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Demand and Supply Analysis of Roundwood in India

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The paper attempts to analyze the trend in production, consumption, import and export of roundwood and its demand and supply gap. The results revealed that positive trend was observed in production, consumption and import. Higher growth rate was observed in import (0.10) and consumption (0.09) which creates a gap between demand and supply. The consumption, production plus import of roundwood and demand and supply gap will be 116.31 MCUM, 70.79 MCUM and 22.44 MCUM respectively in 2025. Lagged demand, GDP per capita and population are positively significant on demand and forest cover decides the supply for roundwood. The gap between demand and supply of roundwood can be bridged by utilizing the substitute products and less utilized species for timber purpose.

Key words: Roundwood, Demand and Supply.

Forests are the most remarkable natural resource which plays an important role in the economic prosperity and ecological stability of the country. In India, forest and tree cover was 7,08,273 Sq.km in 2017 which is 21.54% of the geographic area of the country with the productivity of 0.5 - 0.7 m^3/ha which is lower than the global average of 2.1 $m^3 ha^{-1}$ during 2016 - 17 (FSI 2017). Per capita availability of forests in India was 0.06 ha in 2016 which is much lower than the world average of 0.64 ha. Timber products are environmentally superior to other variants made from metals, plastics, and cement as these are recyclable, energy efficient and reduce greenhouse gases.

Nowadays, forests of the country are shrinking under acute socioeconomic pressure and the foresters are at the crossroads leading to the low availability of wood source for the commercial usage. (Shikha, 2017) stated that India is one of the top producers of tropical logs among International Tropical Timber Organization (ITTO) member countries, but it faces a severe shortage of timber supply from domestic sources to meet its growing demand. (Pandey *et al*., 2008) estimated that more than 50% of total Indian wood supply comes from non-forest sources indicating the wood and composite panel industries face raw material shortages.(Maharaj, 2004) report stated that regardless of significant gains from plantations, India is likely to face the severe shortage of timber supply from both domestic and international sources. In the absence of the effective measure for increasing the domestic production, the country heavily depends on its imports. (Carle *et al.,* 2002) stated that the forest plantations provide a critical substitute for the raw material supply from natural forests, including industrial round wood and firewood. (ITTO report 2017) revealed that the prices for imported hardwoods remain unchanged. Domestic demand for imported sawn wood continues to decrease and there was growing substitution of hardwoods for imported plantation teak. This paper aims to analyze the trend in production, consumption, import and export, demand and supply gap of roundwood and also to identify the determinants of roundwood demand and supply.

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Material and Methods

Design of study

The secondary data on production, consumption, export and import of timbers were collected from ITTO for the period of 2000 -2016. Forest cover data were collected from the state of forest reports published by Forest Survey of India (Ministry of Environment & Forests). Data on GDP per capita were collected from the World Bank report and the wholesale price index of wood and wood product was collected from the Ministry of Statistics and Programme Implementation (MOSPI).

Tools of analysis

Growth rate

Compound Growth Rate (CGR) was used to measure the annual growth rate of production, consumption, import and export of roundwood using the formula $Y_t = ab^t$. The logarithmic form of the equation is Ln Y=ln a + t ln b. The percent CGR is derived using the formula CGR = [Antilog (b)-1] *100. Where, Y_t = Production or consumption or import or export, a = Intercept, b = Regression coefficient of t, t = Time variable. The value of b is computed by using the OLS method. Further, the value of CGR was worked out by using the equation (1).

CGR = (antilog b - 1) x 100 .....(1)

After estimation of the growth rate percentage, the forecast value for the succeeding years is found by the equation (2).

Forecasting year = Actual end year * (1+ CGR) ^number of years .....(2)

Demand model

The demand for roundwood is decided by many factors such as price of roundwood, price of substitute and level of consumption of roundwood which is represented in equation (3).

$Q_d = f(X_1, X_2, X_3, X_4, X_5)$ .....(3)

Where, Q_d - Quantity demanded of roundwood (in MCUM); X_1 -Lagged demand of roundwood (MCUM); X_2- Price of Roundwood (Rs/tonnes); X_3 - Price of substitute (Steel) (Rs/tonnes); X_4 -GDP per capita growth (Current price US $); and X_5- Population (Billion)

Supply model

The quantity of roundwood supply is a function of domestic production, import of roundwood and forest cover.

Supply = production of timber from domestic sources + import - export.

The supply model of roundwood is estimated by equation (4).

$Qs = f(X_1, X_2, X_3, X_4, X_5, X_6)$ .....(4)

Where, Qs = Supply of roundwood; X_1 - Lagged supply (MCUM); X_2 - Rainfall (mm); X_3 - Forest Cover (in sq.km); and X_4 - GDP growth rate (%)

Results and Discussion

Trends in production, consumption, export, and import of roundwood

Production, consumption, export and import of roundwood are important factors in the housing sector which is depicted in Fig. 1. From the fig. 1, it could be observed that positive trend was observed on production, consumption, import and export. This may be due to higher demand for wood and wood products.

Growth rate

The compound growth rate of production, consumption, import and export of roundwood was calculated and projected for 2025 is depicted in Table 1.

Table 1. CGR and projected value of Roundwood

Particulars	Current year value (2017)	CGR	Projected value (MCUM) (2025)
Production	49.52	0.01	56.24
Consumption	55.00	0.09	116.31
Import	3.51	0.10	14.75
Export	0.02	0.03	0.03

Source: ITTO (International Tropical Timber Organization)

The table 1 explains that the higher growth rate is found in the import of roundwood (0.10) followed by consumption of roundwood (0.09). The growth rate of export is 0.03 and the growth rate of roundwood production is negligible (0.01). The production, consumption, import and export will be 56.04, 116.31, 14.75, 0.02 MCUM in 2025 respectively.

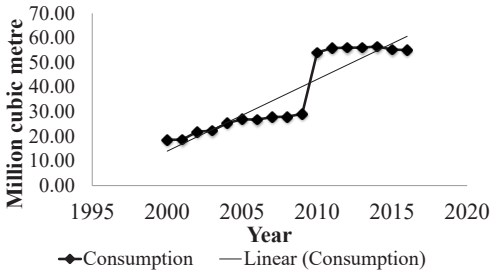

Fig. 1a. Trend in consumption

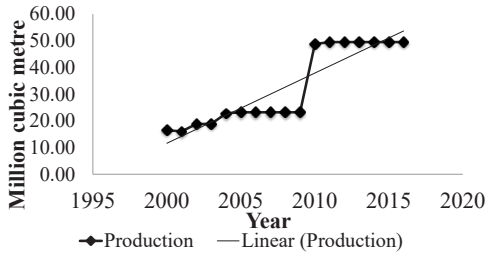

Fig. 1b. Trend in production

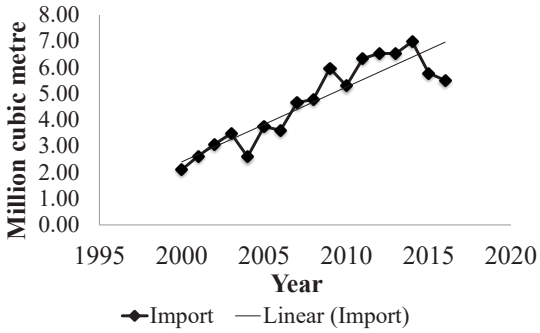

Fig. 1c. Trend in import

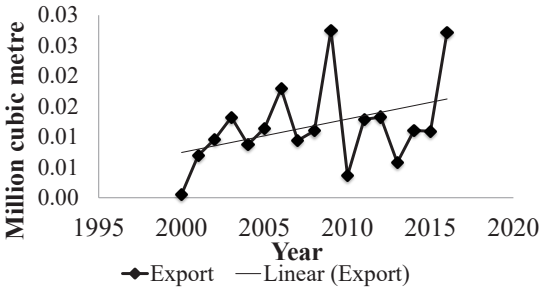

Fig. 1d. Trend in export

Fig. 1. Trends in production, consumption, export and import of roundwood

Demand and supply gap

Due to population explosion, urbanization, and higher income, the demand for roundwood has outstripped the supply of roundwood in India. This makes an imbalance in demand and supply. The

demand and supply gap of the roundwood is depicted in the Fig. 2.

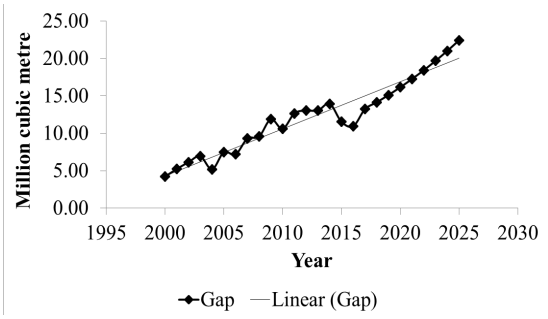

Fig. 2. Demand and supply gap of Roundwood in India

It could be observed from the fig. 2 that the gap between demand and supply of roundwood was widening over the years since the supply from the domestic production along with the import was not enough to meet the domestic requirements of the roundwood. The demand and supply gap of roundwood would be 22.44 MCUM in 2025.

Determinants of roundwood demand

The functional relationship between the demand of roundwood and the variables such as lagged demand, the price of roundwood, GDP per capita, price of substitute products (steel) and population is depicted in Table 2.

Table 2. Regression coefficients of demand model

Particulars	Coefficients	P value
Intercept	407.82 ^{NS} (190.46)	0.05
Lagged demand of roundwood (MCUM) (X_1)	0.59* (0.21)	0.02
Price of Roundwood (Rs/tonnes) (X_2)	0.03 ^{NS} (0.03)	0.40
Price of substitute (Iron) (Rs/tonnes) (X_3)	0.001^{NS} (0.00)	0.57
GDP per capita growth (Current price US $) ($X_4$)	0.07** (0.01)	0.00
Population (Billion) (X_5)	28.23* (23.31)	0.04
R square	0.68	

Note: ** significant at 1 percent; * significant at 5 percent; NS – Non-Significant

It could be seen from the table 2 that coefficient of multiple determination (R2) was revealing that the demand model was a good fit. The R2 value of 0.68 indicates that about 68 per cent of variation on demand is influencing the variation of explanatory variables. Among the selected variables, Lagged demand of roundwood and population were positively significant at 5 per cent level which indicates that an increase in one unit of population and lagged demand of roundwood from the existing mean value, ceteris paribus, would increase the demand for roundwood by 28.23 and 0.59 MCUM respectively. GDP per capita was positively significant at 1 per cent level which indicates that an increase in one unit of GDP per capita from the existing mean value, ceteris paribus, would increase the demand for roundwood by 0.07 MCUM.

Determinants of roundwood supply

The functional relationship between the supply of roundwood and the explanatory variables is depicted in Table 3.

Table 3. Regression coefficients of Supply model

Particulars	Coefficients	P value
Intercept	-259.63 ^{NS} (155.63)	0.12
Lagged supply (MCUM) (X_1)	0.43 ^{NS} (0.23)	0.09
Rainfall (mm) (X_2)	-0.01^{NS} (0.01)	0.50
Forest Cover (sq.km) (X_3)	0.001* (0.00)	0.04
GDP growth rate (per cent) (X_4)	-0.81 (0.97)	0.42
R square	0.72	

Note:* significant at 5 percent, NS – Non-Significant

It could be noted from the table 3 that the value of R2 was 0.72 which indicates the model goodness of fit. The coefficient of forest cover was positively significant at 5 per cent level, which indicated that an increase in one unit of forest cover over their existing mean values, ceteris paribus, the supply of timber would be increased by 0.001 MCUM. Lagged supply, rainfall and GDP growth rate were insignificant.

Conclusion

The supply of roundwood is influenced by forest cover whereas demand for round wood is determined by lagged demand, GDP per capita and population. There is a huge gap between demand and supply of round wood. The supply of roundwood is affected by stringent forest acts and policy and trade restriction. Hence it clearly evidenced that the huge demand-supply gap can be narrowed down by utilizing the existing substitute products and also utilizing less utilized species for timber purpose which is abundantly available in India.

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