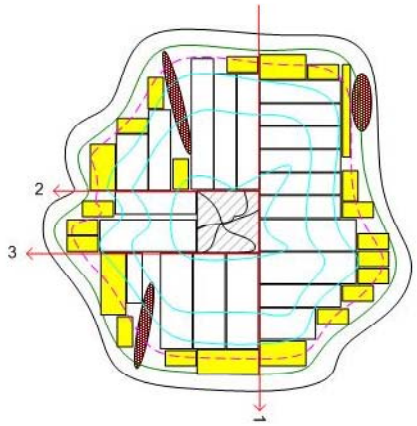
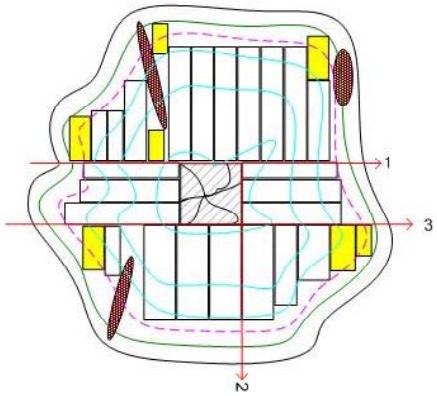
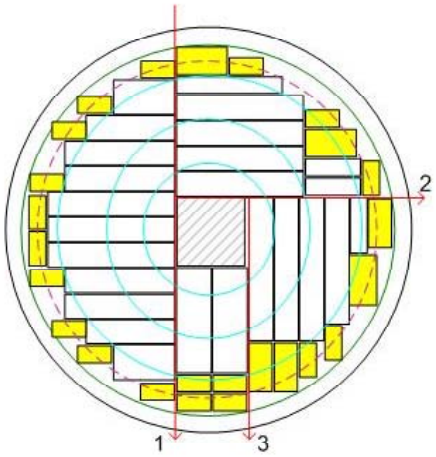
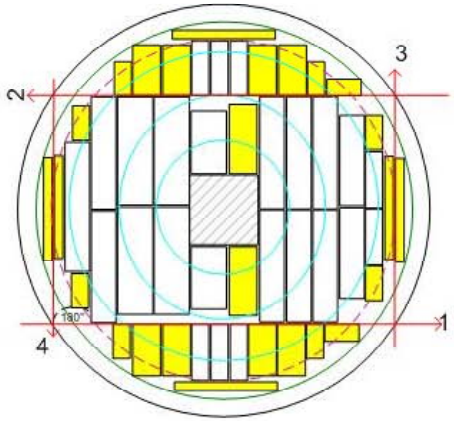
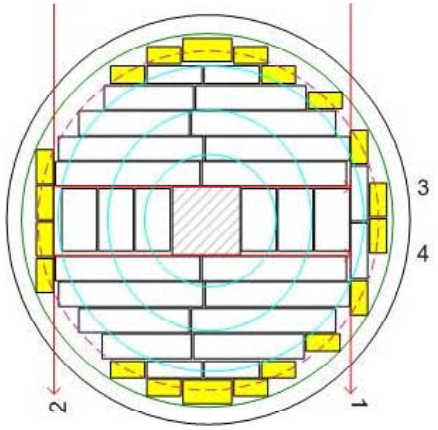
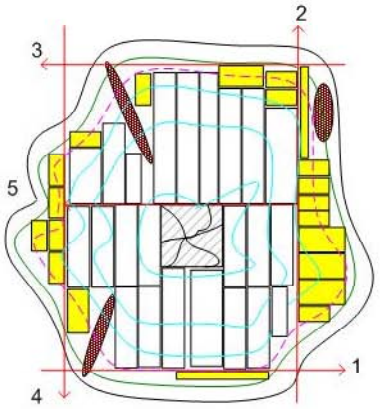
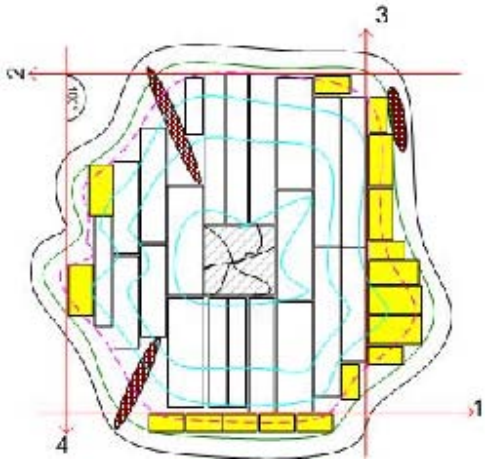
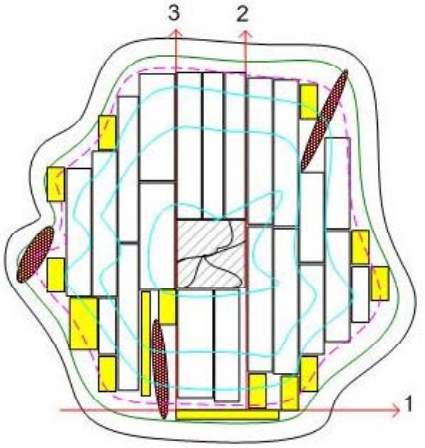
**Appendix 1** Illustration of sawn boards recovered from different log cutting methods

(A) Common cutting methods in local

| | 1. Live sawing | 2. Sawing with a breaking cut | 3. Quarter sawn |
|---|---|---|---|
| Round Logs |   |   |   |
| Irregular Logs |   |   |   |

(B) Lesser-known or less popular cutting methods in local

| | 4. Turn Around at 90° | 5. Turn Around at 180° | 6. Flat sawn |
|---|---|---|---|
| Round Logs |  |  |  |
| Irregular Logs |  |  |  |

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