A Study of Swedish Technology Policies Promoting Development of Industries Linked to Mine and Forest Exploitation

L. Anders Sandberg

A Study Commissioned by the Ministry of State for Science and Technology, March, 1986.

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Preface

In the research and execution of this report I have been assisted by several persons and organizations. I would like to acknowledge the assistance of the presidents and managers of the Swedish subsidiaries in Canada who responded to a study questionaire. I would also like to thank the personnel at the Swedish Trade Office in Montreal and at the Swedish Embassy in Ottawa. Finally, I am indebted to those union, industrial and government officials in Sweden who on short and pressing notice supplied valuable material and answers to my inquiries. In those instances where a source is not given, the data were obtained on a personal basis.

The currency in Sweden is crowns and is abbreviated as SEK in the text. 1 SEK equalled Can $ .16 in 1985.

L.A.S.

Peterborough, March 14, 1986

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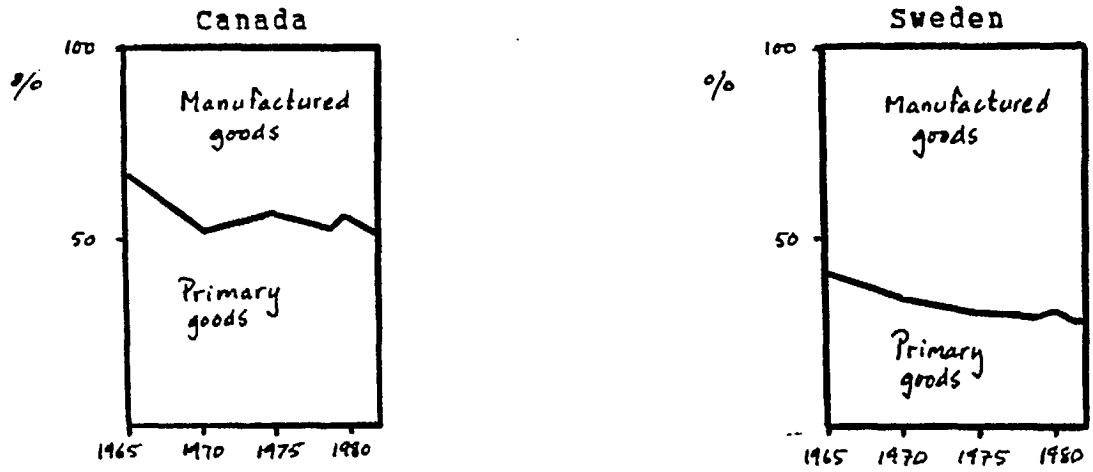
Canada and Sweden are similar in many respects. Their populations are relatively small. Their northern locations and climates are comparable. Both countries rely on a similar resource base, consisting of forests, minerals and water. They also share a past experience as peripheral producers of raw material for more developed industrialized countries, Germany and Britain for Sweden and the United States and Britain for Canada. Indeed, even today the two countries are trading nations with highly open economies, that is, the reliance on exports and imports is relatively high. This condition makes both countries extremely vulnerable to the fluctuations in the world economy.

Despite these similarities, Sweden and Canada have turned out very different economically. The Swedish industrial structure is now (1986) based on specialized secondary goods and capital and local technology while its Canadian counterpart is based on export staples and a secondary complex dominated by foreign capital and technology.

Differences In The Trade Structures Of Canada And Sweden

The data on the export structures of Canada and Sweden illustrate Canada's staple bias and Sweden's emphasis on manufactured goods. Figure I shows that although Canada has increasingly become an exporter of manufactured goods,

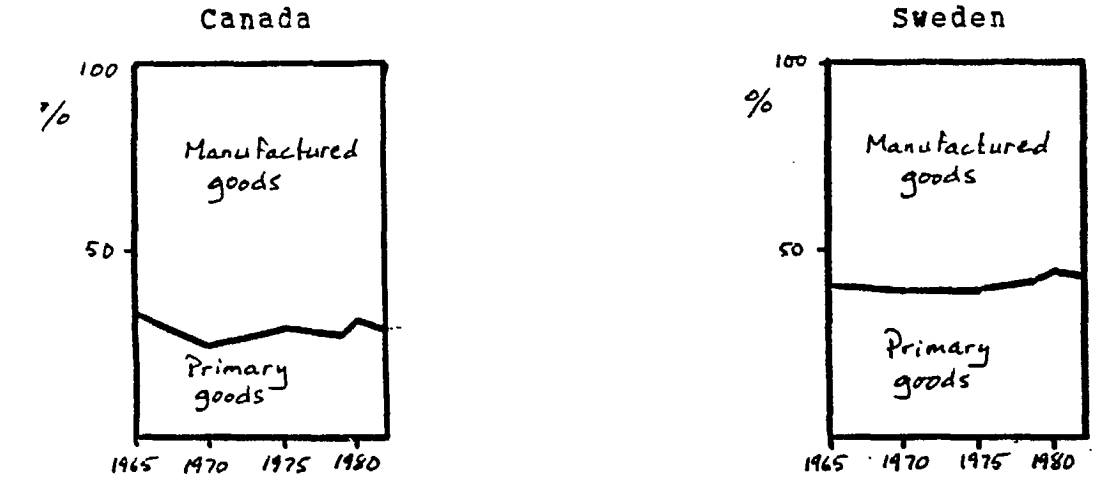
Figure I
Export Structure of the Canadian and Swedish Economies: Percentage Shares of Primary and Manufactured Goods, 1965, 1970, 1975, 1979-82.



* Include food, agricultural raw materials, fuels ores and metals.

Source: UNCTAD Handbook of International Trade and Development Statistics, 1983.

Figure II
Import Structure of the Canadian and Swedish Economies: Percentage Shares of Primary and Manufactured Goods, 1965, 1970, 1979-82.



* Include food, agricultural raw materials, fuels, ores and metals.

Source: UNCTAD Handbook of International Trade and Development Statistics, 1983.

primary goods still constitute half of the value of all exports. In Sweden on the other hand, the proportion of manufactured goods of all exports is much larger. From 1965 to 1982 the percentage increased from almost sixty to seventy per cent.

A similar, but less prominent picture, emerges in the case of the import structures of the two countries. Between 1965 and 1982, manufactured goods constituted from sixty-six to seventy-seven per cent of the value of all imports to Canada. Sweden was not far behind. Approximately sixty per cent of all imports from 1965 to 1982 were manufactured goods (see Figure II). This is a reflection of the specialization in only some manufactured goods and the neglect of others in the Swedish economy. The latter necessitates heavy imports, a fact which has a destabilizing effect on the Swedish economy.

Table I shows the export structure by major commodities for Sweden and Canada. Primary commodities dominate for Canada although road motor vehicles constitute the major export commodity. Motor vehicles, however, do not reflect Canadian export strength as most automobiles are sold to the U.S. through the Auto Pact. Sweden on the other hand, exports mainly secondary goods, such as motor vehicles, machinery, ships and boats and telecommunications equipment. All these commodities are based on local technology.

TABLE I

Export structure (at the SITC 3-digit level), 1981
(ranked by values): Canada and Sweden

SITC Group		Value $,000	% of country total	% of developed world	% of world
	CANADA				
	ALL COMMODITIES	68281197	100.00	5.49	3.42
732	ROAD MOTOR VEHICLES	10871865	15.92	9.07	8.47
341	GAS NATURAL AND MANUFCTD	4435259	6.50	27.04	13.06
641	PAPER AND PAPERBOARD	4359528	6.38	21.75	20.71
251	PULP AND WASTE PAPER	3213784	4.71	35.98	32.48
041	WHEAT ETC UNMILLED	3110509	4.56	19.47	18.46
243	WOOD SHAPED	2554012	3.74	35.72	25.01
331	CRUDE PETROLEUM,ETC	2092650	3.06	9.35	0.67
711	POWER MACHINERY NON-ELEC	1549661	2.27	5.65	5.28
285	NONFER BASE MTL ORE,CONC	1433176	2.10	29.29	12.82
281	IRON ORE,CONCENTRATES	1224142	1.79	34.84	15.72
719	MACHINES NES NONELECTRIC	1198017	1.75	1.71	1.49
684	ALUMINIUM	1157483	1.70	11.70	10.27
561	FERTILIZERS MANUFACTURED	1122233	1.64	16.53	13.30
332	PETROLEUM PRODUCTS	1051871	1.54	2.64	1.14
734	AIRCRAFT	1031396	1.51	3.87	3.66
REMAINDER		27875611	40.82		

SITC Group		Value $,000	% of country total	% of developed world	% of world
	SWEDEN				
	ALL COMMODITIES	28492476	100.00	2.29	1.43
732	ROAD MOTOR VEHICLES	3482652	12.22	2.90	2.71
641	PAPER AND PAPERBOARD	2653723	9.31	13.24	12.60
719	MACHINES NES NONELECTRIC	2489156	8.74	3.55	3.10
251	PULP AND WASTE PAPER	1345075	4.72	15.06	13.60
332	PETROLEUM PRODUCTS	1078420	3.78	2.70	1.17
243	WOOD SHAPED	1031770	3.62	14.43	10.10
724	TELECOMMUNICATIONS EQUIP	1024298	3.59	4.09	3.21
718	MACHS FOR SPCL INDUSTRYS	812903	2.85	3.01	2.51
735	SHIPS AND BOATS	729236	2.56	4.52	3.55
711	POWER MACHINERY NON-ELEC	633651	2.22	2.31	2.16
714	OFFICE MACHINES	565465	1.98	2.34	1.91
722	ELEC PWR MACH,SWITCHGEAR	512835	1.80	2.35	1.91
581	PLASTIC MATERIALS ETC	506930	1.78	2.04	1.95
729	ELECTRICAL MACHINERY NES	497275	1.75	1.44	1.23
695	Tools	4888952	1.72	8.79	7.87
Remainder		10640135	37.34		

Source: UNCTAD Handbook of International Trade and Development Statistics, 1984.

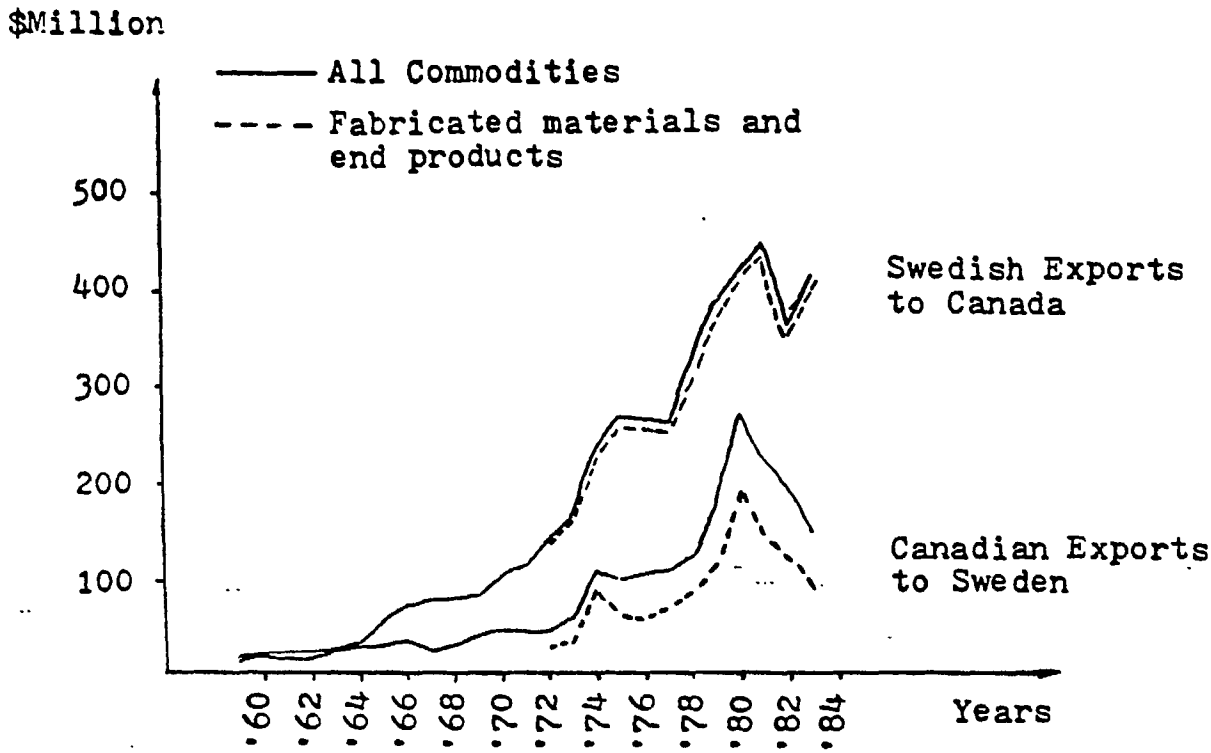
The bilateral trade between Canada and Sweden reflects the competitive status of the two countries vis-a-vis each other. It shows that Canada has developed an increasingly large deficit in its trade with Sweden since the late 1950's (see Figure III). This is primarily a reflection of the ability of the Swedish economy to market secondary manufactured goods in the form of machinery and consumer goods in Canada.

Swedish industries linked to the forest and mineral staples are here much more prominent. Despite Sweden's smaller market (8.3 M) and smaller resource base in forestry and mining, Swedish industries are world-renowned and world leaders in the technology-intensive sectors of the field. The mining industry is continuously engaged in improving efficiency and economy. Mining methods are industrialized and exported by companies such as Atlas Copco, Sandvik, Fagersta, Craelius, Hagglund & Soner, Linden-Alimak, Nitro Nobel, Sala International, Svedala-Arbra, Morgardshammar, Skega, Asea, Kiruna Truck and Trelleborg.

A similar picture may be found in the forest industry. Machinery for the pulp and paper industry, logging equipment, silvicultural machinery and forward linkage goods such as furniture are commodities marketed world wide as well as in Canada by such companies as Becker Stevens, Berolkemi, Celleco, Centro-Morgardshammar, Eur-Control, Flakt, KMW, Sandvik and Ikea.

Figure III

Trade Between Sweden and Canada, 1959-1983.



Source: Statistics Canada. Imports by Countries, Catalogue 65-006 and Exports by Countries, Catalogue 65-003.

Tables II and III give an expression of the ability of the Swedish staples economy, and the inability of its Canadian counterpart, to create backward and forward linkage industries by comparing the trade between Canada and Sweden in the forest and mine product sectors. In the forest product sector, Swedish exports to Canada include both primary and secondary material. One would perhaps expect that Canada, being a major producer and exporter of paper and paper board, would not import such materials. But in 1983, Sweden sold over Can$ 19 M worth of paper and paper board to Canada. At the same time Canada sold almost Can$ 4 M worth of newsprint, a much cruder material, to Sweden. What really stands out in these statistics, however, is the extent to which Sweden exports producer and consumer goods in the forest product sector to Canada while the flow of such material is almost absent in the other direction.

In the mining sector a similar pattern can be noted. Almost Can$ 25 M worth of mining and drilling machinery was sold by Sweden to Canada. Canada, on the other hand only sold Can$ 1 M worth of the same material to Sweden.

These statistics confirm a general view held by many industrial observers, namely, that Canada is well behind Sweden in the management and use of natural resources. What are the roots of that anomaly? What can be done about it? What have the Swedes done with respect to research and

TABLE II
Trade Between Canada and Sweden in the Forest Product Sector ($,000), 1983.

Commodity	Swedish Exports	Canadian Exports
Lumber	2	553
Veneer	2	1,145
Plywood	-	8
Other Wood Fabricated Materials	448	321
Wood pulp and similar pulp	41	8,128
Newsprint paper, paper and paper board	19,313	3,783*
Pulp and paper industries machinery	13,405	1,180
Printing machinery and equipment	494	-
Woodworking machinery and equipment	**	2,571
Furniture and fixtures	13,116	-
House furnishings	2,624	-
Printed matter	995	107
Stationers' and office supplies	1,593	-
Prefabricated buildings and structures	-	322

* Paper and paper board dominated the Swedish exports while newsprint the Canadian exports.

** The Swedish exports to Canada in this category are hidden in the statistical break-down of commodities.

Source: Statistics Canada. Imports by Countries. Catalogue 65-006, 1983; and Exports by Countries. Catalogue 65-003, 1983.

TABLE III

Trade in Producer Goods in the Mining Sector Between Canada and Sweden ($,000), 1983.

Commodity	Swedish Exports	Canadian Exports
Drillling machinery, drill bits and excavating machinery	20,579	755
Mining, oil and gas machinery	4,147	-

Source: Statistics Canada. Imports by Countries. Catalogue 65-006, 1983 and Imports by Countries. Catalogue 65-003, 1983.

necessarily positive. First, rather than producing, buying and developing capital goods in Canada, the branch plants tended to import them from the home country. Second, many of the branch plants were only established to supply the Canadian and Commonwealth market and barred from exporting to any other countries. Third, R & D by the foreign companies tended to be centred in the mother country rather than in Canada.

In Sweden, there is a distinctly different pattern. Swedish industrial policy was more aggressive in the adoption (or theft) and improvement of foreign technology. This technology was then used to develop secondary manufactured goods for the world market. Protection was an integral part of these measures initially. But once the Swedish secondary industries achieved some measure of success internationally the protective tariffs were withdrawn.

In the sphere of foreign capital penetration the Swedish state has acted very differently from its Canadian counterpart. The Swedish industrialists drew freely and extensively on international finance capital of the portfolio type, but fought off attempts by foreign capital to control Swedish economy. One case, the iron mining complex in Lappland, serves as an illustration. It was English capital that in 1888 managed to acquire and build a railway to the iron fields of Lappland. Austrian capital

was also involved. But the State, in alliance with national capital, rebuffed the foreign capital interests. The Swedish mine operators whipped up "nationalistic sentiments" which eventually led to the bankruptcy of the English consortium. Later, legislation was passed (1916) which made it impossible for foreigners to buy mining property in Sweden. In 1949, a law was passed which made it possible to confiscate mining properties still owned by foreigners. In the following year, LKAB, the company in control of the Lappland iron fields bought the Austrian-owned mines which still remained. (Raw Materials Group, 1981)

Swedish industrial ventures are still based on domestic initiative and innovation:

> The bulk of accumulated capital assets and production capabilities are Swedish owned and controlled. Some foreign enterprise is present, but existing policies require that these fully comply with local law and operate in the national interest. In addition, a majority of board members must be resident citizens, and sales of foreign securities to foreigners are restricted. Furthermore, non-citizens cannot normally own any Swedish real estate, nor can they acquire or operate natural resource-based activities such as farms, forest lands and mines. These regulations are all based on the premise that the nation's economic potential can only be achieved through domestic control over resource development and allocation.
>
> (Larsen 1976, p.103)

This does not mean however, that Sweden is autarkic and isolated from world economic events. As indicated, Sweden has a highly open economy and its industries are highly involved in transnational activities.

The nature of Swedish investment abroad and foreign investment in Sweden is as follows: Swedish direct investment in foreign assets reached SEK (Swedish Crowns) 5 billion in 1982, an increase from SEK 1.1 billion in 1970. The employment at the foreign plant facilities was about 360,000 in 1983. Foreign direct investment in Sweden, on the other hand, was just above the SEK 1 billion in 1982. The foreign investment was concentrated in the wholesaling, engineering, chemicals and food processing industries and employed ten per cent, about 100,000 workers of the total industrial labour force. These figures may suggest that Sweden is exporting jobs or suffering from a "trade deficit" in jobs. This is not true. It is generally held that the expansion of Swedish subsidiaries abroad has resulted in net benefits for Sweden. The expansion of the market has meant new customers for Swedish producer and consumer goods. Branch plants have often served as customers of Swedish industrial imports and intermediaries for Swedish exports.

Sweden's success in export markets is based on two basic conditions: first, industrial know-how and second, an outstanding ability to adapt to international markets. In addition, the major part of all exports comes from a handful

of large transnational corporations. In 1984/85, these corporations accounted for over eighty per cent of all export revenues. According to the president of the Trade Council, B.H. Israelsson, the backbone of Swedish industrial expansion is the ten major export companies along with high-technology engineering firms and new firms in such fields as electronics, computers and biotechnology.

The present growth industries can perhaps best be identified by the high-priority industries singled out by the Swedish Trade Council. These include: Construction and energy (SWEBEX); offshore; automobiles; food (Food from Sweden); agribusiness; medical equipment including hospitals; interior fittings; material handling; electronics; and the forest sector. As can be seen from these, the mine product sector is absent while the forest product sector is only one of many potential and expected growth industries.

This should not be unexpected. The forest and mine product sectors have been declining relatively (although not absolutely) as sources of employment and revenue. Some observers even claim that "once our raw materials were an asset, but maybe they are now becoming a disadvantage" (Nabseth and Wallander, 1982, p.79) Such statements are not uncommon among Swedish industrialists and politicians. Flexibility to accommodate new technology and new markets as well as to remain one step ahead of the competition are

mentalities that permeate the whole society. This is a fundamental condition which should be kept in mind when considering the present restructuring of the Swedish economy.

The penetration of foreign markets by Swedish industrial commodities and branch plants cannot only be attributed to the historical events of the late nineteenth and early twentieth centuries.

Corporate, Political And Administrative Structures In The Formation Of Swedish Research And Development Policies, 1945-1986.

We have heard plenty of the full employment situation, the industrial democracy and the progress in the quality of work in Sweden. We may also have heard about the costs of these social programs. But we have heard less about the way in which (1) labour-management relations and legislation have been shaped to suit the needs of the Swedish industries and (2) labour market and social objectives and goals have promoted industrial efficiency. These processes rest on what is referred to as a "corporate incomes policy"; a policy which regulates domestic wages through centralized bargaining among labour representatives, management elites and government officials. The objective of incomes policy is to adjust domestic wages and prices in order to maintain industrial capacity, full employment and an industrial competitive status in world markets.

The conditions for the implementation of a "corporate incomes policy" were established in 1928 and 1939 when labour legislation set down the guidelines for collective bargaining and the penalties for strikes and lockouts. In this process the right of rank-and-file workers to accept and reject company offers was taken away and entrusted to union officials (Hulten, 1970). These labour officials have grown increasingly conscious of the industrial status of Sweden by actively encouraging industrial restructuring through the promotion of new technology (even through it may have been labour-saving), the training, retraining and movement of labour, and the discouraging of strikes.

But the unions have not only collaborated with the management to reach utmost efficiency. They have also responded to rank-and-file suggestions and claims. Three of the major claims which the central union (LO) has advocated and forced the government to adopt have been (1) full employment (2) the equalization of wages and (3) increased safety and participation in the work place. These objectives were fully integrated in the industrial strategy of Sweden in the early 1960's, under the so-called "Rhen-Meidner model." According to this model, the levelling of wages would create a "profits squeeze" which would force inefficient industries to close and "profitable" firms to promote further industrial efficiency. We find, in short, a pro-investment bias built into the labour market policy.

The labour force itself has been managed by the unions and the Labour Market Board (formed in the early 1940's) to meet the demands of industrial development. Today as much as 4% of the total GNP is spent on labour market programs. So-called welfare policies are also part and parcel of labour management. In Sweden, it is uncommon to consider welfare measures as distorting the allocation process and resulting in inefficiencies and slow growth. Instead, it is claimed that welfare measures have promoted the growth and efficiency of the industrial economy. Eliasson, of the Industrial Institute for Social and Economic Research (IUI), sponsored by the Swedish Employer's Association (SAF), puts it well:

> ...much of the Swedish [welfare] system has been very helpful in promoting economic growth. It is not difficult to argue that a healthier and more well-educated working population, one that can look forward to a prosperous retirement age, is a necessary ingredient in a growth economy.
>
> (Eliasson, 1982, p.184)

The particular way in which the Swedish forest and mine sector fits into this general picture will be explored in a later section. First, it is necessary to look at some of the general features of the Swedish R & D system; these features are important because, generally, they are instrumental in the operation of the forestry and mine sectors.

The central government in Sweden is highly centralized and depends on expert teams from employers' associations, unions, ministries and universities, to develop intricate analyses and long-term planning objectives. The Ministry of Finance in particular is responsible for the coordination of over-all policy and planning. Within the Ministry the Economic Planning Secretariat publishes long-term surveys and compiles data and information for ministerial budgets. The Secretariat is advised by various specialist bodies, including the so-called Planning Council (Ekonomiska Planeringsradet), established in 1962, a national independent advisory body, holding no executive powers, "as well as by a number of specialized committees concerned with regional development, training and education, and research." (Larsen, 1975, p.99)

Most of these specialist teams are corporate, that is, composed of members from business, trade unions, various interest groups, research institutes and government agencies. The formation and history of the Economic Planning Council is instructive. In 1948/49 a "collaborative committee" of the major corporations, the labour unions and the government was formed. The literal translation of the committee name was "The Collaborative Council for the Increase of Exports and Production." The committee, nicknamed the "Thursday Club," was chaired by the finance minister. Private industry had seven while the two

major unions (LO and TCO) had four representatives on the club. In 1955, the committee was disbanded and replaced by mutual discussions at the so-called Harpsund Conferences.

In 1962, the Economic Planning Council was formed for cooperation between the government, private industry, labour market organizations and social scientists involved in the long-term planning of the economy. The negotiations were secret and closed. Minutes were not published. Other councils, organized according to the same principles, have since been established. (Hulten, 1970, p.188) One important organization is the Research Advisory Board. It is chaired by the Deputy Prime Minister and acts as a forum for consultations between government spokesmen and persons representing the research community on the long-term aims of Swedish research policy.

The result is that representatives of the major participants in the economy take part in the planning of long-term policies aimed at particular goals. The great advantage of these corporate councils is that they serve as promoters of consensus and unified and technologically progressive industrial strategies.

It is on the foregoing political and social infrastructure that Swedish R & D policy has been forged. As in other economic and social fields all participants in society have taken part, and are taking part in the formulation and implementation of such policies. It is for

that reason we may state that Sweden has no explicitly stated scientific policy. The policy is implicit:

> Elle (la politique scientifique) est incarnee dans les faits par les puissantes institutions suedoises, les mecanismes de consultation et de prise de decision, l'importance et la direction des allocations budgetaries a la R-D et a l'innovation technologique. Le modele suedois de politique scientifique est celui du "Wissenschaft" qui est le mot allemand pour "politique scientifique" et qui signifie "science et culture." Comme tant d'autres traits suedois, ce modele est pragmatique.
>
> (Blais, 1981, p. 73)

Blais' statement provides a perspective from which the science and technology strategies in Swedish forestry, mining and associated linkages have to be viewed. R & D funds are funnelled through the Swedish ministries (departement) and agencies or boards (ambetsverk or styrelser). The ministries are relatively small units, mainly devoted to forming policy for the future development of the country. R & D forms an important part of that planning. The agencies and boards are sub-ordinated to the Government and ministries, but normally they are given a large degree of independence. The directives set out in specific acts, the Forestry or Mining Acts for example, have to be followed but the ways and means of doing so are left to the boards themselves. The boards are generally very large, well informed and exert considerable influence on the

course of the nation generally. There is thus a strong force of continuity in national social and economic policies.

The central budgeting plan, as noticed, allocates funds to the ministries and boards. It is then up to the boards to decide of what use the funds should be used. It is because of these conditions that Swedish research policy may be characterized as (1) sectorized, (2) decentralized and (3) pluralistic. The Swedes describe these characteristics as follows:

> Sectorization means that research is to be regarded as an instrument for achieving those goals which have been set up in different sectors. The research inputs going into different sectors have to be weighed against other alternatives for achieving the goals of each sector.
>
> Decentralization means that decisions implementing research policy are largely taken below cabinet level, ie. by the independent government agencies and by the research-performing organizations or bodies.
>
> Pluralism can be considered a corollary of the foregoing two principles; it means that research is financed through decisions taken in many different organizations and that the resources are channeled to those institutions which perform research.
>
> (Fact Sheets on Sweden, 1983)

STU, the national Swedish Board For Technical Development is a major force in Swedish R & D. It

represents a clear example of how the Swedish corporate system has called forth an integrative force in R & D. STU was organized in the late 1960's by the Social Democrats. The decision to establish STU was part of a larger scheme which involved setting up a department of industry, expanding the regional planning apparatus, and coordinating the operations of public enterprise with a state investment bank. What is crucial in this respect is that the push for these initiatives did not come from the business interests, but "upon the promptings of the trade unions." (Higgins and Apple, 1983, p.621).

The duties of STU are clearly set out in statutory regulations;

> follow technical developments, and keep in touch with research workers, institutions and enterprises,
>
> organize and support co-operation in applied research and industrial development work, and promote contact between authorities, industry, and research institutions,
>
> take initiatives towards technical research of importance for industry and the community, and promote such research and its utilization,
>
> plan and distribute governmental support in the form of loans and grants to applied research, industrial development work and invention activity,

follow the activity at, and supervise, research associations and other co-operative research institutions where research is carried out with the support of public funds,

advise inventors and communicate results of research for commercial utilization,

promote international technical co-operation, and in this connection co-operate with foreign institutions and international organizations,

plan and assume responsibility for the administration of governmental research stations, and

be responsible for the management of funds and administration of personnel for the Swedish Council for Scientific Information and Documentation (*Statens raad for vetenskaplig information och dokumentation, SINFDOK*) and for the administration of personnel for the National Swedish Development Foundation (*Statens utvecklingsfond*).

(European Research Centres, 1982, p.194)

What stands out in all points is the organizational and interactive role of STU. STU almost seems to work as a broker for various research institutes and other research agents. STU stands in close contact with these institutes and agents of STU pass on information from one to the other.

The information function of STU seems to have increased with time. After ten years of operation Director-General Tommer wrote:

> We are more active as brokers between small and large enterprises and researches and inventors. We are putting even more effort into creating the right technical and financial climate for innovation. The importance of our overseas work has dramatically increased, and Sweden's technical attache system has expanded again this year (1978) Cooperation with institutes in other countries has deepened and new instruments of collaboration are being tried out.
>
> (STU, 1978, p.5)

One cannot help but be impressed with the integrated and intricate network of communication between STU and other participants in the economy. Sweden's technical attaches report to a steering committee which stands in direct contact with STU, the ministries of Foreign Affairs and Industry as well as the Royal Academy of Engineering Sciences. STU also maintains liaison officers at Sweden's universities.

It would be impossible to understand the linked activities in the Swedish forest and mine product sectors without any reference to the wider politico-economic context. It is in fact, the features of the so-called Swedish model that we encounter at the micro or sectoral levels of forestry and mining. That should not mean, however, that an understanding of the successful linkage pattern in the forest and mine sectors is a mere exercise in reduction. Nor should it mean that the general model is a precondition for the implementation of the sectoral models.

It may very well be that some of the elements of the practices relating to science and technology in the Swedish forest and mine sectors are applicable to other political and economic contexts.

The Forestry Sector And Its Administration

The management of the forest resources on a sustained yield basis must be considered an important linkage to the forest product sector. It is often assumed that the necessity for reproduction is a contemporary concern. But the protection of the Swedish forests goes back to the county laws of the 13th and 14th centuries. The rules for the management of the forests are now stipulated in the Forestry Act. The Act, in traditional Swedish manner, entails strict regulation of many of the user rights pertaining to, rather than ownership of the resource. Trees felled must be replaced by new planting. Dense new and young forest must be cleared and thinned. Forest considered ready for final felling must be felled. There must be a plan for all forest properties. Finally, the felling of some land is subject to rationing. These are part of the measures behind the successful management of the Swedish forests.

The application of the Forestry Act is done by the Swedish Forestry Administration (Skogsvardsorganisationen) which is a branch under the Department of Agriculture. The

organization is composed of the National Board of Forestry (Skogstyrelsen), in Jonkoping, and 24 County Forestry Boards (Skossvardsstyrelser). Apart from applying the Forestry Act the Administration provides counselling for forest owners and information for interested parties. It also distributes state grants for forest management (silviculture, road construction) and partakes in the development of forestry and community planning. This may seem like costly activities but they are well covered by fees charged to customers who seek the services of the Forestry Boards.

The development of the Forestry Act and its enforcement by means of not only regulations but comprehensive aid and services is an important precondition for R & D policies in the forestry field. The Forestry Act is a national act but its enforcement is executed by local authorities who are in close contact with local producers. The combination makes for close consultation and a clear conception of the needs and gaps in forestry management. A very innovative climate seems to emerge in this context. Innovations seldom drop from the sky but are often the result of more general social and administrative conditions. Innovativeness is exhibited by all the different participants in the forestry sector. There are basically three participants. First, the state is involved through the Swedish Forestry Service (Domanverket) which is a trading agency and profit-making organization which administers the state's woodland and farmland

holdings. The state's forest land area constitutes about 26% of the total. The Forest Service collaborates with Assi, the State Forest Industries, which operates an extensive forest business. R & D based on the environmental and efficiency objectives set by the Forestry Act is performed and marketed by the Forest Service firm, Swedforest.

The second participant in the forestry sector consists of the 12 Forest Owners' Associations, the small holders of the private industry. These associations have a central organization, the Swedish Forest Owners' Association (Sveriges Skogsagares Riksforbund or SSR); in total, their 80,000 members own 49% of all forest land. The forest owners' associations form an important part in four basic fields: 1. conducting roundwood sales, 2. conducting felling and silvicultural activities, 3. processing the timber of their members, and 4. providing information and further education for their members. We can note that through these activities the forest owners' associations facilitate the measures necessary for their members to comply with the requirements of the Forestry Act. We may perhaps state that through the Forestry Act the forest owners are "forced" to become more efficient while the forest owners associations help them to achieve that objective. This takes place through cooperation and sharing of machinery, information, marketing and processing facilities. The forest owners as a

collective, in short, become more open and capable of absorbing the R & D measures necessary for meeting the national objectives of managing the forest on a sustained yield basis. The total picture conveys a picture of what Young refers to, in the context of the Finnish forestry sector, as a sociology of forest research. (Young, 1980)

The third and most important of the participants in the forestry sector are the forest companies which own 25% of the woodland. The backbone of these companies consists of the two largest forest firms in the country which own 90% of the company land. These companies are, of course, also subject to the management objectives set by the state. This has meant that the forest companies, with their great financial assets and R & D facilities, have been conditioned to demand producer goods and pursue R & D objectives which have been conducive to forest management on a sustained yield basis. The results have been impressive:

> The stock has risen throughout the 20th century and Sweden has probably never had as much forest as now. Annual growth is around 85 million m3 sk or 3.6 m3 sk/ha. The drain (fellings and natural mortality) has for some years been around 65 million m3 sk only.
>
> (Fact Sheets on Sweden July 1986)

The Swedes have not hesitated to take other than silvicultural measures to ensure a supply of raw material for the industries based on the forest resource. Waste paper is important as a raw material for the Swedish paper

industry. In order to boost the supply of waste paper, the government passed legislation in 1975 which made the collection of household waste paper mandatory. Since then the collection of old newspapers has increased threefold; this means that one newspaper out of every two is recycled. In 1984, roughly 11% of the fibre supplies to the paper industry consisted of waste paper (Swedish Forest Industry 1985, p.15)

It is not possible, then, to talk of an R & D policy in isolation from a wider politico-economic perspective. R & D is easy to perform; it is also easy to set aside a percentage of the national income for R & D. But to be effective there also has to exist a political and economic infrastructure which is conducive, responsive and capable of disseminating innovations.

Research and Development in the Forestry Sector

As implied, the Swedes consider the forest resource as a renewable resource, much the same as agricultural products. Forests are harvested, replanted, tended and then reharvested. Forest management is constantly improved upon. This is expressed by the recent merger of the College of Agriculture, the College of Forestry, the Veterinary College and the School for Forest Engineers into the Swedish University of Agricultural Sciences (Sveriges

lantbruksuniversitet). The Forest Faculty of the university is located at six locations and carries out a broad field of research. As much as 85% of the Faculty's budget is spent on research, only 15% on education. There is only one other university department, the department of forest yield research (established in 1968) at Umea University which operates outside the Forest Faculty of the Swedish University of Agricultural Sciences. Research is focused on regeneration methods and forest genetics.

Outside the university sector, research is performed by the Forest Operations Institute of Sweden (Forskningsstiftelsen Skogsarbeten) which is composed of a broad spectrum of parties interested in the forest resource, including the Swedish Forest Service (Domanverket), forest companies, mills and forest owners' associations. Costs for 1984/85 were 22.9 million SEK of which 9 million were state grants. Research was concentrated on improvements in 1) stand establishment, 2) stand care, 3) final cutting and 4) storage and transportation of timber.

A research institute of similar stature is the Institute for Forest Improvement (Institutet for skogs forbattring). This institute is financed by foundations, state grants and its own income from services. The 1984/85 budget was 21 million SEK of which 8 million was state grants. Research is focused on forest tree breeding and fertilization of forest soil. These research institutes are

concerned with the forest resource per se from the development of the tree seeds to the mature forest stand.

Education in the Forestry Sector

The 15% of total funds spent on education by the Forest Faculty of the Swedish University for Agricultural Sciences are spent in what seems a highly efficient manner. The university applies quotas in admitting students for certificates in forest studies and forest management and to the masters and doctoral degrees in forestry. These quotas seem to be a function of the needs of the industry, reflecting a streamlined system with efficient use of scarce resources. Umea University offers courses in forest yield and a private school in Filipstad offers a degree in forest technology.

The foot soldiers of the forestry sector are educated in the upper secondary schools where basic training (silviculture, felling etc.) is followed by special courses for machine operators, forest workers and foremen. The education is offered under the auspices of the County Councils at 26 locations in the country.

The comprehensive education of the forest workers, along with unionization, have made their profession fairly high paid and carrying considerable status. (Nova Scotia 1974, p.5) The forest workers, frequently being commuters, are compensated for transportation and, to a certain extent,

travel time. (ibid.) Forest workers are, in addition, employed permanently on a full-year basis.

The relatively good position of the forest workers has meant that rationalization and mechanization within the forest industry have been facilitated. The forest workers' union "takes part, in a viable and constructive way, in discussions and planning for the future policy, rural development, research priorities, implementation of work safety measures, forest mechanization and rationalization, etc." (ibid.) These measures have been agreed upon, even though lay-offs have occurred in the sector.

The president of the forestry workers' union, Arne Johansson, informed the author of the close ties of the union with various administrative and research agencies. The membership is the primary concern of the union but the union also participates and shows "great interest" in forest policy, particularly the economic, employment and environmental aspects of forest management. The union is represented by the president on the board of the Swedish University of Agricultural Sciences and by the secretary on the board of the National Board of Forestry. The union is also represented on the board of the Advisory Committee for Agricultural and Forestry Research. The union also has good contacts with the Forestry School at Umea University.

Johansson also states that the union has an instrumental part in the implementation of the Forestry Act

through its representation on most of the Forestry Boards. (personal correspondence, 1986)

Hektor has found that forest workers in Nova Scotia have a lower annual income status and prestige than their Swedish counterparts. Few forest workers have permanent and secure employment. The Nova Scotia forest industry also suffers from a rate of power saw accidents per volume unit that is more than six times higher than in Sweden. When Hektor found these conditions in Nova Scotia [1974] there was a serious shortage of forest workers in the province. He then concluded: "...the risk of accidents may be one essential reason for Nova Scotia's difficulties in recruiting and keeping forest workers." (Nova Scotia , p.6)

The comparison between Nova Scotia and Swedish forestry practices shows clearly that the human resource is neglected in the Nova Scotia case. In the Swedish instance, on the other hand, good management of forest workers and forests has meant good business. The forest in Sweden is now managed on a sustained yield basis. Forest workers are well integrated in this system through education and through a union which promotes technological efficiency in return for job security, relatively high wages and good working conditions.

Hektor has outlined how Swedish policies could be implemented in Nova Scotia. Hektor urged Nova Scotia to embark on a scheme to promote "Good Forest Management" and

stressed the importance of formulating and legislating long-term objectives which should then be implemented through administrative and educational means.

Hektor argued for the implementation of a forest management program with specified long-term and short-term objectives with support from all parts of the forestry sector as well as by legislation. Other elements contained in Hektor's recommendations included the implementation of training programs, cooperative plans with the Nova Scotia Woodlot Owners' Association and the forest companies, the promotion of safety measures, unions, tax incentives for wood owners etc. All these measures, according to Hektor, should be coupled with a drive to improve the productivity and efficiency of the forest sector. What we are faced with, in fact, is a microcosm of the larger Swedish model which is composed of an important social and political framework which is not only receptive but also conducive to research and development.

In August, 1985, the Swedish daily newspaper, Dagens Nyheter, carried an article on a 61-year-old forest worker, Algot Hermansson, an employee of a large forest company. (August 19, 1985, p.16) Hermansson may perhaps represent a more recent case of the conditions and attitudes of the Swedish forest workers. Hermansson expresses a fatalistic attitude towards mechanization and modernization. Although Hermansson continued with traditional methods of logging for

as long as possible, he finally gave in to the machines. In the process the forest emerged as something not only to be exploited but also managed.

> The forest has to be considered as a crop which is sowed and harvested. And I do feel proud when I see a young forest grow which I have planted myself.(Ibid.)

Hermansson does not romanticize the past. But nor does he feel the present is perfect. The machinery has led to new types of injuries;

> Injuries relating to vibrations result in worn out joints and aches in the neck back and arms. It is common to be overweight. [In addition] when you work with a machine, your body is tense and you hurry even though you may tell yourself to ease up. The sound and power from the machine speeds you up. You have to get dressed like an astronaut to go to work. (ibid.)

Yet the forest workers seem to have progressed. According to Hermansson the forest worker is now a professionally proud and knowledgeable person. The relationship between workers and management has undergone revolutionary change. This is not to say that the basic conflict between management and labour has disappeared. But, Hermansson claims, management is now concerned about workers agreeing to many decisions. "It has happened, more than once, that board meetings (where forest workers are represented) have been adjourned to reach a compromise."

The very condition of being respected and treated like a fellow human being not a "factor of production," is, then, very important to Hermansson.

The incorporation of the unions in the national planning and execution of economic and science and technology strategies is an important aspect of technological progress. The integration of the state, private enterprise and labour unions fosters a corporate atmosphere which promotes the pursuit and necessity of economic efficiency. There is always the danger, in this context, of the union bureaucrats being coopted and siding with the interests of private industry. But, so far the unions and rank-and-file workers have at least benefited from relatively high wages, secure employment and a safe work environment. Many interests of the workers have been looked after. And it is precisely in this field that R & D measures have been very intense. Examples abound. In modern forestry all the trees are felled in one direction in order to allow forest machines to work without losing time. The work is often dangerous, difficult and strenuous for the woodsman's back. Swedish innovativeness has solved the problem by inflating a felling cushion - placed in the cut - from the saw's own exhaust gases (STU, 1978, p.27) In some cases the stress on silviculture and work(wo)men's comfort combine to introduce new technology. Husgvarna has recently put a new saw on the market for clearing, that is removal of

young trees to improve the similarity of the remaining stand. The saw is small in diameter, circular and mounted on a long stem. The saw is much safer and less tiring than work performed by a conventional chain saw. (Forest Scene June, 1985, p.7) The corporate touch to technology is also echoed in the marketing slogan of the large Swedish companies which supply forestry equipment. Sandvik, for example, stresses four major characteristics of its products: comfort, safety, efficiency and economy.

Research, Development and Education in Wood Technology

Once the forest resource is harvested, other forms of research and development are applied. The Department of Wood Technology at the Stockholm Institute of Technology (Institutionen for trateknologi vid Tekniska Hogskolan (KTH)) carries out research in the areas of wood and board materials and production techniques in the mechanical wood products industry. It works closely with the Swedish Forest Products Research Laboratory (Svenska Traforsknings institutet) which is financed by the Swedish Cellulose and Paper Research Institute (Svenska Cellulosa och Pappersbruks-foreningen) and STU to the amount of about 90 million SEK (1984/85). This laboratory very closely resembles Minfo an equivalent in the mine processing industry.

Education in the wood industries is conducted on the same principle as in the forestry sector. There are about 15 upper secondary schools which offer courses in wood process technology. The largest and most well known for the pulp and paper industry is the National Paper School of the Educational Centre for the Wood Industries in Markaryd. Operating personnel for sawmills are educated almost exclusively at the National Sawmilling School in Skoghall. The centres in Markaryd and Skoghall also provide branch training for graduate engineers. In order to ensure that these institutions fulfill the needs of the industry the Employers' Association of the Swedish Wood Products Industry is the umbrella organization for all types of education at the centre in Markaryd. The government listens and responds to these needs through the Labour Market Board (Arbertsmarknadsstyrelsen or AMS). Post secondary education is concentrated in Stockholm, Gothenburg, Lulea and Skelleftea.

On the whole the educational structure resembles that of the forestry structure. Education is provided for all prospective participants and then streamlined for the particular needs of each subsector of the wood products field.

Vulnerability in Energy and Stringent Pollution Controls: Spurs to Technological Innovations

A recognition of vulnerability with respect to energy supplies has led to forceful measures to conserve energy and divert the reliance on fossil fuels to other energy resources. The Swedish pulp and paper industry has been forced to become very energy efficient. Figure IV conveys the drastic decline in the consumption of oil by the Swedish pulp and paper industry. The reliance on oil has declined by as much as 68% during the period from 1973 to 1983. The industry is now more dependent on wood waste and bark and to some extent peat and coal. "The pulp and paper industry now covers on average more than two thirds of its fuel requirements by internal production." (Swedish Pulp and Paper Mission, 1985, p.10).

These measures while initially "hurting" the industry are now providing a competitive edge to the Swedish industry. The Canadian industry has also recognized the importance of energy-saving but even more force should be taken; the sooner this recognition is made the better the chances are for Canada to reach the competitive position of a broad and diversified inter-linked industrial system in the forest product sector.

Energy saving, of course, extends beyond the pulp and paper industry. It also forms part of the larger national effort to become more energy-efficient. And forests, as a source of biomass, constitute an important part of this picture. According to Lars Roy, executive director of the

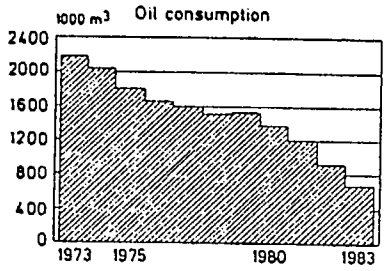


Fig. IV Consumption of oil by the Swedish pulp and paper industry, 1973-1983. 1 m3 ≃ 250 gallons

Source: Swedish Pulp and Paper Mission. Stockholm: Swedish trade Office, 1984, p. 22.

National Board for Energy Source Development (NE): "Forestry energy (including logging waste) tops the list of our energy options. By 1990, 20% of our energy could come from forests." (Hinrichsen and Kayfetz, 1981, p. s-6) Sweden is now also making plans and studies of the potential for establishing high-yielding energy forests. (ibid) We once again note that the linkage attached to the forest resource is not set by the nature of the resource itself; R & D and ingenuity set the horizon for potential use. Resources are not, in other words, they become. A similar story can be told in relation to pollution control. From 1963 to 1973, the Swedish pulp and paper industry increased its output by seventy per cent. At the same time the amount of pollutants was reduced by sixty five per cent. (Sandbach, 1980, p.208)

The environmental improvements did not stop in 1973. Stockman, writing in 1985, claimed that "there are few technological fields within the pulp and paper industry which have received so extensive R & D activities during recent years as the environmental fields." (Swedish Pulp and Paper Mission, 1985, p.15) Although pollution still exists, it has been reduced considerably. The discharge or oxygen-consuming substances and fibers into the Swedish waterways by the pulp and paper industry for the period of 1955 to 1985 is shown in Figure V. The total emission of sulfur to the air form the pulp and paper industry can be seen in Figure VI. In all, one cannot be but impressed with

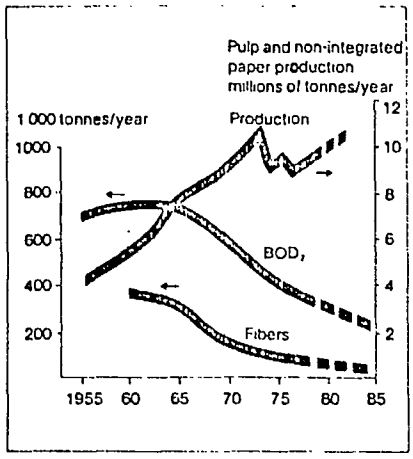


Fig. V Discharge to waterways of oxygen-consuming substances and fibers for the Swedish pulp and paper industry, 1955 - 1985

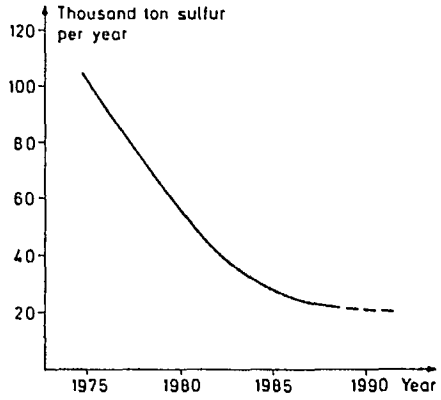


Fig.VI The total emission of sulfur to the air from the Swedish pulp and paper industry

Source: Swedish Pulp and Paper Mission. Stockholm: Swedish Trade Office, 1984, pp. 22-23.

the progress. The progress in turn would not have been possible without government intervention and the setting of stringent anti-pollution standards. Undoubtedly, the implementation of these anti-pollution measures constituted costs to the industry. But these measures also built up a technology against pollution which not only contributed to a clean up of the environment but also to the diversification and promotion of new export commodities. Flakt Canada Limited for example, a subsidiary of Flakt AB in Stockholm, sells pollution control systems to the Canadian pulp and paper industry. This business will undoubtedly grow as the Canadian industry will be forced to adopt more sophisticated anti-pollution measures.

The Administrative Structure of the Swedish Mining Industry

The political and administrative framework of the mining sector is a lot simpler than that of the forest sector. Mining falls under the jurisdiction of the Department of Industry. The National Industrial Board (SIND) is the central administrative authority which, among other things, deals with matters relating to mining, minerals, industries and minerals policy. Within SIND, the State Mining Property Commission (Namnden for statens gruvegendom) administers state mining property to various private concerns. The commission relates almost exclusively with the Swedish Mining Association (Svenska Gruvforeningen)

the central organization for all Swedish mining companies. Foreign mining companies are excluded; foreign nationals or foreign legal entities may not claim mineral deposits or acquire or work claimed mineral deposits in Sweden. Mine managers must be Swedish citizens.

The exclusion of foreign capital in the mining (and indeed the forestry) sector has had far-reaching implications for the linkage pattern in the industry. Potential foreign mining companies have not been able to establish mines in Sweden and then extend forward and backward linkages to the home base, a pattern which is all too familiar in the Canadian situation. Instead, Swedish mining companies themselves, in cooperation with local suppliers, have been able to extend backward and forward linkages locally. Examples abound, but perhaps the most prominent case is Atlas Copco, manufacturer of compressed air equipment for the mining industry. Atlas Copco cooperates with Sandvik, producer of, inter alia, specialty steel which is used in the companies' world renowned rock drilling products.

Underground mining is the most common in Sweden. There are only two open pit mines. As a result the Swedish mining industry has demanded, and received, highly efficient mining machinery from several manufacturers. High wage rates for miners have also prompted the development of labour-saving machinery. Bergdahl states:

> The high wage rates have speeded up a high degree of mechanization using heavy equipment. Sweden is one of the leading countries with respect to the development of techniques in underground mining. This is due to, inter alia, the traditionally good cooperation between mining companies, manufacturers of mining machinery, universities and research institutes.
>
> (Bergdahl, 1985, p.156)

There is no doubt that the restrictions on foreign capital investments have encouraged the close cooperation between various participants in the mine product sector. No foreign mining companies, with linkages to their own machinery suppliers and smelters, have been allowed to establish in Sweden. This condition has forced or encouraged the development of a national primary and complementary secondary manufacturing base. Intercorporate, state-industry, labour-management collaboration have been instrumental ingredients in this process.

Atlas Copco AB is a good example of a company which has grown from a local supplier to an international business supplying sophisticated mining equipment and machinery. Atlas Copco works in close alliance with Sandvik, both incorporating Sandvik steel into their products as well as selling Sandvik drill steel on the international market. Intercorporate integration has also led to the development of integrated mining systems which are custom-made for particular clients. Atlas Copco, along with many other

Swedish industries, have realized that a particular product can only be perfected so much and, in addition, it can be copied readily by competitors. Atlas Copco therefore concentrates not only on selling products but also knowledge and advice pertaining to the product. The company sells both hardware (the physical product) and software (knowledge and service). The latter has become a major competitive weapon. (Eliasson et al, 1985)

Corporate structures, composed of state, union and management representatives, also exist within the mining industry. The unions have their say in the management of the industry and, in turn, they reciprocate in cooperating in whatever structural rationalizations are necessary for continued efficiency.

We may note the comments of one representative (belonging to the Communist Party) of the miners' union during the LO (the central union) congress of 1966. The representative had the following to say about the past and expected rationalizations of LKAB (the state-owned iron ore company in Northern Sweden):

> We are also...prepared to undertake powerful measures to participate in the structural rationalizations which already (1966) have resulted in LKAB of Norrbotten having doubled its production and cut its labour force by one thousand men.
>
> (Hulten, 1970, p.191)

Such responses have only resulted from cooperation, care for the miners' working conditions and living standards and more recently, co-determination (the legislation which gives workers representation on the boards of governors of companies).

Research and Development and the Mining Industry

Minfo, the Swedish mineral Processing Research Foundation, is an example of R & D efforts being shared, executed and performed by industry, government and the universities. Minfo's general aim is to promote R & D in the mineral technology field in cooperation with the National Board for Technological Development, STU. Minfo was formed in 1976 and its programme funds come from private industry (60%) and STU (40%). The programme for 1983-1985 was estimated at SEK 5.2 million of which the private members of Minfo contributed SEK 3.12 million and STU SEK 2.08 million. Minfo, on the surface, may not appear to be anything special. But a closer look at its political and economic context provides a different picture. Minfo is very will integrated with the total R & D effort in mineral processing, making possible a good return on what initially appears to constitute very little money. Minfo's programme board consists of members from mining companies, the mining companies' central organizations, STU nominees and university professors. One member in the latter category,

Professor E. Forssberg from the Department of Mineral Processing, Technical University, Lulea claims that "in general there is a rather close collaboration between industry and the university." (personal correspondence 1985)

The close ties between STU, the industry and the universities allow for the identification of research fields which are not covered by other research teams. Indeed, "the research programme is drawn up after a survey of current requirements with regard to other research projects in progress." (Minfo, 1985, p.2) The 1983-1985 programme was grouped as follows:

> 1 Handling, homogenization, communication, grinding and crushing of minerals.
>
> 2 Separation processes, process control
>
> 3 Water treatment, reuse of process water, de-watering. (ibid.)

These projects are not only prompted by a search for economic efficiency and profits but also to satisfy the demand for improved working conditions and a cleaner environment. One project for example, centred on dust-proofing technology while another project focused on the reuse of tailings pond water.

Apart from Minfo, the Swedish Mine companies perform collective research and development on their own through the Swedish Mining Association (Svenska Gruvforeningen).

However, since LKAB, the government owned iron ore company, is also a member there is considerable participation. We observe, once again, how cooperation within the industry is a major characteristic of research and development. And through this cooperation, adversity, in the form of government regulations (such as anti-pollution measures) or natural constraints (such as low-grade ore) have been overcome through collective and forceful R & D measures.

Boliden, a Swedish company involved in mining, metal production, chemicals, international trading, consulting and marketing is a company which through adversity has come out as a world leader in many fields of mining. The long history of mining in Sweden has forced the company to concentrate on marginal ores. As a result, Boliden has built up a unique fund of knowledge and expertise in mining and processing low-grade, complex and relatively small ore deposits that might otherwise have been deemed uneconomic. (Mosey, 1985, p.50) Boliden also operates a "clean" smelter on the Gulf of Bothnia. In this case "Boliden executives boast proudly of the results of the massive cleanup they were forced to undertake in the wake of legislation passed by the parliament (Riksdag)." (ibid.) The key word in the quotation is forced; government intervention in the case of the Boliden smelter was not detrimental to the company. Instead it forced technological innovations and anti-pollution measures which have played a part in the success

of Boliden. The example calls to mind the expression of a company official with the Cominco smelter in Trail (B.C.) in the National Film Board production "Wher're You Goin' Company Town" (1975). The official responded when queried on the topic of pollution control and workers protection, "It takes time to change us." The message is instructive. Industries are not likely to invest in pollution control and workers' protection by their own initiative. The Boliden and many other examples show that government intervention is necessary. It also shows that an initial cost and cut in profits may turn into an advantage by forcing increased efficiency. That efficiency, with all its spin-offs, may, in turn, be used as a tool in promoting export sales in commodities and services. It also contributes to the ability to establish branch operations in other parts of the world. Boliden, for example, now operates mining operations on the Canadian Shield.

At the iron mines in Kiruna, Kiruna Truck, employing just under one hundred workers, has produced diesel powered trucks since 1959. During the recession of the mining industry the company was acquired by the state agency Regioninvest (1979). Now, Kiruna Truck makes low-profile, short-wheelbase articulated trucks used in underground mining and tunneling and in the steel industry. The trucks are used in the government owned and operated iron mines in Kiruna and the state owned steel mill in Lulea. But export

markets have also been developed. Eighty per cent of sales is for export to twenty-four different countries. Kiruna Truck's latest development is a wholly-electric truck. It moves almost anywhere in a narrow mine, climbs sharp inclines and emits no exhaust fumes. Kiruna Truck represents a good example of an industry linked to mining which has grown to the extent of not being dependent on its initial market. Kiruna Truck also represents an example of a widely known occurrence in Swedish technological development: the state-owned mines and steel mill served as testing grounds for the trucks and one of the Swedish large transnational corporations, ASEA, an engineering company, cooperated in developing the electrical truck. (Kaza, 1985, pp.29-30)

The Kiruna Truck example is not representative of what has existed in the iron mine fields of northern Sweden. The lack of diversification has been typical of the northern Swedish economy. The mines have been production oriented, that is, geared to extract and sell the iron ore. In the late 1970's and early 1980's this strategy proved disastrous (as in Canada). Lay-offs were massive and stock piles increased. Today (1985), LKAB is again profitable and hiring workers by employing a marketing strategy seeking out particular customers and supplying partially-processed ores. Ingemar Pessa, Kiruna's economic secretary, provides the creed to which the local economy now adheres: "The lesson is

that if we have a raw material, we must process it as far as possible, do as much as we can ourselves up here."(ibid., p.30)

The foresight of LKAB has yielded the company a name as a supplier of products and services in the mining equipment industry. LKAB International Canada Incorporated serves as a consultant and supplier of underground rail haulage systems and equipment to the Canadian market. (Swedish Subsidiaries in Canada, 1985/86, p.40) The vice president, Mr. Leif Holmvall, is well acquainted with the Canadian market having served as Swedish Trade Commissioner to Canada and having written, as a consultant, a publication entitled Business Opportunities in Canada - Today and in the Future, (1984). (Newsletter, Swedish-Canadian Chamber of Commerce, No.2 September, 1984)

Export Promotion in the Forestry and Mine Sectors

In 1982/83, Swedish exports to Canada consisted of 1.2% of total exports. That figure was up 30% from the previous year. Canada was the 9th fastest growing export market during the year. During 1984 Canada absorbed 1.3% of Swedish exports and was the 4th fastest growing market. During the first half of 1985 Canada was the 3rd fastest growing export market with 1.6% of the total Swedish exports. Although the Canadian market is relatively small for Swedish export industries, it still constitutes a very

important market of growth. In addition, the Swedish Trade Council recommends that industries before entering the American market, first establish in Canada. The Canadian market is considered a less competitive, indeed protected, market where Swedish industries can get accustomed to overseas operations before entering the more lucrative, but more competitive U.S. market.

Canada thus exemplifies a small but growing export market for Swedish industry and technology. What is Sweden doing to gain a foothold in such a market? The answer may very well provide guidelines to the very important question associated with any form of R & D, namely, how to market and adapt it to foreign customers. This is indeed important for "the most effective way to increase the probability for R & D leading to economic success is to improve the integration between research groups and marketing agents." (Anderson, et al, 1982, p.93).

The Swedish Trade Council (Exportradet) and its various trade offices around the globe promote the Swedish export industries. The Trade Council is unique in that it is operated and sponsored jointly by the state and private industry. For the fiscal year 1984/85, the trade council received the following operating funds in order of importance:

	Millions of Swedish Crowns
1. Government appropriations	179 (52%)

2. Revenues from assignments carried out for the business community	117	(34%)
3. Funding for Swedish project exports	25	(7%)
4. Subscription fees etc.	22	(7%)
	343	Total

The joint operation of the Trade Council is held out to be of important advantage. The trade offices around the world are not only formally tied to the embassies and consulates but can also act as "official representatives of Sweden." The official status facilitates contacts with foreign governments, a condition which is reinforced by high ranking government officials accompanying many missions organized by the Trade Council.

In the sphere of the marketing of goods in Canada, the Swedish Trade offices play a prominent role. In 1984/85, for example, the trade offices proposed several export promotional programs in Canada. The activities were divided into ten major branches, the forest industry, the pulp and paper industry, the metal working industry, the mining industry, energy, health care, the construction industry, transportation and communications, hardware and banking.

The purposes of the activities in the forest and mine product sectors are worth stating; they indicate that the initiative and flexibility exhibited by private businesses is also aided by heavy export promotion by the state.

In the forest industry four programs were launched with the purpose of

1. establishing and deepening contacts between Swedish suppliers and Canadian decision makers in the forest industry.

2. surveying pertinent marketing data such as structure of market, size and growth of market, distribution channels, sales forecast, costs, financing and local production.

3. promoting silvicultural machinery and technology.

4. organizing a study tour to Sweden to visit modern reference installations for sawmill and remanufacturing equipment.

In the pulp and paper sector three programs were organized with the objective of

1. promoting pulp and paper equipment and technology.

2. establishing and deepening of contacts between Swedish suppliers and Canadian decision makers in the pulp and paper industry.

3. exhibiting Swedish pulp and paper and silviculture equipment and technology.

In the mining industry similar programs were organized, i.e. to deepen the contacts between Canadian mining companies and Swedish suppliers of mining equipment. There were direct promotional programs supporting the Swedish forest and mine product sector in Canada.

In the most recent annual report of the Trade Council it was reported that these efforts bore fruit. The "buyers trip" to Sweden by a group of mining officials resulted in increased integration and sales of mining equipment. The forestry sector also undertook a Pulp and Paper Mission to

the United States and Canada which gave the Swedish industries opportunity to establish comprehensive and broad contacts with the North American industry. A five-hundred page publication with the most up to date Swedish technology was published and circulated free for the occasion. The publication was a joint effort to market high technology by the Swedish Forest Products Research Laboratory, private companies and the Swedish Trade Council. We once again note how integration and synchronization of efforts between various actors combine in a major marketing effort.

In the sphere of silviculture the Swedish industry has also shown the same prominence in the Canadian market. Peter Morley of The Forest Scene reported in June 1985 that the "increasing importance of silviculture in Canadian woods operations over the past few years has led to a Scandinavian invasion of trade shows and conventions." (June 1985, p.5) Machines cleaning up logging residue, creating trenches for the draining of bogs, and planting trees were some of the items exhibited by Swedish and Finnish industries.

The integration of R & D and marketing is perhaps the most impressive aspect of the national and international marketing of Swedish wood products. Wood Information (Trainformation); an official marketing agency publishes detailed and comprehensive accounts on the treatment of wood and the use of boards, plywood, chip and fibre boards. The information service caters to the construction industry.

Wood Information also works in close co-operation with the Swedish Finnish Wood Council which promotes export sales of Swedish and Finnish wood products. The frequent pamphlets supplied to the British market contain reference to British standards and how they can be met by Swedish and Finnish wood products in terms of sawn timber, sizes, durability, preservation, moisture content, and performance in fire and processing. Advisory notes from the Swedish Institute for Wood Technology are also published, keeping British customers informed of the most recent methods of handling Swedish wood. The most recent publication, for example, contained advice on machining two Swedish tree species: Nordic Joinery Whitewood and Whitewood. The rapid dissemination of research and development not only nationally but also internationally appears not to disadvantage the Swedish export industries. R & D results are not guarded secrets but used effectively and rapidly to promote the sale and use of Swedish wood products. R & D, put simply, is an effective marketing tool. This example may very well provide us with an answer to the readiness of Swedes to provide information about the Swedish model in general. The provision of information is good business.

It is also interesting to note that the unions, at least from a public relations point of view, are involved in the marketing effort of some companies. Advertisements, announcing the growing expertise of LKAB in technology for

offshore gas and oil exploration, are now signed by the company, a corporate body, the municipalities and the labour unions. (Sweden Today September 1985,p.14) Once again, even if questioned by some observers, the team spirit of industrial ventures is conveyed.

Another example of the coordinated production and marketing efforts is provided by the corrugated board sector. The Swedish Development Group for Corrugated Board (Svenska Utecklingsgruppen for Wellpap, hereafter SUW) is one joint effort by the state-run forest company, Assi, and three private forest companies to develop durable but cheap corrugated board. The purpose of the research organization conveys clearly the strategy of not only developing a commodity but also promoting its wide-spread use. The objectives are to:

> study the influence of the properties of the raw material on the properties of the end product; follow and take part in the work of standardization of corrugated board in domestic and international organizations; study the present and potential fields of application of corrugated board and promote increased usage; study factors influencing and interfering with the conversion of corrugated board into packages. (European Research Centres, 1982, p.1299)

SUW works in close operation with the Swedish Packaging Institute (Svenska Forpackningsforskningsinstitutet) which deals with a whole range of activities associated with

packaging materials. The latter institute is funded by the state and performs contract work for private industry.

Perhaps the most interesting aspect of SUW, apart from confirming the close interaction of the state and private industry, is the practice of disseminating the data quickly to the production floor. In this way a two-way informational flow occurs. As stated in one publication: "SUW arranges information meetings at corrugated board factories where the research workers have the opportunity of direct communication with the production workers." (ibid.)

The public and collaborative efforts of marketing are complemented by a very coordinated network of private marketing. These efforts are conducted by a series of associations which embrace virtually the whole forest and wood product industry. The headquarters of these associations are located at one site in Stockholm. (See Table IV)

Table IV

Private Marketing Organizations In The Forest Product Sector

1. The Swedish Pulp and Paper Association
   Svenska Cellulosa-och Pappersbruksforeningen.
2. The Swedish Wood Exporters' Association
   Svenska Sagverks-och Travaruexportforeningen.
3. The Swedish Wallboard Manufacturer's Association
   Svenska Wallboardforeningen.
4. The Swedish Particle Board Association
   Svenska Spanskiveforeningen.

5. The Swedish Plywood Manufacturers' Association
   Svenska Plywood foreningen.

The concentration in Stockholm on Villagatan provides for close integration, contact and collective strategies to capture international markets.

How Important Are Public Policies For Swedish R & D?

An isolated look at the Swedish industrial lobby and interests was performed on a limited scale by the author. A questionnaire was sent out to the various Swedish companies involved in the Canadian forest and mine product sectors. (See Appendices I & II) One set of questions probed the company officials to state the public policy measures from which they had benefited in developing and marketing their technology-intensive materials. The responses were similar across the board. Technological progress and success were not seen as having benefited form public policies, be they related to social, science or technology issues. This is not surprising. Industrialists are more likely to play up their own initiatives and efforts in promoting technological progress. This is how they perceive their situation and the statistics on R & D expenditures seem to support them at a first glance. In 1983/84, for example, Swedish transnational corporations were responsible for over 70% of total Swedish expenditures on R & D. The share of total Swedish exports and employment of the same corporations stood at 58 and 49% respectively, indicating the great effort put on R & D. (IUI, 1983/84, p.58)

If we look at these figures on a smaller scale a similar picture emerges. The IUI has documented the labour costs for a typical large engineering company. The major

suppliers to the forest and mine product sector, such as Sandvik, Atlas Copco and SKF, fall into this category. (See Table V) A few points are noteworthy in the table. First, only 51% of all labour costs are taken up by production per se. Secondly, R & D, design, construction, documentation and marketing constitute 49% of all labour costs. Industrial expenditures in these fields, in other words, are comparable in size with the cost of machinery and plant facilities.

Evidence also suggests that smaller companies follow the same strategy. After the restructuring of the stainless steel industry in 1984, for example, one such company Avesta Projects AB, emerged. Avesta specializes in process industry construction and spends only around 50% of its costs on the actual manufacturing process. The remaining 50% is spent on scientific research, product development and marketing. It is for that reason Avesta employs a wide variety of skilled personnel, including marketing engineers, metallurgists, chemists, design and construction engineers, procurement experts and skilled expediting officers. (Sweden Today, September, 1985, p.2)

The Avesta case study confirms a general conclusion made by Fredriksson and Lindmark (1979) who claim that the extensive network of Swedish subcontractors are not mere appendages which are dependent on, and nurtured by, their contractors. They are, in fact, often more advanced

TABLE V

The Cost of Labour in a Typical Large Swedish Metal-Working/Engineering Company, 1982.

	Percentage of Total Labour Costs
Research and Development	10
Design, Construction, Documentation	15
Work Preparation (e.g. raw material and production planning)	4
Production	51
a) direct*	(25)
b) indirect**	(26)
Marketing and Distribution	10
Administration	9
Other	1
Total	100

* Includes the cost of the actual production of the commodity.

** Includes the cost of supervision, maintenance, quality control, storage and material transports.

Source: Industrins Utredningsinstitut, Verksamhetsberattelse, 1983-1984. Stockholm, 1984, p. 95.

technologically and better able to cope with temporary recessions than their contractors.

The Swedish technological strength of small companies is also confirmed by the questionnaire sent out to the Swedish subsidiaries in Canada involved in the forest and mine product sectors. The majority of these industries are small and responded consistently that their move into the Canadian market had not been determined by their connection to larger corporations. They were, in other words, not pulled to the Canadian market by the large corporations but came on their own initiative. The replies of the large corporations conveyed a similar picture. Their responses indicated they did not pull any smaller Swedish companies along with them to Canada.

It should perhaps also be pointed out that the Swedish Trade Commission was not implicated as playing a role in the decision to establish branch operations in Canada; this applies to both the small and large companies.

The ultimate picture we end up with pertaining to technological research and development efforts in the Swedish private sector is as follows: The expenditure is high and extends to large as well as small companies. The initiative to market technology-intensive products is most commonly taken without the aid of the state. The above discussion may very well lead us to conclude that R & D follows more from the decisions made by private

entrepreneurs than from public policies. But this is not true. Public policies not only confined to R & D but also to social and administrative areas seem certain to have affected the investment behaviour of industrial concerns. The co-operation between state and industry, as noted previously, was intricate and heavy on the local scene. Indeed, had not the public policies occurred at the local scene, it may very well have been that international penetration and success would not have been possible. Sweden's Trade Commissioner in Canada, Jorgen Casper, claims that "Sweden's achievements as a manufacturing nation since the Second World War came about because of the commitment of Swedish business and government to developing home-grown industries." An economist refers to Swedish industrial policy as falling under the term "niche strategy": "...along with an emphasis on engineering technology, education and low tariffs, Sweden has long practiced the art of building on its own real strengths and identifying potentially high-growth international markets. (Steed, 1985, p. 81)

There is no doubt the Swedish investment climate has contributed to the implementation of the "niche strategy." The founder of IKEA, the Swedish retail chain in furniture, for example, refers to corporate taxation in Sweden as sound and proper and giving the companies the opportunity to save for future investments. (Svenska Pressen, 1985, Nov. 14, p.

7) The Swedish bureaucracy is "working" and not impeding industrial growth. (ibid.)

Outstanding Benefits Accruing to Sweden From an Extended Industrial Linkage Pattern

The perhaps most important benefit accruing to Sweden from up-and-down-stream linkages pertain to employment. The resource sector, as Williams has pointed out, is very capital-intensive. (Williams 1983) It may even, so Williams contends, be linked to the very high unemployment rate in Canada. In Sweden, on the other hand, the extension of the linkage pattern has provided for a more extensive and diversified industrial and employment structure. Unemployment at present is around 3%. We should recognize that the industrial linkage pattern is not only responsible for a low unemployment rate. Labour market policies are also responsible. On many occasions, however, labour market policies are aimed at extending industrial linkage patterns.

Sweden also benefits from a linkage pattern which extends beyond mere economic activities. In Sweden the forests are used heavily for recreational purposes. Sweden, like Norway and Finland, subscribes to the common access prerogative which means all people have access to private land. Swedes ski, walk, pick berries, flowers and mushrooms and practice orienteering throughout the year in the forests. A study of the Nature Conservancy authority has

shown that among urban residents between the ages of 18 and 65:

- 8 out of 10 individuals walk in the forest now and then each year.

- 4 out of 10 individuals take walks in forest more than 20 times a year.

A similar picture emerges if we look into the past. This is expressed in Table VI for the year 1963.

Silvicultural measures, in this context, are a sine qua non. The average Swede would be appalled by the state of the forests in many parts of Canada. At the same time, however, good forest management is good public relations and promotes the concept of the forest as a source for multiple purposes. This is also the case for other economic activities related to the forest resource.

In 1975, Environment Canada completed a study of the wood driving operations in Canada. The report identified a number of resource-user conflicts relating to water quality, physical damage to fish spawning grounds and physical interference with recreational activities such as swimming, fishing and boating. Several actions were taken to remedy the situation, one being the arrangement of a trip to Scandinavia to study wood driving practices.

The observations of the study team visiting Sweden are instructive. The team reported that the "Scandinavian river drives are very well organized and run by experienced drivers working with the most up-to-date equipment probably

Table VI Comparison between the Prevalence of Outdoor Activities and the Desire to Increase the Activity Frequence in Sweden 1963.

Outdoor Activity	% of those questioned who have carried on the activity in the past year	% of those questioned who want to begin practising or to increase their practice
Forest walks, go mushrooming and bilberry picking	85	19
Other types of walking for exercise	75	7
Swimming	67	11
Fishing	41	15
Skiing at home	35	14
Ball games, disregarding tennis in summer	28	3
Fjeld skiing	10	21
Tracking and cross-country running	7	3
Tennis	6	9
Riding	2	6
Golf	2	5

Source: Technical Research Based on Consumers Needs, Demands and Wishes. Stockholm: STU, 1972, p. 162.

more advanced than is encountered on Canadian drives." (Environment Canada, 1978, p.59) The team reported further that the problems encountered in Sweden were currently focussing their attention on the pollution effect of bark and its soluble components. The team suggested that many sophisticated Scandinavian driving techniques could be put to good use in Canada. Swedish pollution controls were particularly impressive:

> As far as pollution and the environmental effects are concerned, it can be suggested that Canadian drivers could emulate their Swedish confreres in making even more greater efforts to share the river resources more equitably with the public. Driving has not been proved to endanger the water quality of Canada's larger rivers, but more frequent sweeps to gather up deadheads, keeping channels open etc., would minimize the visual pollution resulting from drives and result in their being more generally accepted as they are in Sweden and Finland. (ibid.)

We see, then, that also in this instance good management results in a good public image and therefore, promotes more harmonious growth with competing users of the resource.

The importance of linkages locally or nationally may also prove useful in international expansion. This has become important in Sweden's export drive in South East Asia. One example in the forest product sector is telling. In the late 1970's Malaysia experienced a series of

shortages in matches. The government made inquiries in Sweden and in 1981 Swedish Match moved in, purchased a local producer, threw away most of its out-dated machinery and put in second-hand match production equipment from Sweden. In 1984, Swedish Match had captured 50 per cent of the Malaysian market. But this was not all. According to manager Nygaard-Ostby the company made a small profit in match making but the prospects of other sales and production seemed better. The subsidiary's presence in Malaysia opened up the door for other wooden building components such as flooring, doors and kitchens. (Sweden Now, 5/1985) The lesson is clear. A diversified national economy in search for foreign market outlets has an added advantage over a less diversified economy. Canada, for example, does not lack in ingenuity and R & D efforts; these efforts are, however, biased in favour of resource exploitation and so-called mega projects. Canadian resource and engineering companies are involved heavily in such developments in the Third World. These expansions could provide vehicles for the export of more down and upstream linkage commodities.

Drawbacks

The shortcomings of the Swedish model and its associated R & D structure are complex. The 1970's were not successful in growth terms for Sweden. The growth rate of the economy was well below that of the other OECD countries.

The many reasons for the recession and the relative poor performance of the economy are difficult to examine objectively.

In terms of the Swedish forest product sector, there can be no doubt that the increased competition from new producers has played a part. The Boston Consulting Group claims Sweden is disadvantaged primarily by the physical characteristics of its forest and secondarily by high wage rates. These conditions are much more favourable in places such as Brazil and Southern United States. The same source renders a similar conclusion to Sweden iron ore. (Boston Consulting Group, 1979, Appendix 4)

The recommendations of the Consulting Group were for Sweden to concentrate more in those areas where she still holds a comparative advantage. These areas would include the so-called high-technology fields which today are in the most dynamic growth. Swedish industrialists and politicians feel, however, that so-called "structural rationalizations" should maintain the forest and mine product sectors as capable competitors in the world market.

During the 1970's the Swedish industrial complex did not, as stated earlier, manage to maintain a relatively high growth rate. Some observers claim that the reason was the misguided concern for ailing industries (such as the ship building industry) and the maintenance of full employment. The many publications of IUI advocate this viewpoint. The

alternative strategy advocated in many ways challenges the so-called Swedish model. In other ways, however, it is quite consistent with past policies. The following points are listed by IUI as necessary for a future policy package:

> 1. A curb on public sector growth to restore public fiscal balance. This will lead to a temporary increase in open unemployment.
>
> 2. A return of labour market mobility policies from the 50's and 60's to achieve an appropriate supply of skilled labour to growth industries.
>
> 3. Subsidies to crisis firms have to be more or less completely removed during ongoing economic upswing, never to return again in the following slump. Much of the installed capacity in these industries will then be scrapped - but not all - and labour will have to find more useful employment elsewhere. This last measure is probably the critical one for a return of the Swedish economy to a healthy growth path.
>
> (IUI, et al, 1984, p.178)

In another context IUI has claimed that one of the most important tasks performed by the state must be as "a guardian of the rules that guide market processes (the market environment) in which firms and individuals act in order to achieve efficient resource allocation." (ibid, p.11) The IUI is referring to a stable and mobile labour market.

But while these policies echo the policies of the past, they have also been coupled with low wage increases, a

concern for efficiency at the expense of safety, higher unemployment and increased prices of consumer goods (in part due to repeated deflations of the Swedish Crown). There are, in other words, signs of weaknesses within the Swedish model.

Ultimately, the potential threats to the Swedish model are external. These external pressures stem from what some scholars refer to as the new international division of labour (NIDL). The NIDL describes a single world market for labour and for industrial sites which effectively encompasses all nations. (Wolfe, 1984; Frobel et al, 1978) The emergence of the NIDL has been made possible by several conditions. Improved transportation and communications technology has reduced transfer costs. It is now technologically possible to locate different phases of production at different sites. Finally, the rise of pockets of unemployment which harbour labour with a variety of skills at varying costs makes it feasible to seek specific labour markets for specific production processes.

The transnational corporations (TNCs) now take advantage of the NIDL. And it is here that the problem lies not only for Sweden's industrial status but also for other industrialized countries integrated within the NIDL. The TNCs are highly mobile. Indeed, there seems to be ample evidence in support of Knudsen's thesis that "as the degree of corporate centralization increases, responsiveness to a

given host country (or region) decreases." (1981, p.386) At one stage the Swedish labour movement and social democracy supported the expansion of Swedish industries abroad because benefits accrued to the Swedish economy and society from this expansion. In the future, these benefits may not be forthcoming. Swedish TNCs may not only export commodities but also jobs. These jobs may increasingly go to low-wage and new resource areas in the Third World. Today for example, the past backbone of the Swedish economy, iron ore mining, has been abandoned by private investors. There is only one privately owned Swedish iron mine, and it is located in Liberia. A similar picture is observable in the rest of the Western industrialized world.

The Third World is not only a target for Swedish transnational capital. Considerable direct investment is present in the industrial world as well; in Canada alone there are over ninety Swedish subsidiary companies. Only a handful of the Canadian subsidiaries, however, indulge in productive activities.

The transfer of sales agents and productive facilities abroad has also led to the movement of research facilities to foreign locations. The whole process may be referred to as a transfer of technology. Hakansson distinguishes between three stages of technology transfer. (Hakansson, 1981) First, technology is transferred through international trade in capital goods. Such transfer is

often accompanied by training programs and service facilities provided by the exporter. Secondly, the transfer involves the adaptation and improvement of the technology to local conditions. Third, the latter developments may, in time, lead to an "independent indigenous capacity for development and innovation."(ibid., p.48) Through these stages, foreign capital may very well be involved from beginning to end. Initially, however, R & D activities of transnational corporations (TNCs) evolved from the technical departments of the mother companies. But with the recent emergence of the NIDL the TNCs not only export commodities, technology and subsidiary plants but also R & D facilities. The latter is simply a logical step in consolidating and improving the standing in particular markets. In the Swedish case, nearly 50% of the R & D costs incurred abroad refer to improvements of existing products and processes, 40% pertain to the development of new products and processes and 10% to long-range research. This breakdown applies to the operations of domestic as well as foreign subsidiaries.

The tendency of decentralization of transnational corporate activities, including subsidiaries and R & D facilities, is a function of the search for increasing profits and wider markets. It is thus a decision taken from the "topdown." But there are also dynamics in the host country, other than the prospects of profits, that have prompted Swedish TNCs to move. Political demands for local

production and exports in a particularly valuable market may have prompted Swedish TNCs to establish subsidiaries and research facilities in foreign localities. (ibid., p.51) Research centres have also been established abroad to recruit foreign specialists and to keep in contact with foreign research institutions. The former is particularly important since the Swedish income structure "makes it virtually impossible to offer internationally competitive net salaries to highly qualified technical and scientific expertise." (ibid, p.51) These trends should not take away from the fact that only 11% of total Swedish R & D was spent abroad. But they do indicate that the large TNCs are spending a considerable amount of R & D in the host countries to introduce and develop new technology as well as perform basic research. This is particularly true with the machinery industry, where we will find forestry and mining machinery, which spends close to 40% of its R & D costs abroad (this sector alone accounted for nearly 50% of all R & D money abroad).

The danger of these tendencies is that if they intensify they will strip Sweden of the technological efforts which the country now possesses. The Swedes are very much aware of this threat and some legislation is in force to cope with the situation. In 1969, a law was introduced which stated that companies wanting to invest abroad had to show that the foreign operations would have a

positive effect on the trade balance, in other words, promote exports. This piece of legislation was abrogated in 1981 but Swedish companies still have to apply for permission at the Central Bank (the state bank) to make foreign direct investments. These applications may be turned down if the investments "should cause extraordinary damage to the national interest," i.e. affecting negatively the trade balance or employment. (Swedenborg, 1982, p.11)

The question of whether Swedish foreign investments benefit the country is an important one in the Swedish context. Major committees and studies have addressed the question since the 1970's. Views vary and a consensus has yet to emerge. It nevertheless remains true that foreign investments were seen in a more positive light in the past. The present debate and questioning of that position may very well indicate that we are moving in a different direction.

Comparative Perspectives on the Canadian and Swedish Forest and Mine Product Sectors

Comparative data for Sweden and Canada are difficult to come up with in a short-term study. The wider picture, however, is clear. Sweden has been much stronger in developing and exporting linked commodities in the forest and mine product sectors.

But the Swedish technology and know-how does by no means cover all economic sectors. This becomes apparent

when investigating the backward linkages to the Swedish forest industry.

The industrial linkages to the Swedish forest industry is particularly strong in woodhandling and harvesting machinery. The local market is supplied exclusively by local production. But this does not always mean that the supplies are Swedish-owned and controlled. The Finnish transnational corporations Rauma-Repola and Valmet have been particularly active in locating branch plants and taking over Swedish industries in woodhandling equipment.

OSA AB, controlled by Rauma-Repola, supplies 35% of all forwarders in Sweden. Kockums, controlled by the same Finnish interests, provides 24% of all sales in forwarders and 27% of all harvesters. Finally, Umea Mekaniska AB, recently taken over by Finnish Valmet, supplies 21% of all the sales of processors. In these particular fields we find that the Finns are particularly apt and aggressive on the international scene.

In the sphere of chainsaws and cleaving saws, however, the powerful Swedish transnational companies Electrolux, through its subsidiaries Husgvarna, Jonsereds and Partner, and Sandvik have a complete monopoly in the Swedish market. Electrolux completely dominates the Swedish market for saws used by the forestry workers. The sales of chainsaws and clearing saws in Sweden in 1984 amounted to SEK 320 (U.S. $ 37) while the total turnover of Electrolux and Sandvik

reached the impressive level of SEK 2.2 billion. Most of the material, then, was exported, a situation which is reflected in the strength of Swedish sales of chainsaws in Canada.

Swedish production in timber harvesting and handling is, then, very strong. This contrasts, in varying degrees, to the situation in the sawmill equipment and furniture, carpentry and other woodworking applications. The overall rating states that "the industry competes well in the sawmill equipment segments of the market...in the woodworking segments of the market, however, the local industry is weak." In these categories imports are common, accounting well over 60% of the market in Sweden. Of these imports about 1/3 came from West Germany which holds a strong position in the import market of glueing and pressing machines (57%), planing machines (43%), copying milling machines, tenoning machines, shaping and recessing machines (35%). Finland holds 13.3% of the Swedish import market. The Finns are particularly strong in reciprocating saws which holds almost 99% of the Swedish import market.

Italy holds 16% of the Swedish import market and is particularly strong in multi-spindle drilling machines, copying milling machines, shaping recessing machines and tenoning machines. Norway holds 6.1% of the Swedish import market; the dominant sales are in circular saws (60% of total import market). Other imports to Sweden come from

Austria, the Netherlands, Japan, Taiwan and the United States. Canada, in spite of being a leading forest nation, is conspicuous only by its absence on the Swedish import market.

The Swedish exchange of machinery and equipment for the wood harvesting and processing industry conveys an instructive picture. Sweden, as in other fields, has funneled capital and effort into a specialized line of commodities where she is strong and highly competitive, if not leading, in world markets. As for those lines in which Sweden is weak the solicitation of foreign supplies is readily made. The weaknesses are made readily available on request and foreign suppliers are encouraged to promote sales in Sweden. A similar strategy seems to be followed by the foreign suppliers. While large countries, such as West Germany and the United States, concentrate a broad range of producers goods in the forestry sector, smaller countries, such as Finland, Norway, Austria and the Netherlands, focus on one, or a particular set of, commodities. The latter have, in other words been able to carve out an international market niche for one or a few particular commodities. The author has not been able to generate more statistics on the forest and mine product sector in Sweden but it is probably true that a similar situation prevails in the mine sector.

The situation in the Canadian forest and mine sectors seems very different. The deficiencies of the Canadian

mining machinery and equipment and mineral processing sector are very well conveyed by Holmvall. Holmvall, writing for existing and prospective Swedish industries in Canada, shows better than most Canadian sources the specific weaknesses of the Canadian mining industry, a fact which in itself may say something about the disparity in secondary manufacturing between Sweden and Canada.

Table VII shows the Canadian content of machinery and equipment used in Canadian mineral processing. The range for new investment is from 28% to 65% and slightly higher for repair and maintenance, 32% to 86%. A similar picture is conveyed in Table VIII which shows, inter alia, the size of the Canadian machinery industry in mineral processing compared to the size of the domestic market. A discrepancy exists in all sectors, particularly in excavating dredging and loading equipment and parts as well as in industrial furnaces, kilns and ovens. Table VIII also shows Canadian exports as a percentage of total domestic shipments. The surprisingly high figures for some sectors must denote the close integration of Canadian branches with the United States. The last column in Table VIII shows the import penetration of mineral processing machinery in the Canadian market. Once again, for some sectors, we see a very high degree of import penetration.

In Table IX the present manufacturing capability of the Canadian mining machinery is conveyed. The picture shows

TABLE VII

Canadian content of Machinery and Equipment used in Canadian Mineral Processing Operations

	New Investment	Repair and Maintenance
	(%)	
OPEN PIT	28	32
UNDERGROUND	50	51
MILL AND CONCENTRATOR	65	68
SMELTING - REFINING	33 +)	86

+) This figure depends on the process

Source: Holmvall, L. Business Opportunities in Canada - Today and in the Future. Toronto: Swedish Trade Office, 1984, p. 131.

TABLE VIII

	Size of the Canadian machinery industry in relation to the size of the domestic market	Exports as a percentage of total domestic shipments	Import penetration of the Canadian market
		(%)	
SPECIALIZED MINERAL PROCESSING EQUIPMENT AND PARTS			
Rock drilling and earth boring machinery, drill bits and parts	75-80	58-77	78-90
Excavating dredging and loading equipment and parts	19-21	45-99	91-100
Mining, quarrying and ore dressing machinery and equipment and parts	48-67	37-75	73-93
SELECTED EQUIPMENT OF GENERAL APPLICATION USED IN THE MINERAL PROCESSING INDUSTRY			
Bins, hoppers, tanks	93	6	14
Hoists, lifts and winches	67	31	54
Pumps	67	30	53
Conveyors, conveying systems	95	9	14
Ind. furnaces, kilns, ovens	36	39	78

Source: Holmvall, L. Business Opportunities in Canada - Today and in the Future. Toronto: Swedish Trade Office, 1984, p. 132.

TABLE IX

Present manufacturing capability of the Canadian mining machinery industry

	Overall rating	Comments
SPECIALIZED MINING/ MINERAL PROCESSING EQUIPMENT	Low to Fair	
Exploration equip.	High	Wide range of high quality geophysical instruments and diamond drilling equipment
Underground mining equipment	Fair	
Drilling and face breaking	Fair	Incomplete range: no continuous miners, no hydraulic drilling equip., rather low-level technology
Loading & hauling	Fair	Incomplete range: no continuous loading & hauling systems, strong in LHD, haul trucks
Support and other	Fair	Incomplete range and rather low-level technology; no coal mining equipment
Surface mining equip.	Low	
Drilling & blasting	Very low	No Canadian capability
Stripping & loading	Low	Very incomplete range (no wire rope vels, scraper-haulers, front-end loaders, bulldozers) and high import content
Hauling	Fair	Incomplete range & high import content
Mineral beneficiation equipment	Fair	
Screening and classifying	Fair	Fair range but rather low-level technology in a low growth area
Crushing & grinding	Fair	Fair range but lack of sophisticated control devices
Flotation, separation, thickening, drying	Low	Inadequate range of products in a high growth area
Air-liquid quality control (filters, scrubbers)	Low	Inadequate range of products
Bulk material handling	High	Wide range of conveying systems but limited capacity for stacker-reclaimers
Smelting and refining equipment	Low	Inadequate range of products (exc. Inco IVEC technology licensed to Drave U.S.)
SPECIALIZED MINING EQUIPMENT PARTS AND SERVICES	High	Adequate product range, except for open-pit equipment; competitive quality and prices (e.g. custom castings and machine shops)
GENERAL PURPOSE EQUIPMENT WITH MINING APPLICATIONS	Fair	
Industrial process equipment	Low-fair	Pressure vessels, steam generating equipment available but otherwise incomplete range
Metal fabrication	High	Wide range of products available: tanks, bins, hoppers, mining hardware, etc.
Pumps, compressors, fans, heaters	Fair	Large size high capacity items not wide in Canada
Motors, drives and mech. transmission	Low	Diesel motors, drivers, clutches are not available in sufficient quantity
Electric and other equipment	Fair	Good electric equipment capability albeit high import content

Source: Holmvall, L. Business Opportunities in Canada - Today and in the Future. Toronto: Swedish Trade Office, 1984, pp. 133-134.

several weaknesses. Some machinery, such as drilling and blasting, is lacking completely. Even where the rating is fair to high there are often qualifications such as "incomplete range," "low level technology," "high import content" and "inadequate range."

Table X states more explicitly the major items of mining equipment not available from Canadian production.

Table XI indicates some of the strengths and weaknesses in the Canadian and Swedish per capita production of forest goods. In the production of sawn soft wood products Canada seems to be doing quite well. Production is higher than in Sweden and very much higher than in the U.S. Unsawn Canadian logs do not leave Canada for American mills. The exports of sawn products seem impressive. The figures suggest that Canada is making good use of its comparative advantage in forest products. But there are weaknesses. The consumption per capita of domestic production is much lower in Canada than in Sweden. This condition can be interpreted in two ways. Either Canada imports some of its sawn products for which there is not sufficient local capacity, or, alternatively, the Swedes are much better at promoting the use of wood in the local market. Given the previous impressions, it is likely that both conditions prevail.

When examining the statistics on other wood products, a fairly consistent picture emerges. Sweden produces,

TABLE X

Major Items of Mining Equipment
Not available from Canadian Production

Exploration
- All diamonds are imported

Extraction

(a) Open Pit Mining
- Shovels (with capacity exceeding 20 cubic yards)
- Draglines
- Open pit rotary blast hole drills (with capacity to drill a 3 to 17 inch hole to 30 feet plus)
- Tri cone drill bits (exceeding 7 inches)

(b) Underground Mining
- Underground locomotives (diesel, battery and trolley types)
- Full face circular tunnel and raise boring machines
- All types of underground coal excavators and auxilliary equipment
- Single/double face excavators (as for potash extraction)
- Pneumatic percussion blast hole drills
- Hydraulic blast hole drills
- Underground overhead loaders
- High head high volume centrifugal pumps

Concentration, Smelting and Refining
- Special crushers (impactors, pulverizers, hammer mills)
- Specialized control and instrumentation equipment
- Specialized furnaces, roasters and dryers, converters

Source: Holmvall, L. Business Opportunities in Canada - Today and in the Future. Stockholm: Swedish Trade Office, 1984, p. 137.

TABLE XI

Per Capita Production, Consumption and Export of Wood Products in Canada, Sweden and the United States, 1981

	Production			Export			Consumption (excl. imports		
	Canada	Sweden	U.S.	Canada	Sweden	U.S.	Canada	Sweden	U.S.
Sawn softwood products (m^3)	1.57	1.24	.23	1.13	.67	.02	.44	.57	.21
Pulp (tons)	.28	.35	.20	.82	1.02	.01	.54	.67	.19
Paper and cardboard (tons)	.40	.56	.26	.55	.73	.02	.15	.17	.24
Fibreboard (kg)	3.3	28.9	21.3	30.5	59.0	1.4	27.2	30.1	19.9

Source: Swedish Forest. Uddevalla: National Board of Forestry, 1985, pp. 8-9.

consumes and exports more per capita of pulp, paper and cardboard and fibre board than Canada. Given the vast forest areas of Canada, compared to the relatively small area in Sweden, there is no doubt the Canadian forests are under-utilized. If Swedish standards would be employed to Canada, more pulp, more paper and cardboard and more fibre board would be produced, consumed and exported.

Yet, the Canadian forests are over-exploited since the level of silviculture is at a very low level compared to the Swedish situation.

The assertions made here are confirmed by many authorities. Holmvall observes that over 50% of Canada's market pulp capacity is owned by companies which produce no paper or boards. At the same time less than 5% of Canada's paper and board capacity is integrated with pulping facilities. This is a clear contrast to other major pulp and paper producing regions, such as Sweden and the U.S. where an integration of pulp and paper production is occurring.

Holmvall goes on to note that forward integration (which does not seem to occur nationally) to foreign paper-making facilities by Canadian pulp and paper companies is limited. It is perhaps instructive to note that one exception is TEMBEC, a wholly-owned Canadian company, which operates a paper mill in Minnesota.

As opposed to the Canadian situation, foreign companies are often integrated backwards into Canadian primary production. This situation does nothing to "extend the linkage" in the Canadian industry.

One example of the underdeveloped linkages in the Canadian pulp and paper industry lies in the lack of facilities producing light weight coated stock. The stock is used to print catalogues, magazines and newspaper inserts. According to one industry spokesman Canada supplies fifty-eight per cent of U.S. newsprint last year (1985) but only 1.1 per cent of the coated paper. Up until recently even domestic supplies, particularly in the more popular lighter weights, have been limited, leaving printers (Canadian) dependent on foreign sources. (The Gazette, January 4, 1986, p. D-10)

This condition may be changing, however, with a soon-to-open mill at Newcastle, N.B., by Montreal-based Repap Enterprises Inc. The mill is intended to monopolize the Canadian market as well as export coated stock to the United States. The Repap initiative seems to be a step in the right direction. Coated papers are at "the high value-added range" of the industry and employ relatively more workers than other forms of paper-making. Yet the example illustrates a lag in development between Canada and other paper producers. The Canadian industry did not take part in the development of coated paper nor in the creation of a

market for the product. It was first with a proven product and a booming market that an initiative was taken by the Canadian industry.

A reversal of such trends must be a priority in any form of policy-making. The Repap initiative shows that the potential exists; perhaps it also shows that the question of foreign or local ownership and control may be a factor in promoting linkages. Repap is headed by George Petty, the same businessman who was instrumental in the successful formation of TEMBEC in the early 1970's (after the closure by a U.S. transnational corporation, Canadian International Paper).

The Repap example seems to hold a lot more promise for extending the resource link than the recent success by the British Columbia government in attracting an American waferboard plant to the northern part of the province. The new plant, worth $40 M and owned by Louisiana Pacific, received $10 M in benefits. It will employ 400 workers in processing and harvesting and export waferboards to California. (The Montreal Gazette, Dec. 26, 1985, p.F-5)

The detailed breakdown of the Canadian trade in the forest product sector is shown in Table XII. The table ignores the production statistics but still shows the strengths and weaknesses of Canada's trade balance in certain commodities. The table also documents the Canadian trade with its major trading partner, the U.S., and Sweden.

TABLE XII

Canadian Trade in the Forest Product Sector, 1984
(Can$, '000)

	Canadian Exports	Canadian Imports	Canadian Exports to the U.S.	Canadian Imports from the U.S.	Canadian Exports to Sweden	Canadian Imports from Sweden
1. -logs and crude wood materials	355,988	162,435	99,813	157,585	-	-
-% of total exports/imports			28	97		
-Deficit/Surplus	+195,553		-57,772			
2. -lumber and sawmill products	4,545,779	312,524	3,591,280	300,277	677	-
-% of total exports/imports			79	96	0	
-Deficit/Surplus	+4,233,779		+3,291,003		+677	
3. -Woodfabricated material	646,545	217,946	481,933	148,155	1,195	485
-% of total exports/imports			75	68	.2	.2
-Deficit/Surplus	+428,599		+333,778		+710	
4. -Wood pulp	3,908,007	129,253	2,062,394	88,288	19,882	3,652
-% of total exports/imports			53	68	.5	2.8
-Deficit/Surplus	+3,778,754		+1,974,106		+16,230	
5. -Paper and converted paper	6,056,655	762,608	5,102,969	603,175	85	27,722
-% of total exports/imports			84	79	0	3
-Deficit/Surplus	+5,294,047		+4,499,794		-27,637	
6. -Woodland loghandling equipment, chainsaws and woodworking machinery and equipment	308,374	336,744	255,857	235,570	2,325	26,888
-% of total exports/imports			83	70	.8	8
-Deficit/Surplus	-28,370		+20,287		-24,563	
7. -Pulp and paper machinery	80,254	190,380	56,763	127,567	1,142	5,669
-% of total exports/imports			71	67	1.4	3
-Deficit/Surplus	-110,126		-70,784		-4,527	
8. -Printing and bookbinding machinery	37,427	338,323	32,028	211,813	14	3,574
-% of total exports/imports			86	63	0	1
-Deficit/Surplus	-300,826		-179,785		-3,560	
9. -Household furniture	123,900	204,462	114,603	107,814	13	12,419
-% of total exports/imports			92.5	53	0	6.1
-Deficit/surplus	-80,512		+6,789		-12,406	
10.-Office and special purpose furniture	302,375	79,679	286,224	32,493	6	855
-% of total exports/imports			95	41	0	1.1
-Deficit/Surplus	+222,696		+253,731		-849	

Source: Statistics Canada. Imports By Countries. Catalouge 65-006, 1984; and Exports by Countries. Catalogue 65-003, 1984.

A series of consistent features stand out. First, and not surprisingly, Canada exports considerably more than she imports with respect to wood, pulp and paper products. Canada only experiences a deficit in two instances. First, she imports more logs and crude wood materials from the United States than she exports. This should be considered a strength as crude wood products are probably applied in various secondary wood industries in Canada. Less encouraging is the trade surplus in the total trade in logs and crude wood materials; this is undoubtedly a function of unprocessed wood leaving Canada for Japan. The second deficit experienced by Canada is the trade with Sweden in paper and converted paper. Canada imported nearly Can$ 27 M (3% of total imports) from Sweden; this is undoubtedly a function of the lack of manufacturing capacity in some fields of paper-making, such as coated paper (as noted previously). That deficiency is hidden in the total trade and the trade with the U.S. through the huge exports of crude paper from Canada.

The trade surplus in wood, pulp and paper contrasts with a trade deficit in commodities linked to the forest resource. The trade with Sweden is perhaps the most instructive. In the trade with Sweden, Canada experiences particularly large trade deficits in woodland loghandling equipment, chainsaws and wood working machinery and equipment. Eight per cent of all Canadian imports in this

category come from Sweden. The details are even more interesting. In 1984, Sweden was the major exporter of chainsaws to Canada.

The deficit in household furniture is undoubtedly due to the success of the Swedish-owned furniture retail chain, IKEA. Trade deficits in pulp and paper and book binding machinery can also be noted.

Trade deficits with the United States do not appear in all categories but in pulp and paper and printing and book binding machinery they are large. In woodland loghandling equipment, chainsaws and woodworking machinery and equipment and furniture Canada experiences a surplus. Often (except for office and special purpose furniture) the trade surplus with the United States contrasts with a trade deficit at the aggregate level. The pattern conveys a picture which, superficially, shows Canadian strength vis-a-vis the United States. But this may very well be a misguided conclusion. The trade may simply reflect the continental nature of the United States and Canadian market and the flow of parts and goods between branches of the same companies.

In the Canadian trade of machinery and equipment used partially or wholly in the mining industry a very poor picture emerges indeed. Massive trade deficits occur in each category (See Table XIII). The major supplier is the United States but Sweden figures prominently as well. This

TABLE XIII

Canadian Trade in Machinery and Equipment Used Partly or Wholly in the Mining Industry, 1984.
(Can$, 000)

	Canadian Exports	Canadian Imports	Canadian Exports to the U.S.	Canadian Imports from the U.S.	Canadian Exports to Sweden	Canadian Imports from Sweden
1. -Rock Drills	35,389	153,194	18,863	113,012	125	17,554
-% of total exp.s/imp.s	/		53	74	.4	11.5
-Deficit/ Surplus	-117,805		-94,149		-17,429	
2. -Power Shovels, scrapers and bulldozers	22,397	266,535	14,356	166,981	-	581
-% of total exp.s/imp.s			64	63	-	.2
-Deficit/ Surplus	-244,138		-152,625		-581	
3. -Front end loaders & ass'd equipment & parts	-	344,987	-	315,327	-	8,634
-% of total exp.s/imp.s				91		2.5
-Deficit/ Surplus	-344,987		-315,327		-8,634	
4. -Mining & Quarrying Machinery	64,503	131,795	24,081	96,503	41	4,883
-%of total exp.s/imp.s			37	73	.1	3.7
-Deficit/ Surplus	-67,292		-72,422		-4842	
5. -Ore Processing machinery	-	24,288	-	13,121	-	289
-% of Total exp.s/imp.s				54		1.2
-Deficit/ Surplus	-24,288		-13,121		-289	
6. -Geophysical mineral prospecting equipment	20,223	162,003	10,970	147,837	402	261
-% of total exp.s/imp.s			54	91	2	.2
-Deficit/ Surplus	-141,780		-136,867		+141	

Source: Statistics Canada. Imports by Countries. Catalogue 65-006, 1984; and Exports by Countries. Catalogue 65-003, 1984.

is particularly true with respect to rock drills where 11.5% of all Canadian imports come from Sweden.

When looking at the trade in the selective goods associated with the forest and mine product sectors as a whole one more observation should be made. Canada is extremely dependent on the United States in its trade; in many cases the dependence is much heavier than the overall dependence of the Canadian on the U.S. market. In many cases the U.S. market is a "protected" and familiar market. This should be an important consideration in evaluating the strength of the Canadian industries. Many times, the flow of parts and machinery across the Canadian/U.S. border is not an expression of export strength but material flows between branch operations in the two countries.

Recommendations

Holmvall makes the following recommendations for the Swedish business interests involved in the Canadian market. These recommendations Canadians must also heed if they do not wish to concede to research and marketing skills of foreign companies. BE COMPETITIVE, Holmvall begins, "Canada has to invest itself into a better position on the world market." Some of the principal areas in the forest sector include:

1. Improve reforestation.. The reforestation is 4 times higher in Scandinavia than in Canada.

2. Utilize raw material in a much better way. This applies to all areas of the forest industry.

3. Modernize the pulp and paper industry. Canada has to be cost competitive. Eg. Canada's newsprint production machinery is antiquated with almost 30% lower productivity than that of U.S. and Scandinavia. Another important factor is the increasing energy cost.

4. More process controlled saw milling industry. The Canadian lumber industry has to reduce labour cost and improve capacity as well as utilization of raw material. This is also valid for the pulp and paper industry.

5. Canada will be faced with more environmental control, a technology which Sweden has both developed and utilized. (Holmvall, 1984, pp.244-245)

In all these fields, Holmvall urges Swedish businessmen to concentrate their marketing efforts. Nobody can deny the validity of Holmvall's points. The Canadian industry is certainly aware of these problem areas itself.

Holmvall also identifies those areas of the Canadian mining industry where Swedish industries may find a market niche. These can be stated in point form:

1. Higher fuel and energy costs will require a switch from diesel - to electrically-driven machinery.

2. Increasing labour costs and demands for higher efficiency, safety and environmental controls will add to the

need for systems instead of single machine items. Mechanization and remote control will be important parts of these systems.

3. Lower grades of ore will necessitate more efficient ore processing and beneficiation equipment.

4. More sophisticated underground equipment will be needed as surface ores are exhausted.

5. Energy conservation will result in new ore processing methods.

6. The emphasis on mine safety will modify the design of mine machinery.

7. Advanced equipment for geological exploration at increasing depths will be developed.

8. Integrated mining-milling-smelting-refining projects for isolated areas will be developed.

9. There will be developed a new breed of mining machinery for ocean mining. (ibid., pp.138-139)

In all these fields the Swedish industries possess considerable know-how and capability. What can the Canadian government do to ensure Canadian participation and/or increased activity in these fields? Taking a Swedish perspective, many means seem appropriate. And, these actions are not only confined to R & D policies per se.

The overall policy climate has to be considered as well. Some of the strategies which seem useful to the Canadian situation, using the Swedish case as a best example, are described below.

Holmvall feels that the biggest opportunities for Canada are in maintaining and developing exports to the United States. (Holmvall, 1984) Such exports have to be relatively sophisticated to compete in that market. In order to reduce costs for product development and renewal costs, Holmvall suggests Sweden and Canada share R & D and commercialization projects. The fear is perhaps that Canada, being behind in many fields, would receive the short end of the stick. Holmvall argues, however, that this may not be the case as cooperation may lead to

> cross-investment by the one country in the other, including joint ventures [and] cross-licensing. How such shared R & D projects might be brought about could be worked out in every specific case. It is probable that there should be at least two in every areas, one favouring Sweden and the other favouring Canada, because an exactly even 50/50 expectation of benefit would be unlikely for any one project.
>
> (ibid., p.247)

According to Holmvall, NRC is very interested in sourcing Swedish technologies in Canada. STU or the Swedish technical attaches could be equally interested in sourcing Canadian technology in Sweden. The prospects are perhaps best in the R & D intensive new technologies and industries,

but there should also be room in the resource sector. Holmvall lists the potential fields of cooperation in the forest and mine sector as follows:

> Forest Products: composite materials (especially wood/cellulose based); bio-engineered conversion products of cellulose; robotic machinery for logging, chipping, sawing, plywood, etc.; remote sensing devices in forest surveys, serial replanting; bio-engineered pest controls. Offroad equipment generally.
>
> Mining: robotic mining machinery (including surface mines and coal mining in mountain terrain); tunnelling generally; metal products.
>
> (ibid., p.249)

Besides cooperative ventures, one way to secure Swedish technology would be to put more pressure on Swedish TNCs to establish plant and research facilities in Canada. Canada is a growing market. And, as many Third World countries have shown, a national government of a growing and important market can state stipulations for the establishment of foreign branch operations within its national borders.

Carrot and stick strategies to attract or force foreign companies to locate in Canada should not only be employed. It is also important to develop a political, administrative and corporate infrastructure which calls into being, retains and further develops technology. Appropriate steps should be taken to change the social and administrative structures of the forest and mine product sectors. The Swedish example

suggests, in this context, that the development and dissemination of R & D should be seen as a network problem, where the agents in the system form nodes which are linked together in a societal system of communication. The building of an R & D system should be seen as a transformation of R & D capacity, receptive capacity or reduction of the obstacles of the transfer of knowledge. (Andersson et al, 1982, p.100) As we have seen and stressed in other sections, it is along these lines the Swedish R & D effort has evolved in the forest and mine product sectors.

The implications for the Canadian forest and mine sector are several. The key word is integration. An integration of the work and aspirations of the various participants in the industry should be encouraged. The specifics of such an integration are difficult to work out in this context but they should follow a set of basic principles.

1. Increased efforts should be made to integrate the aims of labour for a safer and more rewarding work environment with the goals of efficiency by the private entrepreneurs.
2. Increased efforts should be made to promote inter-corporate collaboration. This could result in major technological breakthroughs which would suit Canadian mine and forest conditions. Canadian forest and mine companies should be encouraged to contact Canadian manufacturers of mining and forestry equipment. Studies should be performed

to investigate the intercorporate linkages in Canada. Are these linkages extensive? If so, why have they not resulted in more forward and backward linkages?

3. Integration should be promoted between governmental bodies (municipal, provincial and federal) to serve the needs of corporations and labour alike. The Swedish case suggests more cooperation should be encouraged to help the industry and its workers adjust and cope with the increasing demands for industrial efficiency.

4. Lower levels of governments, administrative structures and unions should be encouraged to take part in the planning and execution of federal or provincial policies vis-a-vis the forest and mine product industries. Responsibilities, in other words, should be delegated to promote communication not only from the top down but from the bottom up.

5. The universities should become more integrated in the execution of R & D. Research should not only be basic but also applied to particular needs identified through the setting of national goals in the forest and mine sectors.

6. More efforts should be placed on R & D associated with marketing. Marketing should become demand rather than production oriented. The needs of customers should be monitored and documented. Customers cannot be expected to appear automatically.

7. The pace of development in Swedish industries associated with the mine and forest sector calls for urgency. The

integration of hardware, software and aggressive marketing indicates a progression forward. Measures to improve the Canadian situation should be taken as soon as possible.

8. In association with all of the above points it would be appropriate to identify production niches which would be particularly suitable for Canada in the forest and mine product sectors. These production lines, with proper support, should aim for international competitiveness rather than continental complacency. The local multiplier effect may thereby be stronger and the stifling dependence on the American market reduced.

9. When considering the Swedish situation one is forced to consider the very contentious issue of the pros and cons of foreign direct investment. Foreign capital is barred from exploiting natural resources in Sweden. There is no doubt that this policy has promoted good management and extensive linkages to the resource. National control over natural resources, coupled with legislation promoting proper management, has served the national interest.

State intervention and planning have thus called forth relatively good corporate citizens. Good corporate citizens have not dropped from the sky; they have been forced in that direction. In support of that contention it is interesting to note the behaviour of one large Swedish forest company in Canada, Stora Kopparberg, in Nova Scotia. Management policies and prices paid small holders for wood by Stora

were at one stage very poor. Over-cutting was practiced and monopoly power was exerted. Only a public outcry and bad publicity caused Stora to mend its ways. The example is instructive. Even Swedish industries, if allowed to, may be bad corporate citizens.

The Swedish policy on foreign investment should raise Canadian concern on at least two accounts. The first pertains to the open-door policy vis-a-vis foreign investment in the mining and forestry sectors. The second pertains to the regulations which pertain to forest regeneration, pollution control and energy-saving. The Swedes have been very strict in regulating developments in these fields. And the strictness seems to have benefited rather than handicapped the industry. This should be considered more in future Canadian policy-making.

APPENDIX I

Swedish Companies in the Forest and Mine Product Sectors Located in Canada, 1986

Mr. Ron Newport, President
AGEMA INFRARED SYSTEMS LIMITED
5230 South Service Road, No. 125
Burlington, Ontario, L7L 5K2

Mr. Ian Fraser, President,
ALIMAK INC.
3070 Lenworth Drive
Mississagua, Ontario, L4X 2G1

Mr. A.C. de Lery, President,
ASEA Inc.
10300 Henri Bourassa Blvd. West
Saint Laurent, Quebec, H4K 2J3

Mr. M. Hogan, President
ASTRALLOY-VULCAN INC.
1625 Steeles Ave. East, Unit 13
Brampton, Ontario, L6T 1A4

Mr. J.L Hedlund, President
ATLAS-COPCO CANADA INC.
745 Montreal-Toronto Blvd.
Dorval, Quebec, H9S 1A3

Mr. L.D. Laidman, President
BOFOLKEMI INC.
5915 Airport Rd., Suite 610
Mississauga, Ontario, L4V 1T1

Mr. Curt Jarnfeldt, General Manager
BOLIDEN CANADA LIMITED
Box 197, Toronto-Dominion Centre
Toronto, Ontario, M5K 1N6

Mr. Jack Stark, General Manager,
BRIO SCANDITOY INC.
4995 Timberlea BLvd., Unit 2
Mississauga, Ontario, L4W 2S2

Mr. G. Eriksson, President, CELLECO LTD.
797 Lakeside Rd.
Foster, Quebec, J0E 1R0

Mr. B. Soostmeyer, President
CENTRO-MORGARDSHAMMAR (CANADA)
220 Humberline Drive, Unit 1
Rexdale, Ontario, M9W 5Y4

Mr. Kurt Karlgren, President
EKMAN PACIFIC ENTERPRISES LTD.
555 West Hastings St., Suite 2675
Vancouver, B.C., V6B 4N6

Mr. B. Neapole, General Manager,
EMAR CANADA
Division of Euroclean Canada Inc.
Box 549, Canada Ave.
Huron Park, Ontario, N0M 1Y0

Mr. Roy Olander, Area Manager,
EMP-CONTROL CANADAL LTD.
5555 Bois Franc Road
St. Laurent, Quebec, H4S 1B1

Mr. Stanley Lundberg, President
FAGERSTA SECOROC LIMITED
1157 Blair Road
Burlington, Ontario, L7M 1P9

Mr. Bob Melville, President
FLAKT CANADA LIMITED
Box 5060, Station F
Ottawa, Ontario, K2C 3P9

Mr. A. Tetrault, President
FLYGT CANADA
300 Labrosse Ave.
Pointe Claire, Quebec, H9R 4V5

Mr. R.C. Phillips, President
GOTAVERKEN ENERGY SYSTEMS LTD
73 Water Street North
Cambridge, Ontario, N1R 3B4

Mr. Thomas Hakansson
Hakansson Industries Ltd.
24 Simmonds Drive, Unit 1
Dartmouth, Nova Scotia, B3B 1R3

Mr. Bjorn Bayley, General Manager,
IKEA LIMITED
3200 Sweden Way

Richmond, B.C., V6V 2A5

Mr. Karl-Erik Jonsson, President
KMW INC.
150 White Oak Road
London, Ontario, N6E 3A1

Mr. Leif Holmvall, Vice President
LEAB INTERNATIONAL CANADA INC.
117 Nymark Ave., Unit 302
Willowdale, Ont., M2J 2H3

Mr. K.S. Sandhu, Regional Manager,
NOSS AB
16899 Hymus Blvd.
Kirkland, Que., H9H 3L4

Mr. Lars E. Andersson, General Manager
NOVA SCOTIA FOREST INDUSTRIES
Box 59
Port Hawkesbury, N.S., B0E 2V0

Mr H. Johanson, President,
SALA MACHINE WORKS LIMITED
3136 Mavis Rd.
Mississauga, Ont., L5N 1T8

Mr. Steve Boneham, President
SANDVIK CANADA INC.
6835 Century Ave.
Mississauga, Ont., L5N 2L2

Mr. Maths Hedlund, President,
SVEGA CANADA LIMITED
PO Box 1136
North Bay, Ont., P1B 8K4

Mr. B. Overgaard, President
SKF CANADA LIMITED
40 Executive Court
Scarborough, Ont., M1S 4N4

Mr. Thomas P. Hall, President and General Manager,
STORA FOREST INDUSTRIES
Box 59
Port Hawkesbury, N.S., B0E 2V0

Mr. J.E. Bergstedt, President

SUNDS DEFIBRATOR LIMITED
Refiner Division
45 St. Joseph Street
Lachine, Que., H8S 2K9

Mr. Nils Bjorkman, President
TETRA PAK INC.
200 van Dorf Road
Aurora, Ontario, L4G 3G8

Mr. Harry Mills, President
Trelleborg
2600 John Street, Unit 121
Markham, Ontario, L3R 3W3

Mr. W. Romlid, Vice President
VOLVO BM CANADA
10 Indell Lane
Bramalea, Ont., L6T 3Y3

Company:

Do you a) produce goods b) assemble goods

c) provide sales d) provide services e) all of the above

What proportion of your business is devoted to providing goods and services to the forest and/or mine sector?

When did you establish operations in Canada?

What was the valu of your sales/production in 1984?

Do your branches have the mandate to export commodities? If so, to where and how large is that market?

An IUI (Industrins Utredningsinstitut, sponsored by the Swedish Employers' Association) publication claims that the value of a commodity is doubled after it leaves the factory. The marketing effort consists of two parts: 1. finding and informing the right customers and 2. overcoming trade barriers. The publication goes on to state that the marketing effort takes place in the foreign branch plants primarily.

Does this reflect your position?

If no, why not?

In your marketing efforts, do you collaborate with other Swedish companies?

Which?

Are you at all dependent on the Swedish Trade Commission in your marketing efforts?

Did the Trade Commission play an important role in your establishing in Canada? What role(s)? Was it helpful in overcoming tariffs, finding a sales agent, locating potential customers, etc.?

Were there other factors, other than your own initiative, which aided your company in establishing operations in Canada?

Sweden's economy is in large part dependent on a small group of relatively large companies (SKF, Atlas Copco, Sandvik, Volvo, etc.). These companies are very sensitive to the international business cycles. The smaller Swedish companies, on the other hand, are very dependent on subcontracts from the large companies.

Is the dependence of the small companies on the large ones transferred to branch plants overseas?

If you represent a small company, did you follow in the wake of a large company? Which?

If you represent a large company, did you "pull" any smaller companies with you as you established in Canada? Which?

If you produce or assemble goods, from where do you get your producer goods (machinery, equipment etc.) and raw material?

If you operate in both the United States and Canada, how are your operations related? Do the branches work independently of each other? Or, are there material flows from one to the other?

To what extent is your company integrated with other Swedish companies (in terms of ownership and control)?

Swedish companies in Canada provide both products (through sales and production) and services (such as consulting). What percentage does services constitute of total business? What has been the trend? What is the trend?

What is your major competition in Canada? Is there any

competition at all? (For what products?)

Have you transferred any of your R&D (research and development) and design facilities to the United States and Canada? If so, how much? Where?

To what extent do you consider your commodities as technology-intensive (having involved considerable R&D efforts and being globally in the forefront technologically)?

What, in your opinion, were the major Swedish public policies which contributed to your success in the development of your technology-intensive commodities?

Does any of the transfer of technology from Sweden to the branch plant in Canada benefit Canadian R&D, design, etc.? Is there a trickle down effect? Or does the technology remain in a certain enclave (the branch) from which it is serviced? Have you seen situations in which Swedish personnel have been recruited and Swedish technology copied and further developed by Canadian companies? If so, have these strategies paid off?

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