ASIA PRO ECO PROGRAM

Feeding China's Expanding Demand for Wood Pulp:

A Diagnostic Assessment of Plantation Development, Fiber Supply, and Impacts on Natural Forests in China and in the South East Asia Region

Vietnam report

Jean-Marc Roda &
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Jean-Marc Roda & Santosh Rathi
(CIRAD)

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Photos by Christian Cossalter
Design & Lay-out by Ahmad Yusuf

Center for International Forestry Research
Mailing address: P.O. Box 6596 JKPWB, Jakarta 10065, Indonesia
Tel.: +62 (251) 622622; Fax: +62 (251) 622100
E-mail: cifor@cgiar.org
Web site: http://www.cifor.cgiar.org

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Contents

Context

Regarding the forest sector, in a context of substantial areas of denuded and bare lands (initially around 25% of Vietnam area), forestry rehabilitation and development plans have been continuously on the focus in Vietnam since the end of the war. The first projects were planned under an existing broader program, the United Nations World Food program (1975-200). These projects essentially concerned agro-forestry and demonstrations trials. Vietnam started its economic renovation policy (known as "Doi Moi") in 1986 with a series of major economic programs and industrial development plans[1]. Among them, the program 327 (1993-1998) was initially planning substantial effort to rehabilitate forest degraded lands. It soon shifted to focus on forest protection in critical zones.

Finally, the program 661 (1998-2010), also known as "Five million hectares reforestation program" (5MHRP), really put the emphasis on a substantial increment of the nation's forest areas. By the end of this program, the national forests are expected to cover more than 14 million hectares. The program includes both protection of existing forests and reforestation. Initially, Most of the production plantations were planned to be established with fast growing exogenous species (i.e. eucalyptus). Now, the government is promoting the development of indigenous species as much as possible.

Wood pulp and paper industry

Situation

The Vietnamese pulp and paper industry is relatively underdeveloped, in terms of international competitiveness, and it is not able to fulfil the important and growing national demand. Thus, the 5MHRP is including a large set of measures to develop pulp wood plantations, with parallel industrial programs in order to develop the national pulp and paper industry (Barney, 2004, 2005). The underdevelopment of the Vietnamese pulp and paper industry is mainly caused by the spread of the sector into a relatively high number of state-owned units. All except a few are of moderate size, with rather old equipments and high relative costs. From over 25 pulp mills, only five have a production capacity exceeding 10 000 T/year; and from over 50 paper mills, only 20 have a production capacity exceeding 10 000 T/year (Table 1).

Table 1: Theoretical production capacities of the main pulp and paper mills in Vietnam

Main pulp and paper mills in Vietnam (theoreticalproduction capacity)								
No.	Name	Capacity (mt/y)		Address	Phone	Fax	Product	Contact
		Pulp	Paper					
1	Agriculture Products Co.	7 000	7 000	Yen Bai Town, Yen Bai Prov.	029-862278	029-862804	Joss	Mr. Truong Ngoc Bien
2	An Binh Paper Co., Ltd.		30 000	Di An Dist.,Binh Duong Prov.	08-8960 155	08-8960 700	Kraftliner, corrugating	Mr. Han Vinh Quang
3	Bai Bang Paper Co.	61 000	100 000	Phong Chau Town, Phu Tho Prov.	0210-829755	0210-829177	Printing & writing	Mr. Vo Si Dong
4	Bao Ha Export Co.	4 000	3 600	Bao Yen Dist.Lao Cai Province	021-820058		Joss	
5	Binh An Paper Co.		52 500	Di An Dist.,Binh Duong Prov.	0650-751635	0650-750389	Prit.& Writ., coated p.	Mr. Thai Van Thao
6	Binh Minh Paper Co., Ltd.		14 000	Tien Du Dist., Bac Ninh Prov.	0241-838942	0241-838942	Paper & board	Mr. Nguyen Dinh Binh
7	Cau Duong Wood Co.		10 000	Duc Giang Town Hanoi City	04-8271 440	04-8271 607	Tissue	
8	Chau Thoi Co., Ltd	5 800	5 000	D An Dist., Binh Duong Prov.			Hygienic	
9	Chemical & Electric Co.		6 000	20 Le Quynh st., Hai Phong City	031-836752	031-836254	Joss	Mr. Tran Huy Hoang
10	Dong A Co. Ltd.		12 000	Phong Khe, Yen Phong, Bac Ninh Prov.			Printing & writing	
11	Dong Nai Paper Co.	15 000	20 000	Bien Hoa IP, Dong Nai Prov.	061-836201	061-836231	Printing & writing	Mr. Luong Phuong Dong

Main pulp and paper mills in Vietnam (theoreticalproduction capacity)								
No.	Name	Capacity (mt/y)		Address	Phone	Fax	Product	Contact
		Pulp	Paper					
12	Ha Long Trading Co.	5 600	5 100	162 Le Thanh Tong st., Ha Long City	033-828024	033-828025	Joss	Mr. Pham Van Trinh
13	Hai Phong Paper Co.	1 500	4 000	Ton Duc Thang St., Hai Phong City	031-835538	031-835462	Joss, tissue/hygienic	Mr. Vu Duong Hien
14	Hoang Long Co., Ltd.	3 300	5 000	Dap Cau. Bac Ninh Town	0241-821855	0241-821068	Joss	Mrs. Hoang Thi Long
15	Hoang Van Thu Paper Co.	4 000	20 000	Quan Trieu Ward, Thai Nguyen City	0280-844652	0280-844548	Tesliner	Mr. Nguyen Van Vui
16	Hong Vuong Paper Mill		3 000	Yen Phong Dist., Bac Ninh Prov.			Printing & writing	
17	Hop Tien Paper Mill		12 000	Yen Phong Dist., Bac Ninh Prov.			Wrapping	
18	Hue Packaging Co.		4 000	18 Pham Hong Thai St., Hue City	054-820374	054-832793	Wrapping	Mr. Nguyen Ba Phuoc
19	Joss Paper Mill	4 000	3 600	Bac Quang Dist., Ha Giang Prov.			Joss	
20	Lam Kinh Paper Mill	3 000	3 000	Tho Xuan dist., Thanh Hoa Prov.	037-834373		Tesliner	
21	Lam Son Paper Co.	4 000	17 000	32 Ngo Tu St., Thanh Hoa City	037-851461	037-854323	Wrapping	Mrs. Le Thi Oanh
22	Linh Xuan Paper Co.		12 000	Thu Duc Dist., HCMC	08-724 1153	08-7240512	Tissue/hygienic	Mr. Tong Van Ngoan
23	Lua Viet Paper Co.	2 000	4 600	Ha Hoa Dist., Phu Tho Prov.	0210-883117	0210-883120	Wrapping	Mr. Nguyen Van Ly
24	Mien Tay Paper Co., Ltd.		3 200	84 Mau Than St., Can Tho City	071-895090	071-894525	Wrapping	Mr. Phan Quang Thuan
25	Muc Son Paper Co.	16 000	15 000	Lam Son Town, Thanh Hoa Prov.	037-834074	037-834099	Kraftliner, corrugating	Mr. Nguyen Xuan Tai
26	My Huong Paper Mill		15 000	110 to Hieu St., Hai Phong City	031-848810	031-780660	Kraftliner, corrugating	Mr. Vu Khac Long
27	New Toyo (Vietnam)		20 000	Singapore IP, Binh Duong Prov.	0650-743750	0650-743754	Wrapping	
28	Pham Thu Co., Ltd.		3 000	14/6 Tan Thoi Tay, HCMC	08-7100 405	08-7100 406	Board	Mr. Pham Van Thu
29	Phu Cuong Co., Ltd.		3 000	Go Vap Dist., HCMC	08-8955508		Wrapping	
30	Phu Giang Paper Co., Ltd.	1 500	10 000	Tien Du Dist., Bac Ninh Prov.	0241-838087	0241-838270	Kraftliner, corrugating	Mr. Nguyen Nhan Phuong
31	Phu Tho Paper Co., Ltd		5 500	345/6 Lac Long Quan St., HCMC	08-8651786	08-8650 241	Kraftliner, corrugating	Mr. Vo Van Tam
32	Quang Phat Co., Ltd		10 000	374 Le Hong Phong st., HCMC	08-8390 402	08-9966676	Wrapping	Mr. Nguyen Cam
33	Rang Dong Paper Co.	1 100	6 500	Dien Khanh dist., Khanh Hoa Prov.	058-780121	058-780123	Wrapping	Mr. Dao Vu Lam
34	Sai Gon Paper Co., Ltd		7 500	1/7C Pham Van Chieu, HCMC	08-8947 877	08-8940 359	Tissue/hygienic	Mr. Cao Tien Vi
35	Song Lam paper Mill	5 400	5 400	Hung Nguyen dist., Nghe An Prov.	038-760128	038-760158	Duplex, Kraftliner	Mr. Hoang Phung
36	Tan Hoa Hiep Co., Ltd		4 000	Hoc Mon Dist., HCMC	08-7102 160		Wrapping	
37	Tan Mai Paper Co.	40 000	68 500	Thong Nhat Ward, Bien Hoa City	061-822257	061-824915	Newsprint, kraftliner	Mr. Nguyen Dinh Tuan
38	Tan Phu Thinh Private Co.		15 000	53/6A Pham Van Chieu St., HCMC	08-9969180	08-9871512	Wrapping	Mr. Le Tan Cong
39	Thai Nguyen Paper Co.	8 000	7 500	Tan Long Dist., Thai Nguyen City	0280-844202	0280-844309	Joss	Mr. Tran Duc Quyet
40	Thanh Loi Co., Ltd.	4 400	4 000	Da Huai Dist. Lam Dong Prov.	063-876661	063-860267	Wrapping	
41	Truc Bach Paper Co.		3 000	128 Thuy Khue St., Hanoi City	6889458/12	04-6885269	Tissue/hygienic	Mr. Le Quang Hung
42	Truong Xuan Paper Js Co.		10 000	Thai Nguyen Province			Printing & writing	
43	Van Diem Paper Co.	1 500	19 000	Phu Xuyen Dist., Ha Tay Prov.	034-784210,	034-784251	Printing & writing	Mr. Pham Hong Tuoi
44	Van Phat Co., Ltd.		38 500	Ben Cat Dist., Binh Duong Prov.	0650-511059	0650-511418	Duplex, wrapping	Mrs. Cao Thi Quynh Anh
45	Viet Nhat Paper Co.		13 000	Yen Phong Dist., Bac Ninh Prov.			Printing & writing	
46	Viet Tri Paper Co.	10 000	35 000	Thanh Mieu Ward, Viet Tri City	0210-846702	0210-851109	Coated, Kraftliner	Mr. Nguyen Van Hien
47	Vinh Hue Paper Co.	7 200	8 000	Thu Duc Dist., HCMC	08-7241458	08-7240530	Tissue/hygienic, Joss	Mr. Nguyen Hoa
48	Vinh Phu Paper Mill		3 600	Thuan An Dist., Binh Duong Prov.	0650-755565	08-8971 708	Wrapping	Mr. Ho Xuan Hoat
49	Xuan Duc Paper Co.	1 200	7 600	54B Nam hoa st., Dist., No.9, HCMC	08-7310 012	08-7313238	Board, duplex	Mr. Duong Van Cao
50	Yen Son Holding Co.	14 000	13 000	Km4 Yen Bai City	029-852026	029-855555	Joss	Mr. Tong Van Mui

The industrial plan which is associated to the reforestation plan was aiming to reach 0.615 million T/year of pulp and paper production in 2005, and 1.05 million T/year in 2010. The aim is to provide at least 80 to 90% of the national consumption. So far, plantation programs as much as industrial development plans have faced notable problems in their implementation in Vietnam. The progress of the pulp and paper productions is ceiling since 2000, difficultly reaching two thirds of the results expected by the industrial plan in 2005. In the meantime, the demand continues to increase (Figure 1, Figure 2).

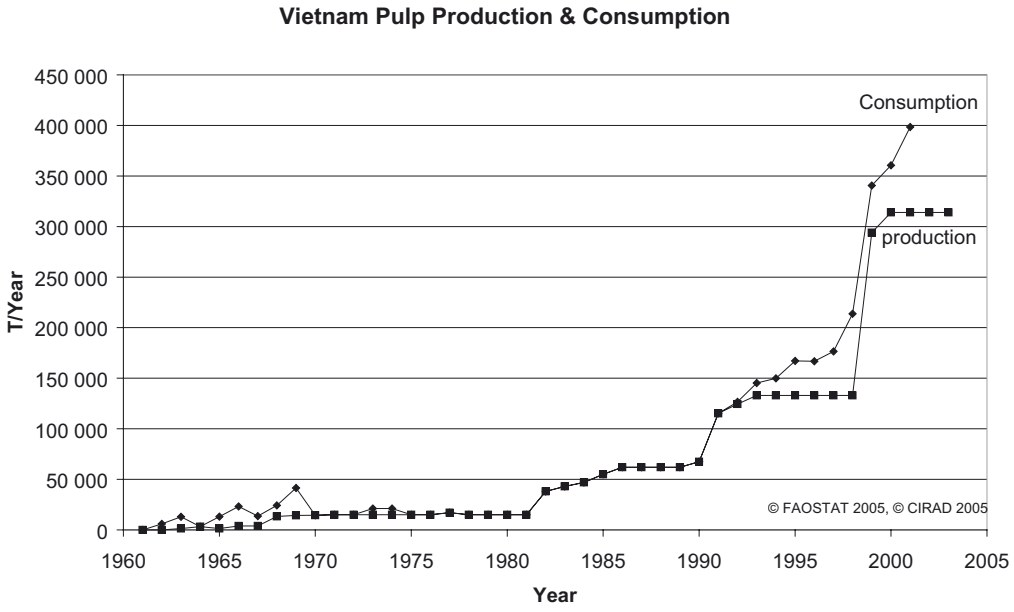


***Figure 1**: Vietnam pulp production and consumption*

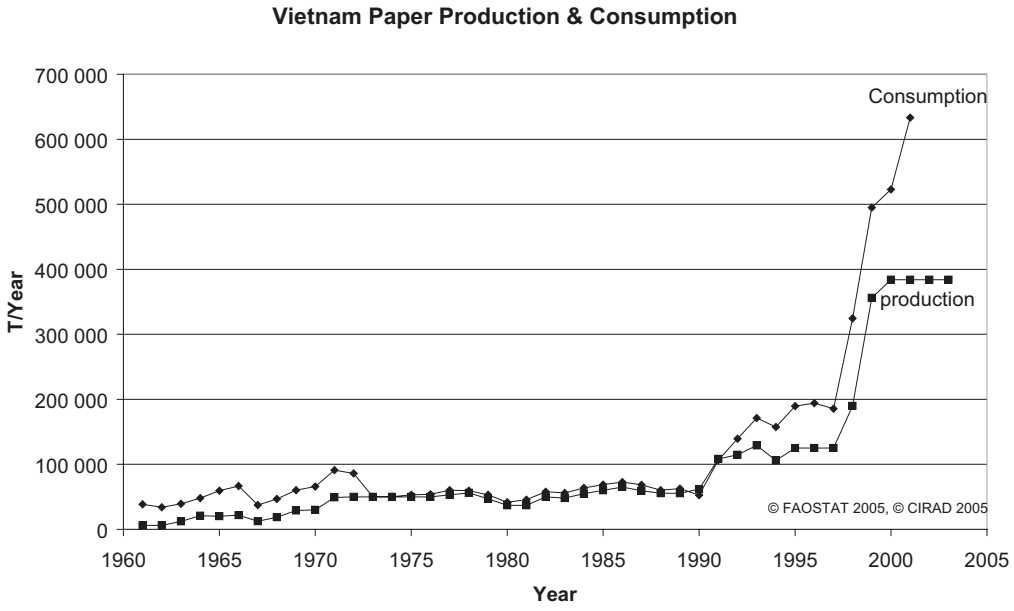


***Figure 2**: Vietnam paper production and consumption*

The pulp production has not been able to follow the increase of demand, and despite the average small capacity of the pulp mills, most of them are far from reaching their theoretical capacity. All mills suffer from supply difficulties, and have to import significant amounts of pulp. Imported pulp represents an average of 45% of the input in Vietnam paper mills, and 60 to 65% of their production costs.

Underlying causes of the production-ceiling

Plantations under development

The underdevelopment of the plantation areas and of the plantation productivities is one consequence of the lack of raw material. Many reports and expertises have been produced in the past (mainly World Bank and UN reviews, but also NGOs reports), stressing some causes of the many problems that the Vietnamese plantation sector has been facing over the years. Among the listed impediments, are:

- Bureaucracy and lack of participatory approaches
- Too frequent changes in the objectives, erratic financing
- Problems in land allocation
- Low quality of the seed and seedlings, and inadequate sylviculture
- No market orientation in commercial implementation
- Many projects are not really welcomed by local communities and poor populations

From this list, most of the Vietnamese actors whom we interviewed were mainly emphasizing the very low plantation productivity, due to low quality seedlings and the poor silvicultural practices.

Logistic costs

Regarding the industrial operations, a major negative factor is the very high cost of the Vietnamese pulp wood at the mill's gate. The main reason relies in the fact that the resource is scattered into small patches all over the country, in between rice fields, other land uses, and the very steep hills. This increases the cost of regrouping the raw material and prevents scales economy.

Another reason of the high supplying cost relies in the poor transportation network: Most of the country network is unpaved in Vietnam. In 1999, only 10% of the roads were paved. Furthermore, the available transport vehicles are structured into a variety of small capacity models, maybe adapted to the poor road conditions, but out of scale for a viable pulp wood transport. This increase of the transport cost has its initial cause in the multiple loadings and unloading sessions when changing of transport mode. A transport session of pulpwood in Vietnam can include up to four different transport modes (Figure 3).

In the worst but not exceptional case, the primary transport, from the forest stand to the forest road, is carried out by bullock carts. The extended primary transport, along the forest road up to the forest depot, is carried out by those specific Vietnamese "comprehensive trucks" that can load from 1 to 4 tons. The secondary intermediate transport, from the depot to the forest exit or the paved road, is carried out by small trucks of 5 to 10 tons of capacity. The secondary terminal transport, along the paved road to the mill's gate, is carried out by bigger trucks, of 10 to 25 tons (Figure 3). In this particular case, the too many intermodal transfers, as much as the too long distances covered with undersized vehicles, critically increases the transport cost.

Another reason of the high transportation cost of the raw material for pulp is the exceptional share of bamboo within the supply (up to 25 and 30% of the supply in average for the main Vinapimex units[2]). Due to its anatomy, round bamboo uses a lot of volume, in comparison to its weight. The transport cost of a ton of bamboo is accordingly very high compared to other fibre sources. Furthermore bamboo has a high content of silica, which complicates the process, or decreases the paper quality, and anyway increases the relative process cost.

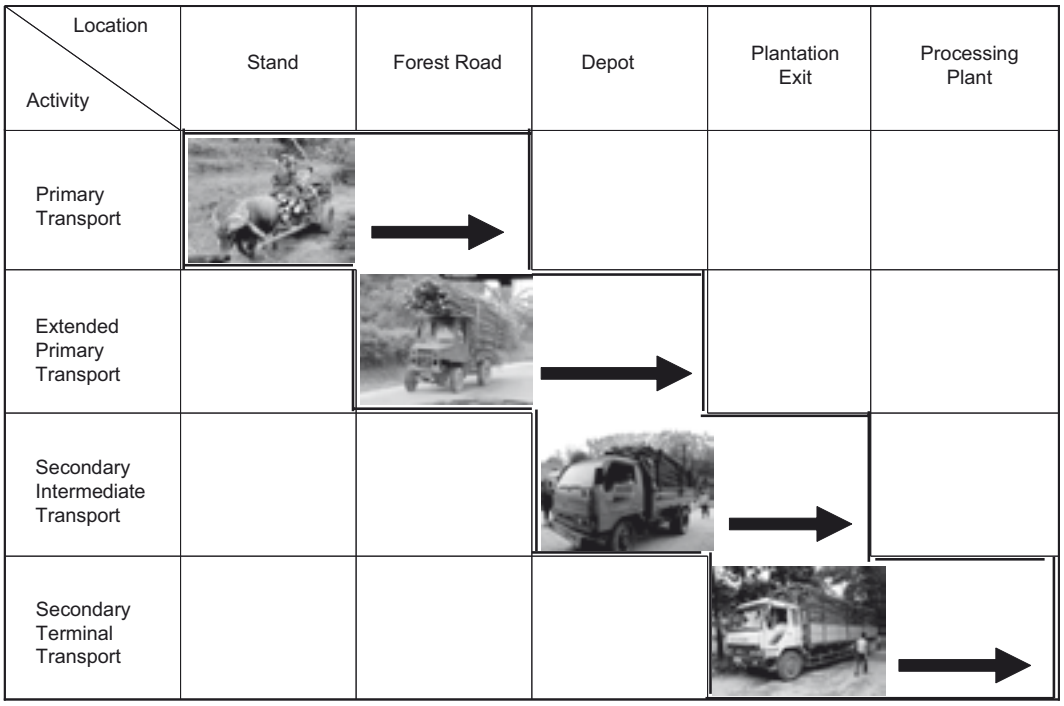


***Figure 3**: Typical transportation sequence for pulp wood in Vietnam*

Competition for the supply with chips and board industry

Beside the transport cost problems, Vietnamese pulp mills have to face a harsh competition for the supply of raw materials, with chip mills and board mills competing for the same resource pool[3] but benefit in terms of different cost structures.

Since the economic reform, with the help of its cheap but skilled labour force, Vietnam has seen an important development of its furniture, flooring, and other woodworking industries. Based on increasingly big amounts of imported timber, and re-exported manufactured products, the Vietnamese sector has become one of the new Eldorado of the world furniture industry. The Vietnamese board and panels industry, which dynamics are directly linked to the furniture and indoor - outdoor wood industry, has benefited of this trend, which has boosted the ational consumption up to more 800 000 m3/year. Far above that level, the production has rocketed up to 1.6 million m3/year and more in 2000, the difference being essentially powered by the exports towards Japan (Figure 4).

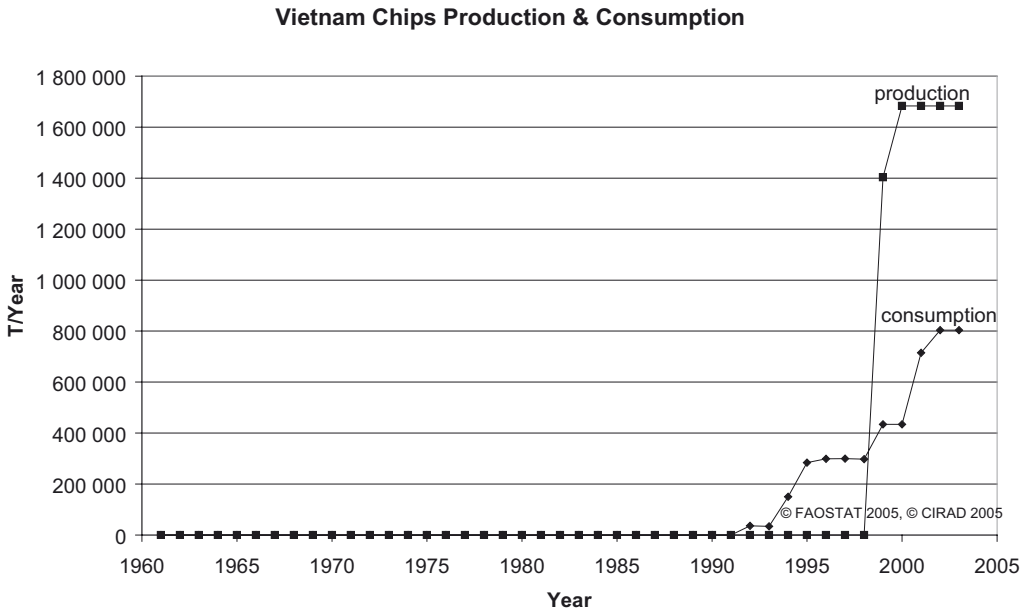


***Figure 4**: Vietnam chips production and consumption*

Six main mills contribute to this production. Chip mills need a lower investment than pulp and paper mills, and their operating cost is lower too. Taking into account the chip export prices and the processing costs, the purchasing power per cubic meter of round wood can be higher for chip mills than for pulp and paper mills. Thus for the farmers and other private producers, are often tempting alternative markets because of the ability to the chip mills are of tempting alternative markets because of the ability to obtain raw materials in a wider range and at better prices.

The initial industrial development plan

Combined to the political desire of accompanying the development of each Vietnamese province with the establishment of its own industrial unit, the five million hectares reforestation program (5MHRP) led to an ambitious industrial development plan totaling 5 million T/year of new capacity (Table 2).

The dimension of this industrial development project is huge, with as much capacity as needed by five internationally competitive mills of 1 million T/year of capacity each. In reality, however, the capacity development is spread into more than 22 industrial units, none reaching 500 000 T/year of capacity. A lot of official and non official reports have been written about both the plantation and the industrial development plan, and most of them criticise the viability of such an industrial structure, given the realities of the global market. Vietnamese mills indeed have to compete with larger mills[4] located overseas, which produce on the global market and can sell their products in Vietnam at an very competitive price[5], even with the protection by high import taxes[6].

All the interviewed Vietnamese experts were unanimous to explain that the supply is difficult to be economically viable in Vietnam when the distance between the plantation and the mill is over 100 km, because of the specific geography of the country and because of its high transport costs. These factors were also used to justify the political choice to spread the paper industry into small units all over the country. But at the international scale, where the pulp and paper market is a global market, the most competitive products come from countries were the raw material is collected easely up to 200 km away from

the mill, thanks to better transportation networks[7]. Conversely, the transportation of the pulp or of the paper is much cheaper, and it can easily be cheaper to purchase pulp on international spot markets, than to process it. As a result, the Vietnamese policy appears to induce excessive costs relatively to the global market.

Thus, the Vietnamese policy is locked into a difficult dilemma, between the impossibility to plan big units because of difficult supplies, and the excessive relative cost induced by the too numerous small units which are planned.

Table 2: Initial industrial development plan for pulp and paper industries (Barney, 2004)

Mill	Capacity (T/year)		Comments
	2001 2005	2006-2010	
Upgrade paper mill Bai Bang	55 000	100 0000	Expand phase II
Upgrade paper mill Viet Tri	10 000	30 000	Expand phase II
Upgrade paper mill Tan Mai	50 000	120 000	Expand phase II
Upgrade paper mill Dong Nai	15 000	100 000	Expand phase II
New Paper mill Kon Tum	130 000	260 000	Operating from 2004
New Paper mill Thanh Hoa	50 000	200 000	Operating from 2004
New Paper mill Hoa Binh	200 000	300 000	Operating from 2005
New Paper mill Bac Kan	50 000	100 000	Operating from 2005
New Paper mill Bac Giang	100 000	200 000	Operating from 2005
New Paper mill Bac Nghe An	100 000	200 000	Operating from 2005
New Pulp and paper mill Lam Dong	100 000	300 000	Operating from 2005
New Paper mill Lai Chau	--	150 000	Operating from 2007
New Paper mill Son La	--	150 000	Operating from 2007
New Paper mill Yen Bai-Lao Cai	--	200 000	Operating from 2006
New Paper mill Lang Son	--	150 000	Operating from 2006
New Pulp and paper mill Nam NA [?]	--	150 000	Operating from 2007
New Paper mill Quang Tri New	--	100 000	Operating from 2007
Paper mill Tay Quang Nam	--	100 000	Operating from 2008
New Paper mill Binh Dinh	--	150 000	Operating from 2007
New Paper mill TN Dac Lac	--	200 000	Operating from 2006
New Paper mill Can Tho	--	200 000	Operating from 2008
New Pulp and paper mill Binh Thuan	--	150 000	Operating from 2007
Other small and medium mills	340 000	1 390 000	Expansion Investment
Total	1 200 000	5 000 000	Achieved Planning Targets

The industrial development plan adapted with pragmatism

As mentioned in the section "Wood pulp and paper industry: Situation", the sector faced a lot of difficulties. Actually, behind an official speech regularly highlighting the plan, a pragmatic treatment of the situation progressively arose. There is no official change of the plan, but the industrial development delays and other impediments have already been acknowledged by the managers of the MARD. We were unofficially told that most of the planned investments were cancelled or postponed until the economic situation become clearer (Table 3).

Of the 22 main units that were part of the initial industrial development plan, 12 are cancelled, three are postponed until further information, and seven are adapted.

Table 3: Adaptation of the industrial development plan, from interview

Mill	Investment plan
Upgrade paper mill Bai Bang	Adapted
Upgrade paper mill Viet Tri	Adapted
Upgrade paper mill Tan Mai	Adapted
Upgrade paper mill Dong Nai	Adapted
New Paper mill Kon Tum	Cancelled
New Paper mill Thanh Hoa	Adapted
New Paper mill Hoa Binh	Cancelled
New Paper mill Bac Kan	Adapted
New Paper mill Bac Giang	Cancelled
New Paper mill Bac Nghe An	Cancelled
New Pulp and paper mill Lam Dong	Cancelled
New Paper mill Lai Chau	Postponed
New Paper mill Son La	Cancelled
New Paper mill Yen Bai-Lao Cai	Cancelled
New Paper mill Lang Son	Cancelled
New Pulp and paper mill Nam NA [?]	Cancelled
New Paper mill Quang Tri	Adapted
New Paper mill Tay Quang Nam	Postponed
New Paper mill Binh Dinh	Cancelled
New Paper mill TN Dac Lac	Cancelled
New Paper mill Can Tho	Postponed
New Pulp and paper mill Binh Thuan	Cancelled

Wood supply sources

Forest series and other land uses

The forest cover of Vietnam has been decreasing from 14 million ha (42% of the land) in 1961 to its lowest level, around 9.6 million ha (29% of the land) in 1990. According to FAO data, a dramatic drop in the forest cover occurred at he end of the 1970s (FAOSTAT, Figure 5).

In 2002, the forest cover was consisting into 9.8 million ha of natural forests, 1.9 million ha of plantation forests and 7.3 million ha of bare lands or bush (Table 4, Figure 6). Different institutes and projects has inventoried Vietnam land uses and forest with different categories and typologies, which makes difficult to cross the data. For example the Ministry of Science, Education, & Environment and the Ministry of Agriculture & Rural Development (MARD) use different land use series. In its 1999 land use map, the Ministry of Science, Education, & Environment represent 10 different land uses[8]. Conversely, the 1999 map of the Forest Inventory and Planning Institute (FIPI), belonging to Ministry of Agriculture and Rural Development (MARD), presents 21 different land uses[9]. With this map, there are some severe overlappings by different types of land uses, which leads to miscalculations of the detailed areas. But for a general overview, this data allows to visualize the location of natural forests, bush & seldom trees, bare & grass lands, and others (Figure 7).

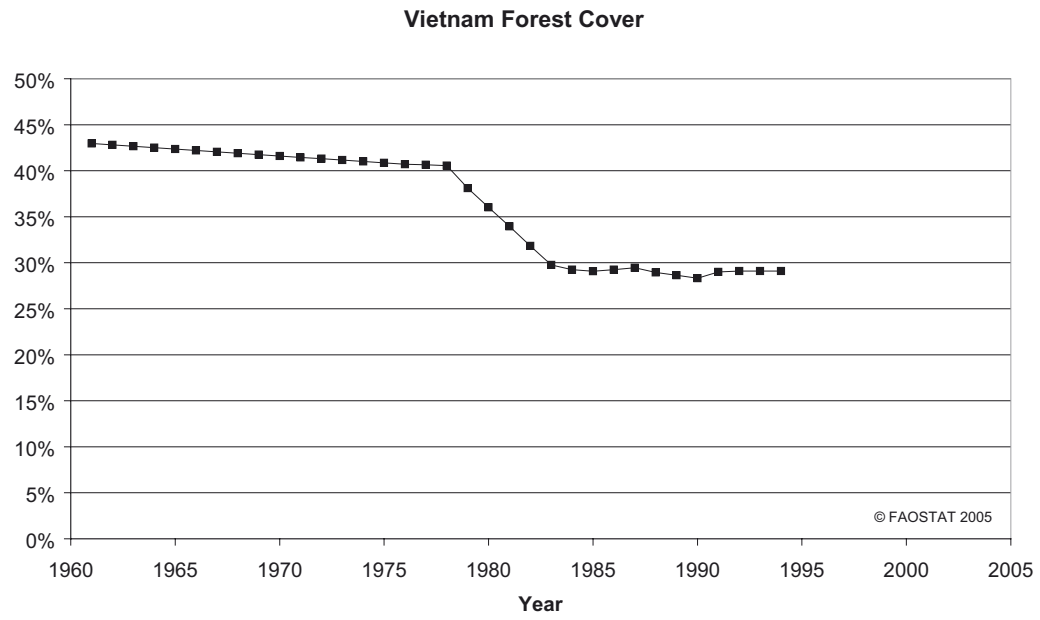


***Figure 5**: Evolution of forest cover in Vietnam (FAO data)*

The specific existing pulp wood plantations are not specifically identified by neither the MARD statistics, nor by the map of the FIPI. Their area is between 2 million ha (Table 4) and above 243 000 ha (FIPI's map, 1999). According to Barney, 2004, the area could range from 782 000 ha of Eucalypyus, Acacia, and Pinus in 2001 (Jaakko Poyry, 2001, in Barney, 2004), to 832 400 ha for the same species (FAO, 2000, in Barney, 2004), while 794 000 ha, still for the same species, was stated for 1999 (Central Board for Forest Statistics, 2001, in Barney, 2004). The "forest plantations" are scattered all over the country (Figure 8), which complicates the logistics of the pulp wood supply.

Table 4: Forest cover by province (areas in ha, by the Forest Protection Department, 2004)

Provinces	Land area	Natural forests	Plantations		Bare lands	Other	Forest cover (%)
			Production	Protection			
Vietnam	33 037 857	10 088 288	2 023 509	195 062	6 718 576	14 012 422	37.3
Lai Châu	906 512	303 758	13 093	1 615	467 255	120 791	35.1
Điện Biên	955 411	356 242	10 994	445	411 217	176 513	38.5
Sơn La	1 405 500	497 429	24 948	4 345	389 427	489 351	37.5
Hoà Bình	466 253	150 267	45 350	4 593	126 082	139 961	42.9
Lào Cai	635 708	224 839	48 623	1 145	144 970	216 131	43.2
Yên Bái	688 292	214 471	102 449	11 946	230 310	129 117	47.8
Hà Giang	788 437	289 007	39 716	5 051	269 910	184 753	42.3
Tuyên Quang	586 800	259 052	70 484	3 108	115 549	138 606	56.7
Phú Thọ	351 957	69 547	78 636	6 055	49 233	148 486	43.8
Vĩnh Phúc	137 148	9 409	17 633	770	5 681	103 655	20.3
Cao Bằng	669 072	292 227	3 069	8 675	272 125	92 976	45.4
Bắc Kạn	485 721	224 032	33 583	3 690	173 299	51 118	53.8
Thái Nguyên	354 110	104 824	50 085	426	50 481	148 294	43.9
Quảng Ninh	606 428	167 868	87 100	6 300	171 694	173 466	43.1
Lạng Sơn	830 524	222 365	100 773	10 533	364 456	132 397	40.2
Bắc Giang	382 200	73 577	75 746	5 754	30 649	196 474	40.6
Bắc Ninh	80 480	-	695	4	126	79 655	0.9
TP Hải Phòng	151 919	10 773	3 786	-	5 812	131 549	9.6

Provinces	Land area	Natural forests	Plantations		Bare lands	Other	Forest cover (%)
			Production	Protection			
Hải Dương	164 772	3 103	6 545	-	531	154 592	5.9
Hưng Yên	89 084	-	-	-	-	89 084	-
TP Hà Nội	91 846	-	5 815	29	785	85 216	6.4
Hà Tây	219 296	4 426	11 705	505	6 556	196 104	7.6
Hà Nam	84 953	6 582	2 162	92	2 469	73 647	10.4
Nam Định	167 631	1 125	4 595	73	2 412	159 426	3.5
Thái Bình	153 780	-	6 767	206	16 577	130 230	4.5
Ninh Bình	138 272	23 697	3 712	70	2 374	108 419	19.9
Thanh Hoá	1 111 660	356 825	110 396	3 535	231 398	409 506	42.3
Nghệ An	1 648 729	662 925	77 170	5 463	502 801	400 371	45.2
Hà Tĩnh	605 574	184 458	53 652	6 952	120 183	240 330	40.5
Quảng Bình	805 186	449 024	54 341	5 595	159 294	136 932	63.2
Quảng Trị	474 573	117 419	66 725	7 285	153 196	129 948	40.3
T.Thiên Huế	505 399	178 983	57 192	7 381	109 149	152 694	48.2
TP Đà nẵng	125 624	37 054	15 057	401	12 323	60 789	41.8
Quảng Nam	1 040 514	388 209	51 392	5 691	349 991	245 232	42.8
Quảng Ngãi	513 603	100 089	52 261	10 098	141 781	209 375	31.6
Bình Định	602 506	167 067	57 568	4 562	145 121	228 189	38.0
Phú Yên	503 506	128 623	23 856	3 596	126 042	221 388	31.0
Khánh Hoà	469 343	163 534	30 221	2 376	122 356	150 857	41.8
Ninh Thuận	336 006	140 812	9 502	1 228	75 084	109 381	45.1
Bình Thuận	782 230	292 673	23 662	2 498	88 717	374 680	40.8
Kon Tum	961 450	597 959	30 378	2 467	204 014	126 632	65.6
Gia Lai	1 549 571	727 489	30 646	2 157	349 002	440 277	49.1
Lâm Đồng	976 220	573 836	33 231	9 017	38 850	321 286	63.1
Đăc Lăc	1 306 201	587 846	14 541	2 423	146 207	555 183	46.3
Đăk Nông	651 442	361 180	7 603	1 753	45 579	235 327	56.9
Đồng Nai	586 030	110 122	41 602	3 150	22 980	408 177	26.4
Bà Rịa V.Tàu	197 514	14 417	15 547	266	6 424	160 860	15.3
TP HCM	298 500	13 821	21 448	9	1 033	262 189	11.8
Bình Dương	268 347	1 056	13 673	1 205	1 309	251 105	5.9
Bình Phước	685 599	123 403	43 666	6 167	146 589	365 773	25.3
Tây Ninh	402 923	34 703	8 118	3 365	17 602	339 134	11.5
Long An	449 187	800	61 597	7 994	9 081	369 715	15.7
Đồng Tháp	323 800	-	10 369	656	4 813	307 962	3.4
Tiền Giang	286 663	306	10 455	1 268	-	274 634	4.2
Bến Tre	231 501	985	2 864	-	4 367	223 285	1.7
Vĩnh Long	147 374	-	-	-	-	147 374	-
Trà Vinh	236 585	1 230	4 203	237	7 267	223 647	2.4
TP Cần Thơ	138 960	-	-	-	-	138 960	-
Hậu Giang	157 850	-	2 001	-	479	155 370	1.3
Sóc Trăng	322 301	1 559	7 548	28	5 779	307 388	2.8
Bạc Liêu	254 190	2 455	1 563	1 514	2 976	245 682	2.2
An Giang	340 623	583	11 897	329	6 688	321 126	3.8
Kiên Giang	628 497	48 931	35 689	4 917	30 470	508 490	14.2
Cà Mau	519 970	9 293	83 810	4 049	19 651	403 168	18.7

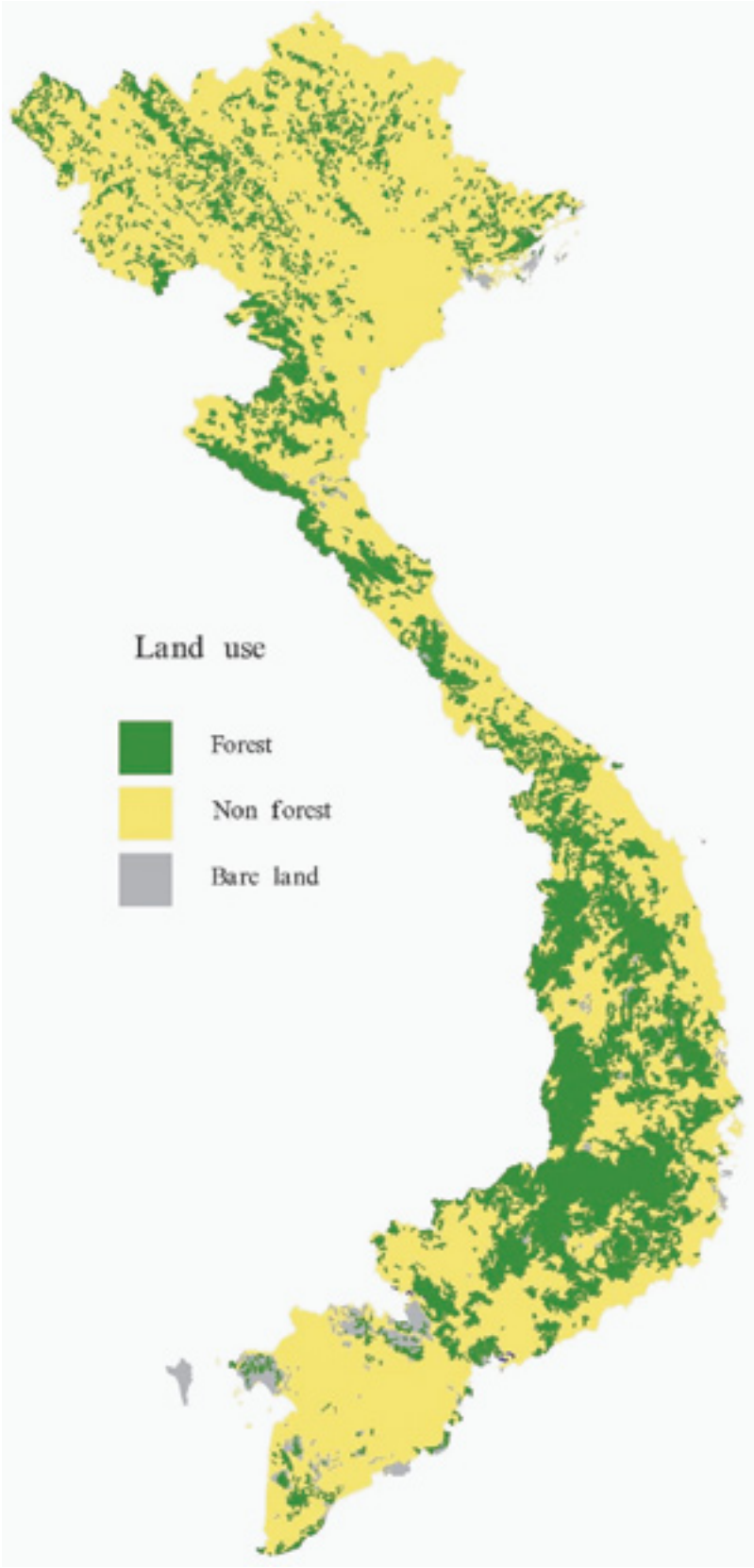


***Figure 6**: Theoretical forest cover in Vietnam (extracted from FIPI's map, 1999)*

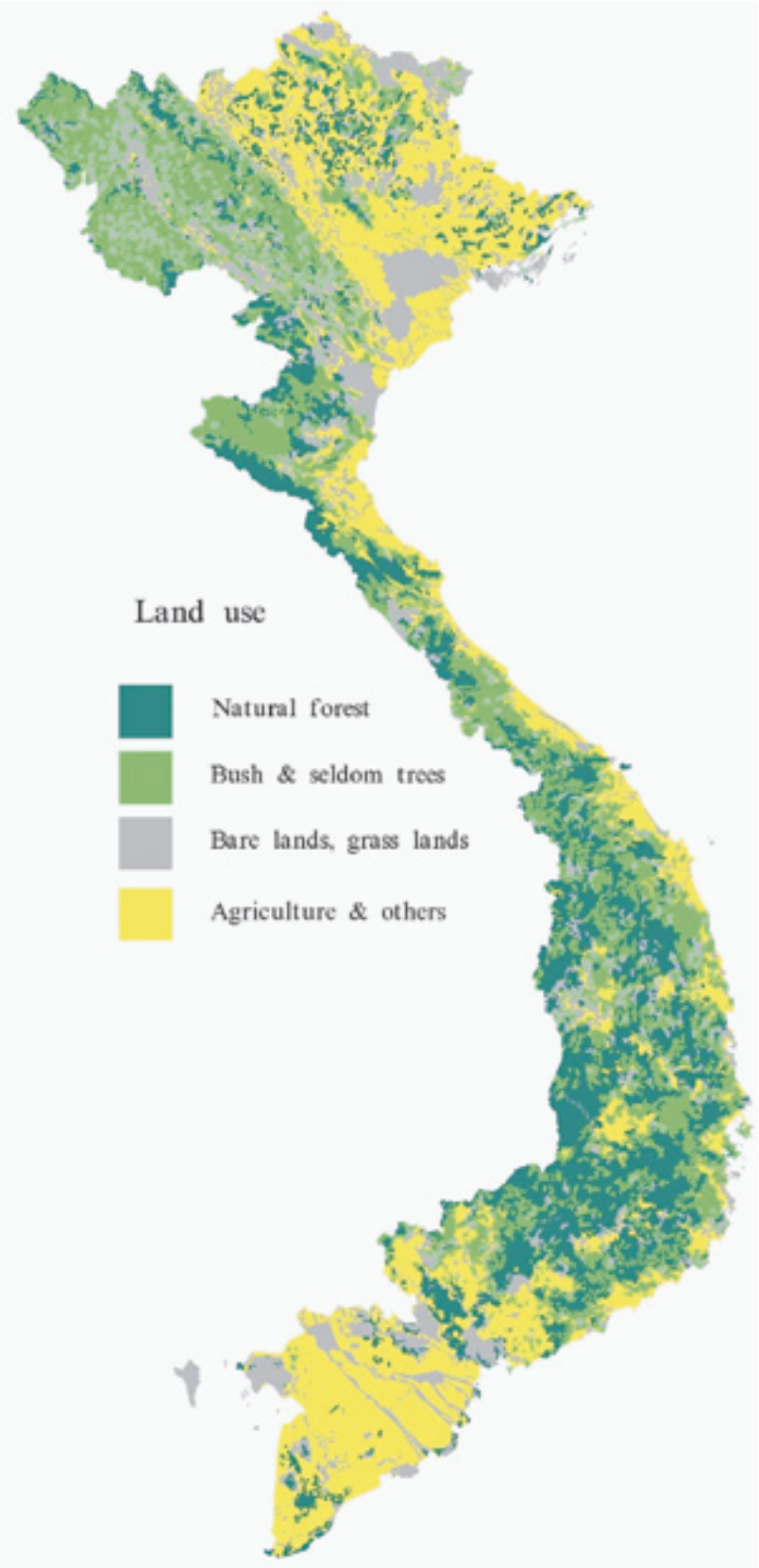


***Figure 7**: Major vegetation series in Vietnam (extracted from FIPI's map, 1999)*

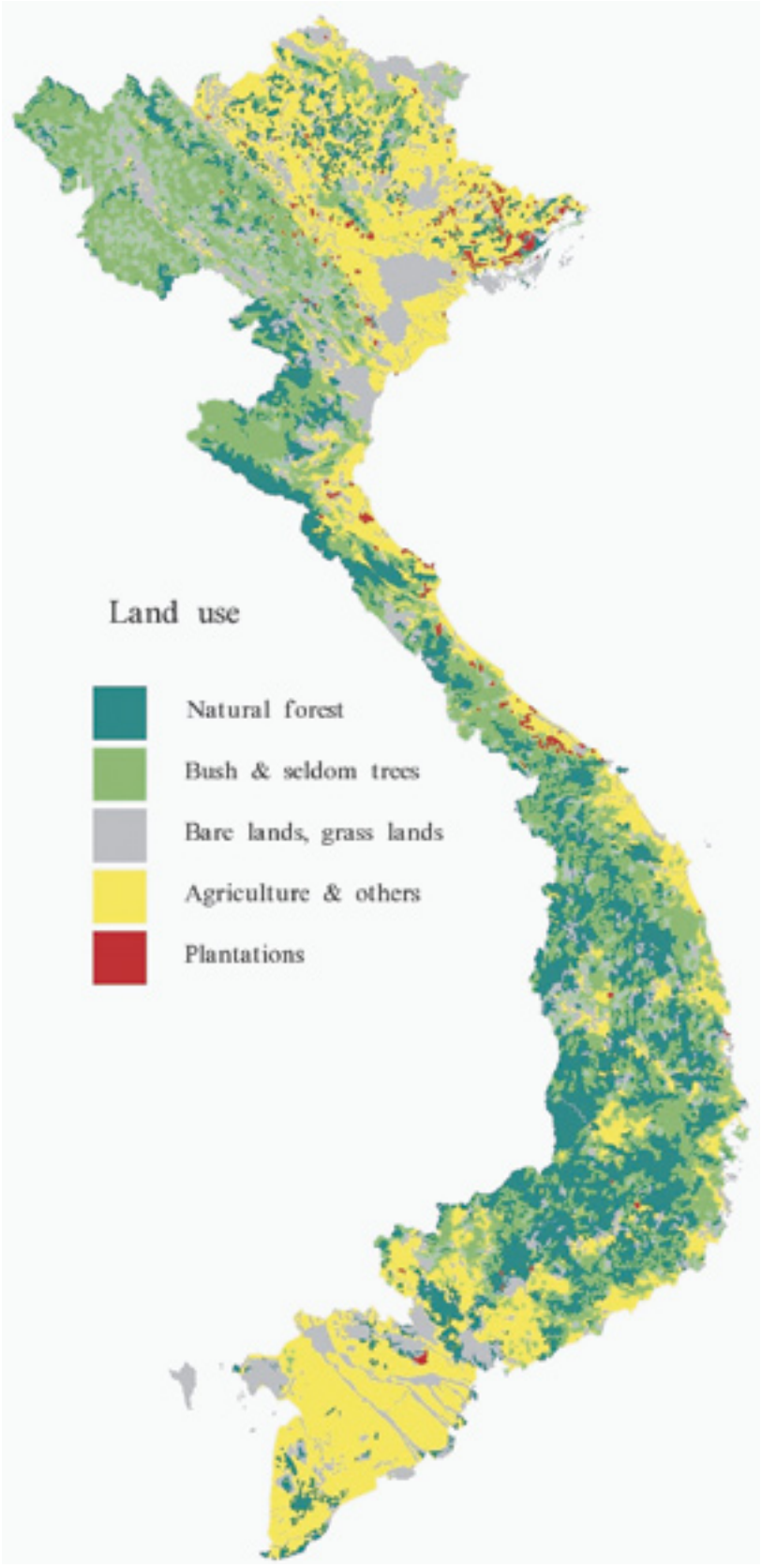


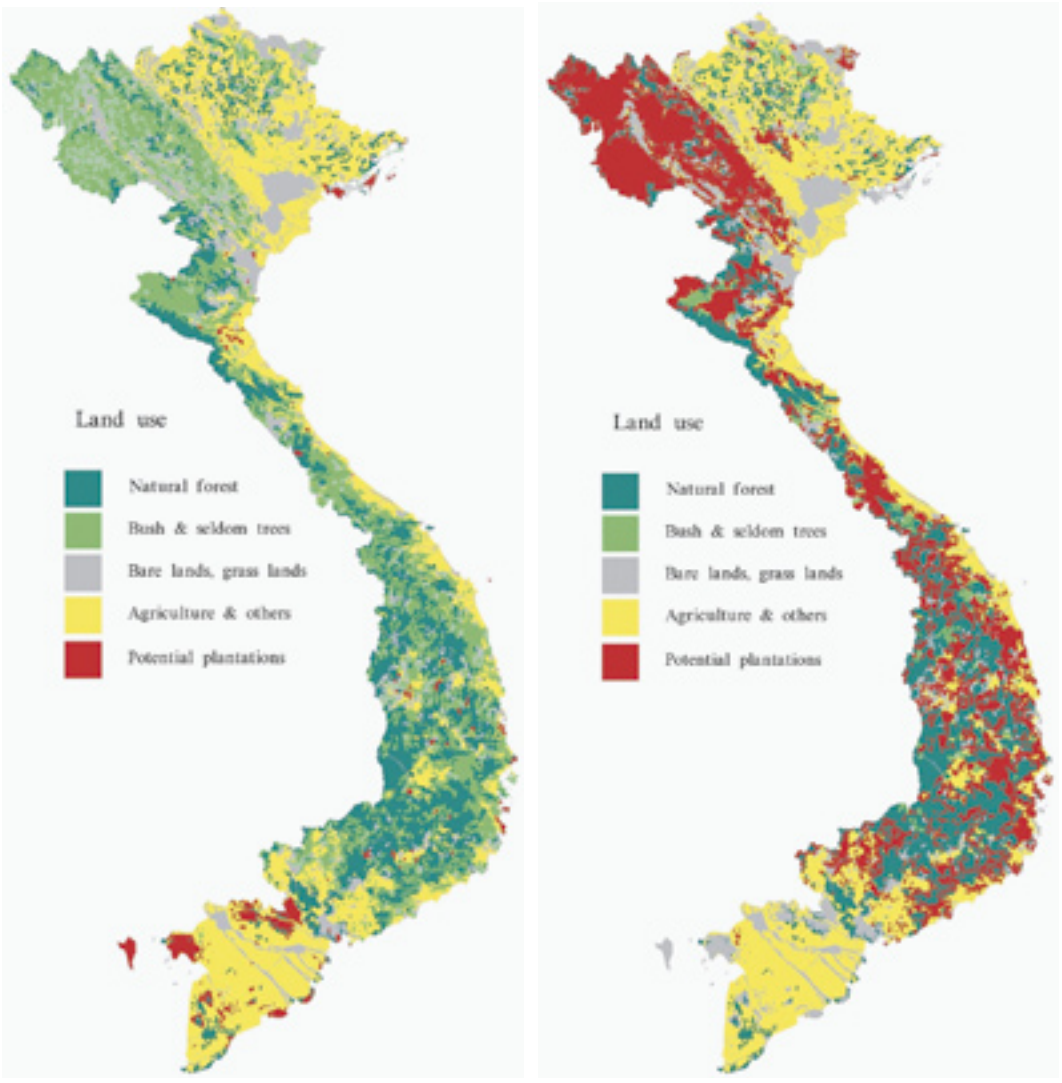
***Figure 8**: Location of Forest plantations in 1999, in red (extracted from FIPI'smap, 1999)*

Potentials for pulp wood plantations

The following considerations do not include any questions on neither the economic value nor the ecologic value of the discussed strategies.

The more precise data according to the different vegetations series are those of the FIPI's map established in 1999. Among the vegetation series where some pulp wood plantations could be theoretically developed, the most probable are at least the "potentially cultivable bare lands" (Figure 8, option A), accounted for 760 000 ha in 1999.

A less probable extent could theoretically be taken from 9 million ha of bush (Figure 9, option B). This theoretical figure would in fact be considerably lessened by taking in account social and ecological factors as much as soil fertility.



A: Potential extent on cultivable bare lands

B: Potential extent on bush

***Figure 9**: Potential extent of pulp wood plantations, in red (computed from FIPI's map, 1999)*

Prospective analysis: the pulp and plantation sector

A first critical factor: the logistic organisation

As seen in the chapter "Underlying causes of the production-ceiling", one of the critical factors of the Vietnamese pulp and paper sector is the logistic constraint. It hampers the competitiveness of the national industries, except in some "protected pockets". Even when the development of the wood pulp plantations will be completed, the logistic question will still lock the development of the industry.

Transport is an important factor for the competitiveness of the forest and wood firms. It is a remarkable source of cost in the forest industry and at the world scale; it can represents from 20 to 40% of the wood delivered cost at the mills. Road transport is the major mode used. Forest roads are essential not only for timber harvesting but also to provide access for forest management and control purposes. It should be emphasized that their sustainable development has to be considered strictly connected to an efficient transport and reliable access to the forest.

Theoretically, the forest resources transport logistics existing today at the global scale can be divided into 3 major categories as follows.

Category 1: Worst and expensive logistics

In absence of proper road network and ability to afford the motorised transport (e.g. tractors), the cost for transporting wood to mills is very expensive. The traditional transportation means (e.g. bullock cars) are used to transport the wood from place of harvesting to the forest road. Further small tractors are used to dump the wood at the depot followed by small lorries or big tractors which carry the wood to plantation exit. At this point, the big lorries are used to transport the wood to the processing plants or mills. This whole operation needs many times of unloading and loading which costs in terms of money and time. The transportation cost thus is exorbitant and system as a whole is inefficient with respect to time and labour required.

Category 2: Intermediate logistics

In countries where fair amount of road network is developed and stake-holders have an investment capacity to afford motorised transport, the intermediate logistic for wood transport is an obvious choice. Small or medium sized tractors are used to bring the harvested wood to depot where it is further transported by big sized tractors or lorries up to plantation exit. Subsequently big lorries are used to convey the wood from depot to processing plant. The cost and efficiency of the system is appraised to be intermediate. These kind of systems exists today in countries like France, Germany etc.

Category 3: Optimised logistics (such as in Nordic countries):

The logistics of the transport system is well optimised in countries with a high importance of their pulp and paper sector, such as Nordic countries. Either the wood is transported to depot by a tractor or transferred directly to the big lorries to transport it to processing plant directly. Other cases totally eliminate multiple loading and unloading and thus very efficient in terms of cost, time and resources management. This is possible owing to the fact that the forest road network is well developed in such countries.

In comparison with the 3 above categories, the Vietnamese situation is described below.

Vietnam logistics: the present day situation

The road network is not yet well developed in Vietnam. The harvested wood is transported mostly by means of bullock cart owing to the road network and investment capacity of the individuals working in the sector. Further small to medium sized tractors or lorries are used to carry the wood to plantation exit through the depot. Subsequently it is transferred to the big lorries (10-15 tonnes) to bring it to mills or processing plant. This transportation sequence (already illustrated in Figure 3) resembles perfectly to the worst and expensive logistics explained above. The costs are very high (see Table 5), and, compared at the international scale, are even higher than what can be observed in Cambodia, for example.

Since lot of unloading and loading as well waiting time is involved at each stage, the system is not economical and efficient.

Table 5: Pulpwood transport costs in Vietnam (source: field survey)

Costs expressed in Dongs/T/km				
	Forest road	Forest depot	Intermediate depot	Mill's gate
Primary transport	11 110 - 41 670			
Extended primary transport		3 430 - 5 140		
Secondary intermediate transport			1 330 - 2 350	
Secondary terminal transport				1 250 - 1 320
Costs expressed in USD/T/km (exchange rate of 01June//2005)				
	Forest road	Forest depot	Intermediate depot	Mill's gate
Primary transport	0.70 – 2.64			
Extended primary transport		0.22 – 0.33		
Secondary intermediate transport			0.08 – 0.15	
Secondary terminal transport				0.08 – 0.08

As a result of the high transport costs, it becomes cheaper to buy imported pulp than to process it from the local resources, as soon as the transportation exceeds a relatively short radius. For example, Vietnamese experts and other stakeholders tend to consider that the viable radius for the pulp wood supply should not exceed 100 km. Such considerations were cited by the stakeholders to explain the initial and non-optimal industrialisation plan, with a lot of small to medium mills scattered all over the country[10].

Vietnam logistics: Ideal situation

In a theoretically ideal situation, Vietnam logistics would greatly benefit of a huge scale development of the road infrastructure, where all the main and secondary roads should be paved. Paving as many roads as possible would allow a new kind of transportation sequence. Only short track distances between the forest stands and the main forest roads would be covered by the small capacity comprehensive trucks. The big lorries would be able to connect directly forest roads to the mill's gate, reducing the intermodal

operations to the minimum, and allowing real scale economies for the transport cost. Such an ideal sequence is represented in Figure 10.

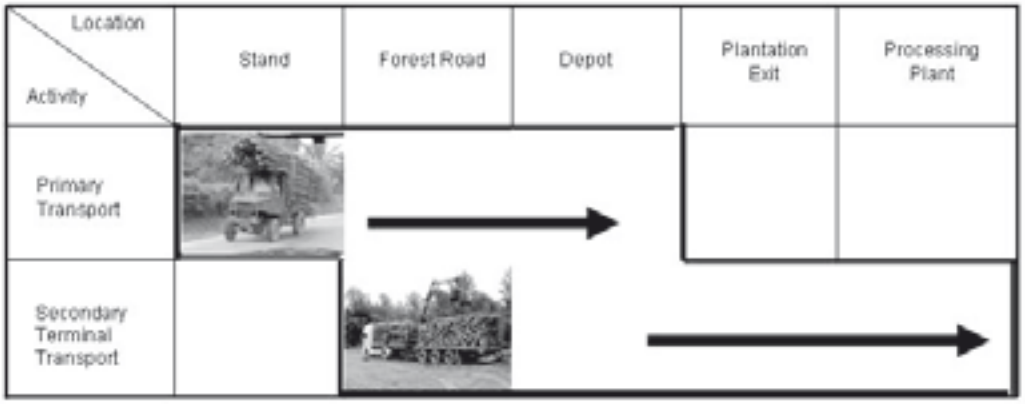


***Figure 10**: Ideal / theoretical transportation sequence for pulp wood in Vietnam.*

A second critical factor: the competition with chips mills for the wood supply

In Vietnam, there is clearly a competition for the supply of raw material between pulp and chip mills. The same categories of industrial round wood (in terms of species, qualities, and size) can supply both. Before 2000, around 30% of the Vietnamese pulp wood production was removed from the pulp sector and was finally exported as chips. Despite the high increase of the Vietnamese pulp wood production up to its ceiling in 2000, the available surplus of supply for the pulp industry soon elapsed: the chips industry reacted quite fast and soon captured another share of the newly available supplies. By 2002, the share of the pulpwood production diverted to chips exports was 48%, and the volumes available for the pulp industry had decreased to less than 670 000 m3/year, after a peak of more than 900 000 m3/year in 2000 (Figure 11).

The roots of this harsh pressure of the chips exports on the available raw material probably lie in two levels. First, chips industries demand lower investments than pulp industries. They are therefore more flexible, and have lower operating cost. In a context of high international demand, with the proximity of huge and lucrative markets for chips such as Japan, the purchasing power of the chipping industry emphasize the concurrence of the supply between the two sectors.

Second, the national policy environment generally promotes exports of added value goods. In the case of wood products, there are export taxes from 5 to 45% on round wood and semi-processed products[11], but wood chips and other wood particles[12] are exempted of export tax.

This distortion gives a comparative advantage to the woodchips export industry, compared to the pulp industry, in order to capture the national resource of pulp wood. This comparative advantage can be measured through the capacity to pay the raw material, according to the different industrial uses: for example, when one ton of raw material can be paid from 25 to 30 USD at the pulp mill's gate, it can be paid from 28 to 35 USD[13] at the chip mill's gate. As a result, farms and small owners who don't have a specific supplying contract with a pulp mill prefer to sell their pulp wood production to the chip mills, when they can.

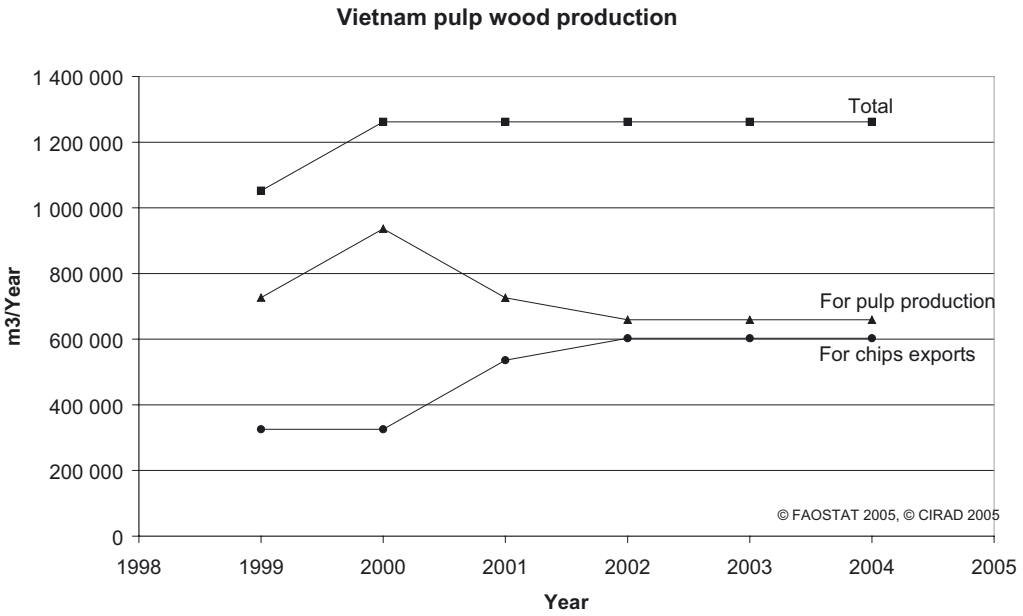


***Figure 11**: Vietnam pulp wood production and main uses*

Optimised transport cost model for pulpwood supplies

According to the data from our field survey and interviews, we can parameterise a transport costs model for chips and pulp log transport in Vietnam. Costs range from 0.08 to 2.6 USD/T/km, depending on the transportation mode. The cost parameters for each transport mode, including intermodal costs before export, are presented below (Table 6).

Table 6: Transport costs parameters in Vietnam

Transport mode	Transport cost (USD/T/km)
Ox cart	0.70 – 2.64
Comprehensive 3T trucks	0.22 – 0.33
15 T trucks	0.08 – 0.15
Large trucks, on paved roads	0.08 – 0.08

We consider the existing and the potential industrial transport of pulp wood within the country up to the mill's gate or the exit points where it can be sold "Free On Board", towards any export market as such as Japan or China. The country's territory is represented by a spatial grid, constituted of a sufficient number of cells being as many territorial units. Field survey and data (location and state of different transportation networks, transportation costs, river ports, railways stations, sea ports, etc.) allow to compute and to assess any possible transport cost, from any territorial unit towards any mill's gate or export point (when exporting pulpwood or wood chips from industrial plantations).

We define a generalised transport cost model, were the pulpwood can be transported by various transportation modes, with differentiated transport costs. The considered transportation modes are:

- track and unpaved road
- paved road

The transport can be unimodal or multimodal. The latest case occurs when the goods are unloaded and loaded from one mode to another one, at any intermodal point (i.e. from track to road, at a storage place). The transport cost model allows to assess and to compare (for every territorial unit of the grid) the transport cost for every possible transport combination, from the forest to any export point, (unimodal and every multimodal combinations are computed). For every territorial unit, the lowest possible transport cost before export is considered as the transport cost criteria to be used when considering the potential of this place for an industrial plantation.

Denote c as the centroïd of territorial unit *x* among *G* territorial units in the grid. Denote *i* as the mode of transportation within the transportation mode index *I* describing n modes of transportation. Denote *k* as an intermodal point between transportation mode *i* and another one. Denote *z* as mill's gate or an export point among *Z* possible export points. Denote D_i as the distance between 2 points and C_i as the transportation cost per kilometre, according to the transportation mode *i*. We then have the transport cost model (1):

$$\begin{aligned}
&\forall c \in [1, G], \forall z \in [1, Z] \\
&\forall i \in [1, n], i \in \{1 = \text{track}, 2 = \text{road}, 3 = \text{railway}, 4 = \text{river}\} \Rightarrow n = 4 \\
&\forall k = k(i), \forall D_i \in [0, +\infty[, \forall C_i \in [0, +\infty[\\
&TC = \min\left(D_i(c, k_i) \cdot C_i + \sum_{i=1}^{n-1} \left(D_{i+1}(k_i, k_{i+1}) \cdot C_{i+1} \right) + D_n(k_{n-1}, z_n) \cdot C_n \right)
\end{aligned} \tag{1}$$

where *TC* is the lowest possible transport cost before the mill's gate or before export, regarding the territorial unit *x*.

The model can be derived into one generic transport cost model where loading points *x* in the plantation can be considered exactly as any intermodal points (in this case between the production stage to a transportation mode), and where export points *z* can also be considered exactly as any other intermodal points (in this case between the last transportation mode, and the export transportation mode, i.e. "sea"). We then have a generic multimodal transport cost model (2) derived from (1):

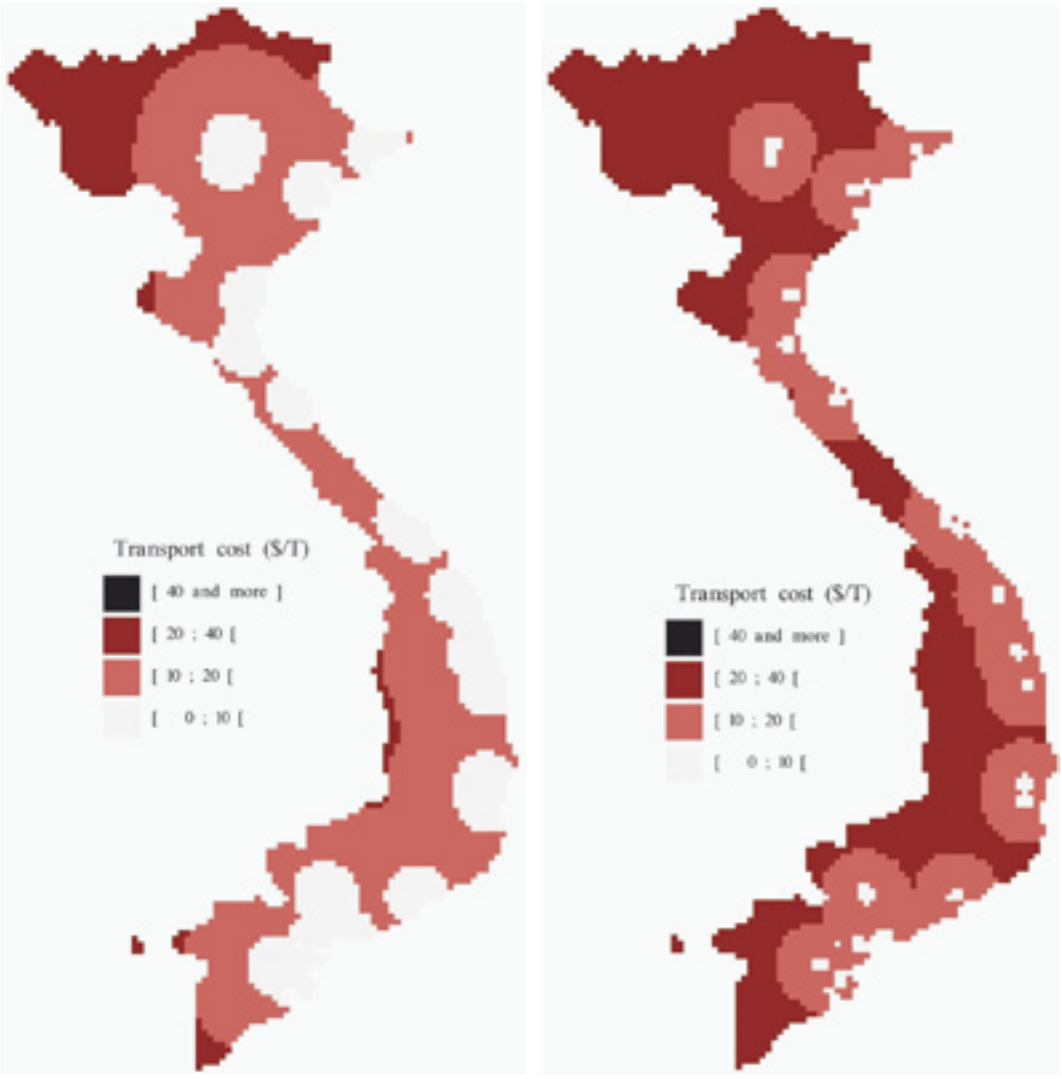
$$\begin{aligned}
&\forall i \in [1, n], i \in \{1 = \text{track}, 2 = \text{road}, 3 = \text{railway}, ..., n = \text{transportation mode } n\} \\
&\forall k = k(i), \forall D_i \in [0, +\infty[, \forall C_i \in [0, +\infty[\\
&TC = \min\left(\sum_{i=1}^{n} \left(D_i\left(k_i^1, k_i^2\right) \cdot C_i \right) \right)
\end{aligned} \tag{2}$$

where k^1 and k^2 are the two intermodal points (loading-unloading points) at the beginning and at the end of the transportation mode *i*, and where *TC* is the lowest possible transport cost before processing or export.

It is possible to draw different maps of Vietnam according to the transport cost model for pulpwood processing or exports. The variation margins that are given for each parameters in Table 6, allow to compute and compare a "high margin – worst case" with a "low margin - best case" transport cost scenario. The transport cost model is computed in order to draw a map of transport costs according today's situation of the pulpwood logistic sequence (see maps A and B of Figure 12). According to our field survey, it seems that the worst case scenario (upper cost margins) would be quite common.

Under this cost scenario, the adapted implementation of the National industrialisation plan will not really change the situation (see the map A of Figure 13, quite similar to the map B of Figure 12), while an improvement of the road network, allowing an ideal logistic sequence (see the cost parameters of this ideal sequence Table 7), would dramatically improve the situation (see the map B of Figure 13).

In this regard, the industrialisation strategy appears to be completely depending on the logistic bottleneck.

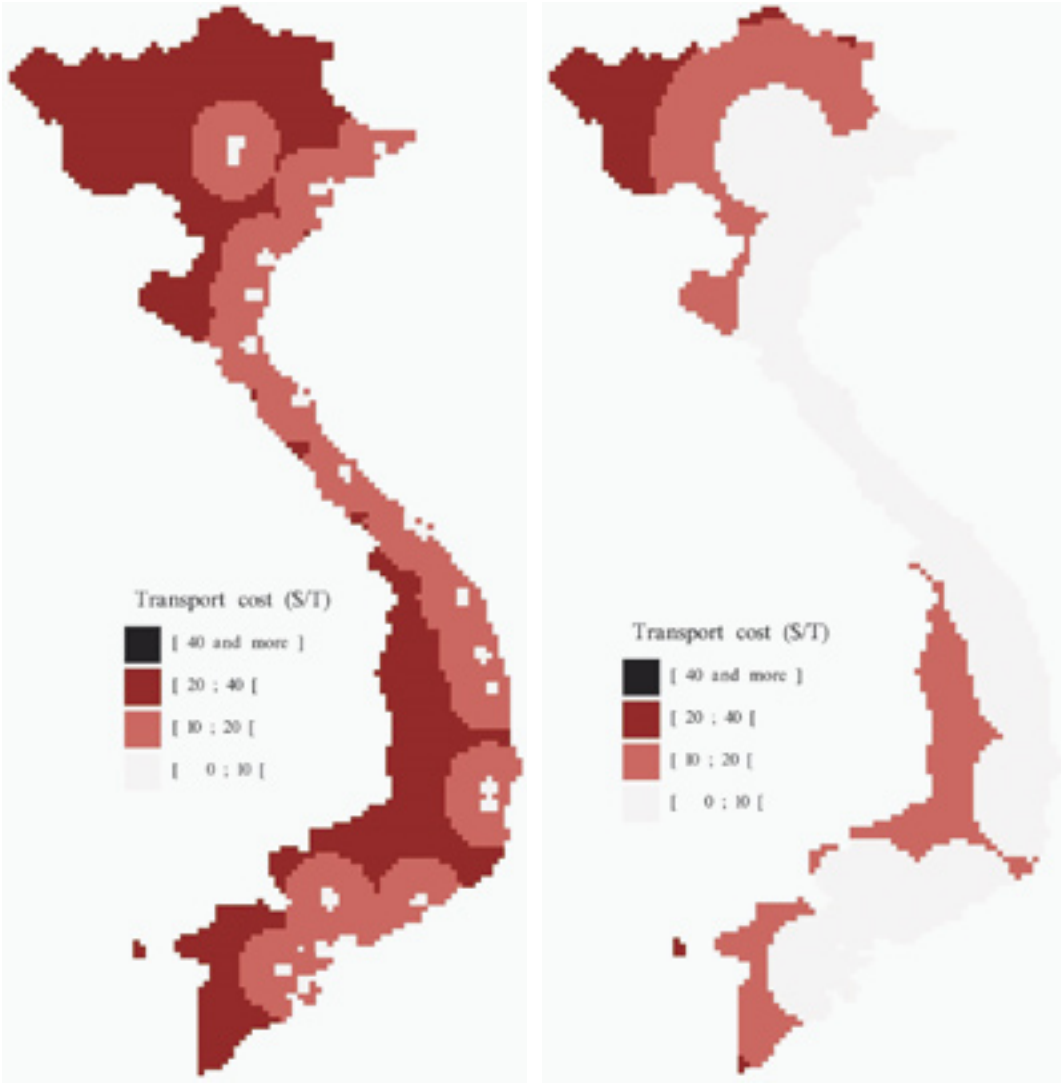


A: best case scenario (low margin) *B: worst case scenario (high margin)*

***Figure 12**: Pulp wood transport costs to the existing mills, in Vietnam (USD/T)*

Table 7: Transport costs parameters in Vietnam, considering an ideal logistic sequence

Transport mode	Transport cost (USD/T/km)
Comprehensive 3T trucks	0.22 – 0.33
Large trucks, on paved roads	0.08 – 0.08



A: Without logistic sequence improvement (high margin)

B: With logistic sequence improvement (high margin)

***Figure 13**: Pulp wood transport costs to the future set of mills, according to the adapted industrialisation plan*

Economic feasibility of the different industrial paths

Economic feasibility of the pulpwood supply

Using the transport cost model for the pulpwood supplies, it is possible to compute and compare several maps of the range of economic feasibility. The feasibility depends of the price paid at the mill's gate, and of the price paid at the forest gate (including stumpage and harvesting cost). The variation of the costs observed on the field is given in the following table (Table 8), as well as the value used for the feasibility calculation. Under the strong hypothesis of a median mill gate price of 28 USD/T and a minimum forest gate price of 16 USD/T, a variation from 9 to 14 USD/T would be available to pay the transport costs, according to the field data. In order to compare the different industrial scenarios, we choose arbitrarily a value of 12 USD/T as representative of the cost radius of pulpwood economical supply.

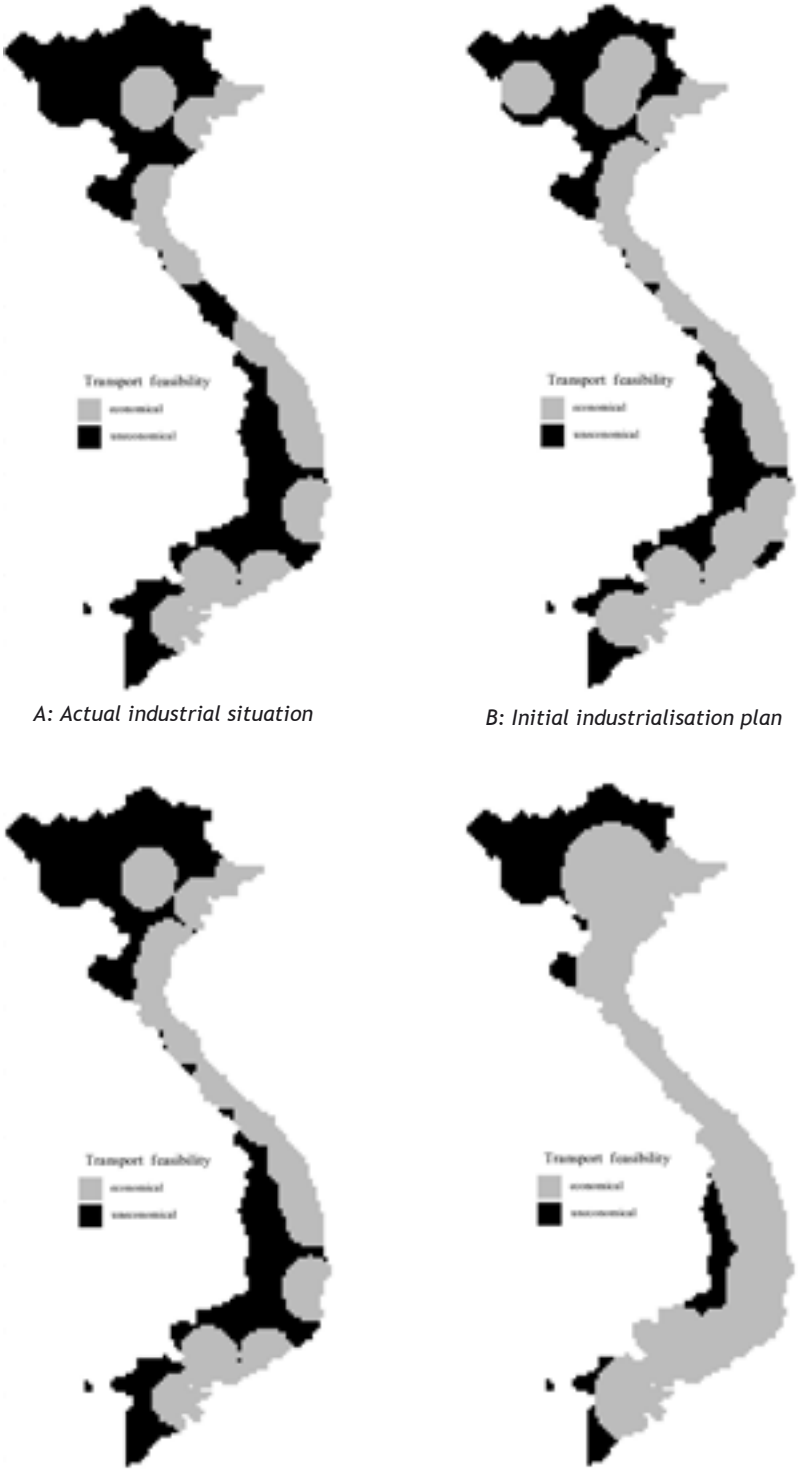
Table 8: Cost parameters of the pulpwood supply

	Low margin (USD/T)	**High margin (USD/T)**	**Value used for the feasibility calculation (USD/T)**
Pulp mill's gate price	25	30	28
Forest gate price (Stumpage + harvesting cost)	11	20	16
Feasible range for the transport cost	14	10	12
Transport mode (actual logistic sequence)	Low margin (USD/T/km)	High margin (USD/T/km)	Value used for the feasibility calculation (USD/T/km)
Ox cart	0.70	2.64	0.70
Comprehensive 3T trucks	0.22	0.33	0.22
15 T trucks	0.08	0.15	0.08
Large trucks, on paved roads	0.08	0.08	0.08
Transport mode (ideal logistic sequence)	Low margin (USD/T/km)	High margin (USD/T/km)	Value used for the feasibility calculation (USD/T/km)
Comprehensive 3T trucks	0.22	0.33	0.22
Large trucks, on paved roads	0.08	0.08	0.08

It is interesting to compare the feasibility maps of today's situation (map A of Figure 14), with the initially planed industrialisation map (map B of Figure 14), and with the adapted industrialisation plan (map C of Figure 14), all of these scenarios taking in account an actual logistic sequence. Another interesting scenario is the adapted industrialisation plan but considering an ideal logistic sequence (map D of Figure 14).

In the current situation, approximately 40% of the national territory is within economical transportation distance of a pulp mill (map A of Figure 14). The complete implementation of the initial industrialisation plan would only increase this share to approximately 60% (map B of Figure 14), because of the poor logistic sequence, while the pragmatically adapted industrialisation plan would already increase this share up to approximately 50% (map C of Figure 14).

But with an ideal logistic sequence, the implementation of the adapted industrialisation plan would make approximately 70% of the national territory within economical transportation distance of a pulp mill (map D of Figure 14).



A: Actual industrial situation

B: Initial industrialisation plan

C: Adapted industrialisation plan

D: Adapted industrialisation plan / ideal logistics

***Figure 14**: Feasibility of various pulpwood supply scenarios*

Economic feasibility of the chipwood supply

The feasibility depends of the price paid at the mill's gate, which is higher than in the case of the pulp mills, and of the price paid at the forest gate, which is the same in both cases. The variation of the costs observed on the field is given in the following table (Table 9), as well as the value used for the feasibility calculation. Under the strong hypothesis of a median mill gate price of 32 USD/T and a minimum forest gate price of 16 USD/T, a variation from 15 to 17 USD/T would be available to pay the transport costs, according to the field data. In order to compare the different industrial scenarios, we choose arbitrarily a value of 16 USD/T as representative of the cost radius of chipwood economical supply.

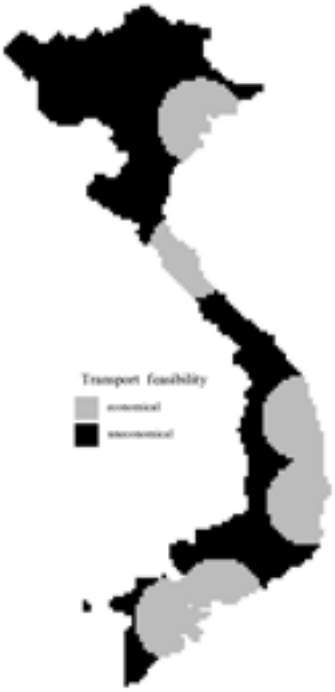
Table 9: Cost parameters of the chipwood supply

	Low margin (USD/T)	**High margin (USD/T)**	**Value used for the feasibility calculation (USD/T)**
Chip mill's gate price	28	35	32
Forest gate price (Stumpage + harvesting cost)	11	20	16
Feasible range for the transport cost	17	15	16
Transport mode (actual logistic sequence)	Low margin (USD/T/km)	High margin (USD/T/km)	Value used for the feasibility calculation (USD/T/km)
Ox cart	0.70	2.64	0.70
Comprehensive 3T trucks	0.22	0.33	0.22
15 T trucks	0.08	0.15	0.08
Large trucks, on paved roads	0.08	0.08	0.08
Transport mode (ideal logistic sequence)	Low margin (USD/T/km)	High margin (USD/T/km)	Value used for the feasibility calculation (USD/T/km)
Comprehensive 3T trucks	0.22	0.33	0.22
Large trucks, on paved roads	0.08	0.08	0.08

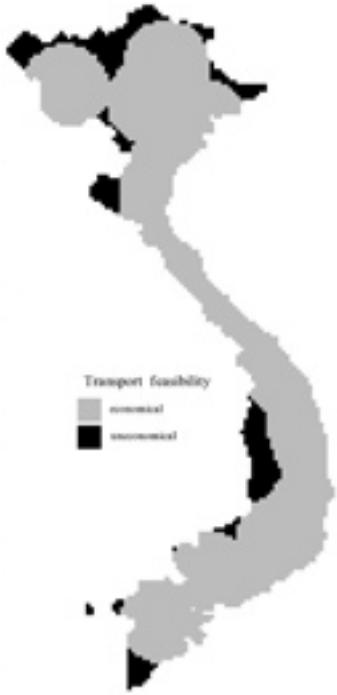
In comparison with the pulpwood maps, feasibility maps of the chip supply show very different patterns for every case[14]. Current situation (map A of Figure 15), which is the worst "chipwood supply" scenario, let approximately 40% of the national territory within economical transportation of a chip mill. This proportion is the same than for the pulp mills, but the areas can not be exactly superimposed. In North Vietnam, Baibang surroundings seem free of competition with chip mills, but a large area around Haiphong can be suitable for chipwood sales. This area would be even greater when considering river transportation, which has not been the case with the transportation model, by lack of data. In the central and south parts of the country, the economical area for chipwood transportation superimpose some of the corresponding pulpwood economical areas, and when it is the case, the chipwood economical areas are even much larger.

Implementing the initial implementation plan would make approximately 90% of territory within economical distance of a chip mill (map B of Figure 15). This would critically deepen the division between comparative advantages of pulp and chip industries.

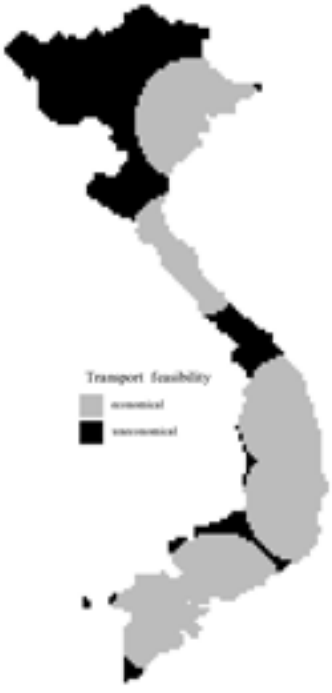
Considering ideal logistics, the actual industrialisation would lead to approximately 60% of territory within economical distance of a chip mill (map C of Figure 15), while implementing the initial industrial plan would increase this share up to almost 100% (map D of Figure 15).



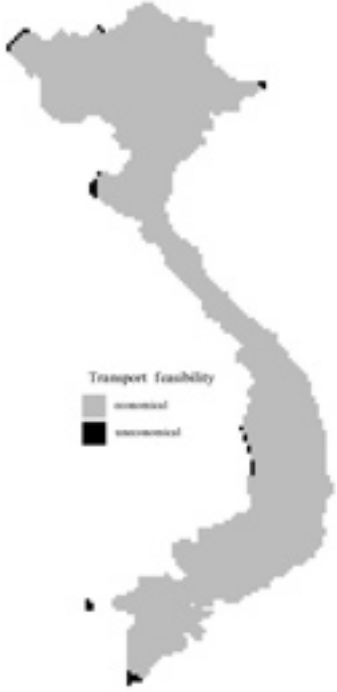
A: Actual industrial situation



B: Initial industrialisation plan



C: Adapted industrialisation situation / ideal logistics



D: Initial industrialisation plan / ideal logistics

***Figure 15**: Feasibility of various chipwood supply scenarios*

Conclusion: China's demand footprint

Vietnam displays a strong will to be self sufficient with its paper production, but the production is leveling-off, despite an ambitious industrialisation plan and an even more ambitious pulp wood plantations development plan. A major reason of this ceiling is the difficult logistic of the pulpwood supplies: even with the development of the plantation areas, a large share of the country remains outside a radius of economical transportation distance towards the pulp mills. It seems that the improvement of the logistic organisation of the country would produce induce much more effects on the pulp and paper production than the multiplication of the number of mills throughout the country.

Another major problem emerges with the fact that the existing wood chip industry already captures a large share of the resources, and clearly appears as a negative factor on the pulp and paper production in Vietnam. As long as the raw material will be better paid at the wood chip mill's gates, these mills will easily compete with the pulp mills for the supply. The economic feasibility maps clearly illustrate the comparative advantage of the wood chip industry in capturing the resource: in the same harvest and stumpage costs conditions, its area of economic transport is definitely much larger. Conversely, this means that in one precise place, pulpwood sold to a chip mill can generate a greater margin either for the transport operation, or for the stumpage and harvest operation, or both.

The export market of the Vietnamese chip mills has been traditionally fueled by the Japanese demand, but now the Chinese demand seems to be taking over: in 2004 Vietnamese chips accounted for more than 17% (more than 50 000 tons) of the Chinese imports. And the Chinese demand is still growing.

Unless some fiscal or other economic instruments dramatically lessen the comparative advantages of the chip industry in Vietnam, an increasing share of the Vietnamese pulpwood will be captured for the chip exports towards China. China's demand footprint appears to be great in Vietnam, and probably will be more important in the future.

In this context, one could assess and discuss the economic efficiency of prematurely forcing the development of the pulp and paper industry in Vietnam, involved in a harsh competition with the chip industry, while using the development of this chip industry (fuelled by the Chinese demand) could help to finance and develop the plantations in Vietnam through its higher capacity to pay the raw material, prior to develop the national pulp and paper self-sufficiency.

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  - Beatrice TAUZIEDE
    Attachee Commerciale, Secteur Agriculture et Agroalimentaire, Ambassade de France au Vietnam, Mission économique de Hanoi
  - CAO THANG BINH
    Operations Officer, Rural Development& Natural Resources, THE WORLD BANK
  - CAROLE L Y
    Technical Adviser, INFORMATION CENTRE FOR AGRICULTURE AND RURAL DEVELOPMENT, MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
  - Chu Dinh Quang
    Head of Division of Forest Utilization Management, FORESTRY DEVELOPMENT DEPARTMENT, MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
  - Dang Van De
    Director, Vin Ohu Paper Raw Materials, Doan Hung Afforestation yards
  - DO DINH SAM
    Senior Scientist, Focal polnt of GEP Project on Mangrove, MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT, FOREST SCIENCE INSTITUTE OF VIETNAM
  - Do DuC DOI
    Deputy Director, DEPARTMENT OF LAND REGISTRATION AND STATISTICS, MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
  - Frank BINGEN
    Programme Officer, Cooperation Section European Union Delegation of the European Commission to Vietnam
  - HOANG HAI TRI
    Deputy General Director, VINAFOR - VIETNAM FOREST CORPORATION
  - HOANG THANH
    Programme Officer- Rural Development & Environment, Cooperation Section, European Union Delegation of the European Commission to Vietnam
  - LE QUY AN
    Prof, President, Vietnam Association for the Conservation of Nature and Environment (VACNE)

- NGO UT- M.Sc,
  Director General, MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT, FOREST INVENTORY AND PLANNING INSTITUTE
- NGUYEN BA NGAI,
  Ph.D. in Agriculture, Senior Lecturer, Vice-Head of Scientific Management and Intemational Co-operation Department, FORESTRY UNIVERSITY OF VIETNAM
- NGUYEN DINH TU
  Di rector, FORESTRY UNIVERSITY OF VIETNAM, MINISTRY OF AGRICULTURE & RURAL DEVELOPMENT
- Nguyen Hai Nam
  SGP PTF Coordinator, United Nations Development Programme,
- NGUYEN NGOC BINH
  DERECTOR GENERAL, DEPARTMENT OF FORESTRY, MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
- NGUYEN NGOC QUE
  Head of Market Information Division, INFORMATION CENTRE FOR AGRICULTURE AND RURAL DEVELOPMENT
- Nguyen Phan Thiet
  Director, FORESTRY UNIVERSITY OF VIETNAM , CENTER FOR FOREST INDUSTRY, Forestry University of VietNam
- Nguyen Xuan Thang
  Director, Vinafor - Bac Giang
- Patrick COONEY
  Programme Officer, Cooperation Section, Delegation of the European Commission to Vietnam, European Union
- PHAM NGOC MAU
  Deputy Chief of Forest Ecology and Resource Division, FSIV - FOREST SCIENCE INSTITUTE OF VIETNAM
- QUACH CONG HUA
  Senior Expert, DEPARTMENT OF LAND REGISTRATION AND STATISTICS, MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
- Ta Van Chung
  Vice President ; Vinapimes - VIETNAM PAPER CORPORATION
- THIERRY MERMET
  General Director, THE BAMBOO FACTORY,
- TRAN VAN CHU
  Vice Dean of Facultry of Forest Products Processing , Leader of Department of Funiture Design and Interior Decoration, FACULTRY OF PRODUCTS PROCESSING
- Tran Van Hung
  Deputy chief, International cooperation division, Forest Inventory Planning Institute (FIPI)
- TRUONG HUU CHI
  Researcher, Informatics Center for Agricultural and Rural Development, MARD
- VO DAI Hal
  Deputy Director General, FOREST SCIENCE INSTITUTE OF VIETNAM (FSIV)

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Endnotes

[1] Under a socialist oriented management system.
[2] Bai Bang, Tan Mai, Dong Nai, Viet Tri, Hoang Van Thu, Van Dien, and Binh An units.
[3] Pulp and chips industries basically use the same raw material.
[4] The larger the mill is, the more it can gain in terms of scale economies for its operating costs.
[5] Especially, the market of bleached eucalyptus kraft pulp (BEKP) is highly competitive.
[6] Up to now, the national industry is protected by import tariffs of 40-50%
[7] In the pulp and paper industry, the rule of thumb indicates the internationally competitive supply limit to be around 200 km, when the transportation network is modern, and when the pulp wood can be carried with large trucks of 45 T of capacity, or more.
[8] Agriculture, Bamboo, Bare lands, Bush, Forest, Grass lands, Mangroves, Plantations, Water, Wetlands.
[9] Alluvial sand, Fruit tree crops, Swamps, Potential riziculture, Potential garden culture, Potential annual industrial crops, Riziculture, Bare lands, Meadows, salt work, Aquaculture, Mangrove, Forest plantation, Rich & medium natural forest, Poor natural forest, Bush, Bush & seldom trees, Shifting fire and grass lands, Perennial industrial crops, Water systems, , Urban areas
[10] See above, the sub-chapter "The initial industrial development plan" and the sub-chapter "The industrial development plan"
[11] The export taxed products belong to the following custom categories:
44.03 Wood in the rough, whether or not stripped of bark or sapwood, or roughly squared.
44.04 Hoopwood; split poles; piles, pickets and stakes of wood, pointed but not sawn lengthwise; wooden sticks, roughly trimmed but not turned, bent or otherwise worked, suitable for the manufacture of walking sticks, umbrellas, tool handles or the like.
44.06 Railway or tramway sleepers (cross ties) of wood.
44.07 Wood sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end jointed, of a thickness exceeding 6 mm.
44.08 Sheets for veneering (including those obtained by slicing laminated wood), for plywood or for other similar laminated wood and other wood, sawn lengthwise, sliced or peeled, whether or not planed, sanded, spliced or end-jointed.
44.09 Wood (including strips and friezes for parquet flooring, not assembled) continuously shaped (tongued, grooved, rebated, chamfered, V jointed, beaded, moulded, rounded or the like) along any of its edges, ends or faces, whether or not planed, sanded.
44.15 Packing cases, boxes, crates, drums and similar packings, of wood; cable drums of wood; pallets, box pallets and other load boards, of wood pallet collars of wood.
44.16 Casks, barrels, vats, tubs and other coopers' products and parts thereof, of wood including staves.
44.18 Builders' joinery and carpentry of wood, including cellular wood panels, assembled parquet panels, shingles and shakes.
[12] Custom category 44.01: Fuel wood, in logs, in billets, in twigs, in faggots or in similar forms; wood in chips or particles; sawdust and wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms.
[13] This variation margin is given according to the different data got within the field survey, and according to the variation of the VND (Vietnamese Dong)-USD (US Dollar) exchange rate. It is just an indicative variation margin. Thhoughout the whole country, it could be higher or lower.
[14] But no map of the adapted industrialisation plan has been computed for the chip mills, by lack of data.

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