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KSH CONSULTING

A CONSULTING CONCEPT

MILL OPTIMISATION SERVICES

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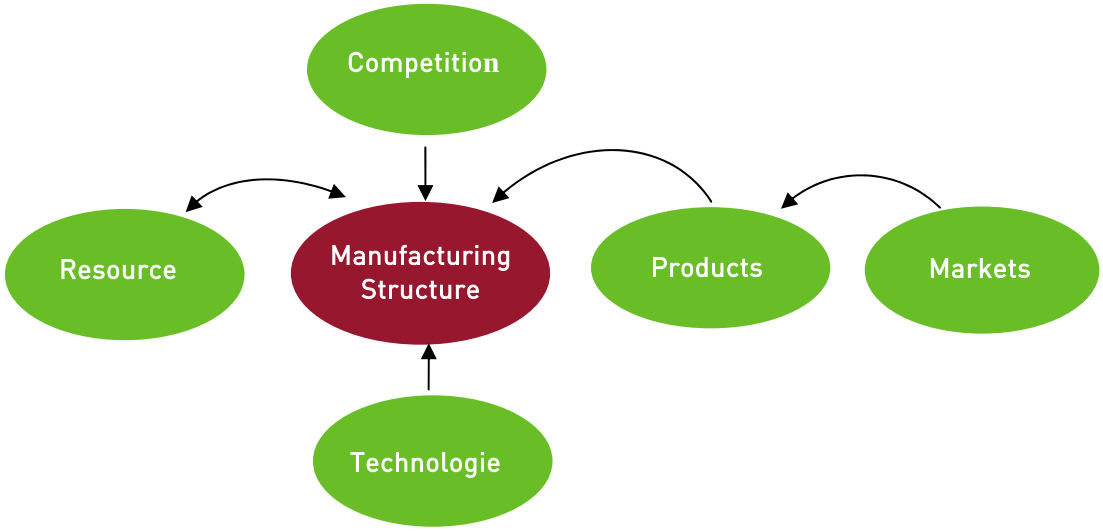
BACKGROUND

Global paper and paperboard production capacity reached 408 million tonnes in 2005. This capacity is growing at a pace of roughly 3% per year. Approximately 1 to 1.5% of this growth comes from creep production, meaning that the existing capacity is continuously optimised.

This production capacity is spread over the world as follows: Asia 34%, North America 27%, Western Europe 26%, Eastern Europe 5%, Latin America 4%, others 4%. The profile of the manufacturing capacity in each region has been shaped over the years by various driving forces (Figure 1). The most important driver is the regional market demand followed by the resource base.

Figure 1
Drivers of Regional Manufacturing Structure



After a decade of poor financial performance, paper companies' executives focus today on building value instead of building assets. To be a value creator, the return on capital employed (ROCE) of a specific asset must exceed the weighed average cost of capital of the company. To achieve that in a commodity-based capital intensive industry, the asset performance must be fully maximised. Since the driving forces depicted in Figure 1 are continuously in action, companies need to monitor their competitive position and make proactive strategic and tactical decisions to maintain and improve their profitability.

As depicted in Figure 2, three main drivers impact cost performance: regional factors, mill configuration and operational performance. Regional factors typically determine 15% to 25% of the cost variability between different operations. However, a company has little control on it since it is driven by the plant location. The biggest driver of cost performance is the mill configuration, which typically accounts for more than 50% of mill-to-mill differences. Operational performance is typically the smallest cost determinant. However, it is the only cost factor that can be managed and improved on the short-term since the mill location and configuration are largely determined at the time of initial investment and cannot be easily changed.

Figure 2
Drivers of Cost Performance

Regional Factors	Mill Configuration	Operational Performance
• Fibre Quality	• Asset Quality	• Capacity Utilisation
• Fibre Cost	• Technical Age	• Operational Efficiency
• Energy Cost	• Product-Mix	• Organisational Efficiency
• Labour Cost	• Furnish	• Optimised Product-Mix
• Chemical Cost	• Mill Capacity	• Optimised Furnish
• Delivery Cost		• Product Quality
• Exchange Rate		

The cost competitiveness of a mill generally deteriorates over time due to technological advancements at newer mills and increasing maintenance costs. Global market developments are also impacting cost competitiveness.

When a mill ages and stops to be a value creator, its owner needs to take action by repositioning the asset. The ultimate goal is to optimise the asset with a long-term perspective by making the required modifications to the mill configuration. However, there may be opportunities to enhance asset operational performance with a short-term focus through minimal investments (performance improvement program). KSH Consulting has designed its "Mill Optimisation Services" to address both short-term and long-term issues, but with a strong focus to maximise the performance of viable assets.

OBJECTIVES

KSH Consulting, as part of its consulting practice, offers mill optimisation services. These services are designed to assist customers in assessing the current situation and future competitive position of their existing mills and in formulating plans, which will maximise the short-term and long-term value of these assets. The specific objectives targeted by these services are as follows:

- to perform a strategic asset review and market assessment in order to clearly identify the factors underlying the unsatisfactory results, to assess strengths and weaknesses and at the same time to establish the basis for determining short-term and long-term development directions;
- to develop a performance improvement program designed to enhance short-term profitability and competitiveness within the confines of minimal investments in both soft and hard assets;
- to develop a long-term capital investment program to reposition the mill in its business environment, ensuring its long-term financial viability and maximising its value.

SCOPE OF SERVICES

Strategic Asset Review

The first step in this planning process is to perform a Strategic Asset Review. This phase is principally based upon data gathering and evaluation of the mill and is supplemented by an evaluation of the markets for the mill products and the marketing strategy employed.

Although the consultant's knowledge of the asset should be gained from an independent assessment of the business unit rather than the opinions of mill management and operating personnel, KSH Consulting uses a participatory style and close working relationship is established at the management, operations, marketing and accounting levels within the mill. This active involvement of mill personnel in the planning process ensures full support and ownership of the resulting strategy and its implementation plan.

To develop a successful optimisation strategy, it is necessary to know what has transpired in the past, where the mill is today and where it is expected to be in the future under a status quo scenario. The scope of work is focused on specific major inputs, such as:

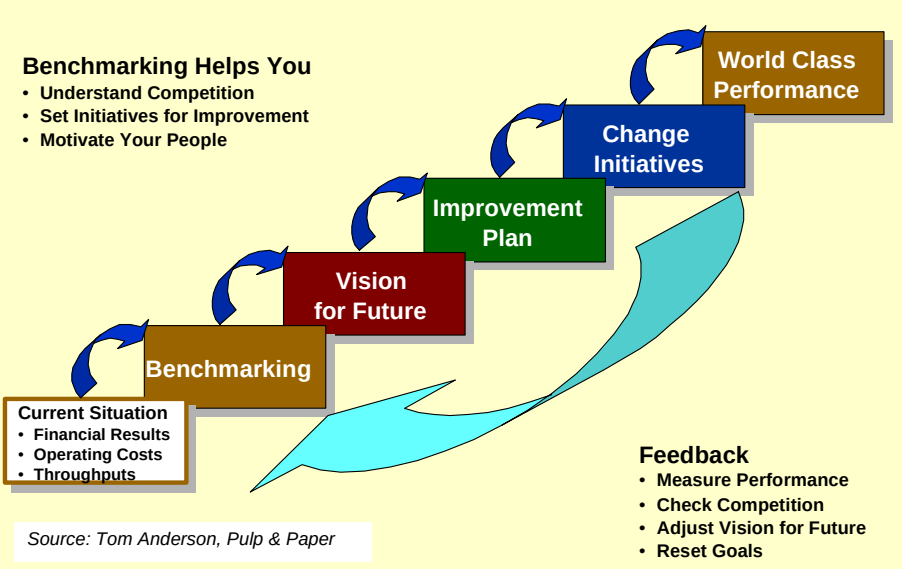
- corporate strategy;
- product-mix (current grade-mix, production volume, product specs);
- revenue, revenue sources and customer base;
- market outlook (market size, expected growth, trade flow, trends, key competitors, price trends);
- fibre supply review;
- grade manufacturing cost and contribution;
- management and labour review;
- product quality and paper machine performance (including lost time analysis);
- performance of other process islands;
- capital reinvestment in the mill.

Each of these inputs is evaluated both on a historical and current perspective basis.

Benchmarking

To establish a vision for future development, asset characteristics, operating performance and regional factors must be benchmarked against industry standards, industry leaders and the competition. This analysis along with KSH expert opinion will allow a proper assessment of the current mill situation, the industry environment and the gap that exists against the competition and industry leaders. Benchmarking provides the required feedback to the project team to develop a vision for what the mill needs to become, to establish realistic targets and to develop and implement the key change initiatives required to move forward (Figure 3).

Figure 3
Benchmarking – How Does
It Add Value



Data gathered during the strategic asset review is compared against industry competitive standards using specific indices. This comparative analysis focuses on:

- asset characteristics: paper machine trim, paper machine capacity, design speed, technical age, etc.;
- regional factors: fibre characteristics, fibre cost, energy cost, labour cost, etc.;
- operating performance: production stability, efficiencies, utility usage, furnish composition, personnel productivity, manufacturing cost;
- maintenance performance: workforce, cost, planning, capital reinvestment;
- operations and maintenance management practices.

Base Case Scenario

Once a proper analysis of the information gathered is completed, a financial outlook of the current business is developed, assuming that no changes are made to the current mill configuration, product-mix and operational performance. However, expected future prices, costs and required capital investment to maintain the equipment in the current condition is taken into consideration.

A financial model of this business scenario is developed to determine the value of the mill given the expected future business environment.

This scenario is considered as the "status quo" or "base case" scenario, which defines the "terms of reference" for ascertaining the best remedial opportunities and long-term development options if viable.

Performance Improvement Program

A performance improvement program (PIP) is designed to provide an operating strategy, which should yield an immediate improvement in financial performance. The information gathering phase of the PIP is carried out in sequence with the strategic asset review.

Mill level analysis builds upon the strategic asset review and deals directly with business efficiency issues while establishing a baseline for determining and improving the economic viability of a business unit. The focus is on maximising quality, throughput and short term profitability by adjusting flexible, "low investment" parameters, such as:

- process operating conditions;
- process operating procedures;
- raw material inputs;
- labour utilisation and organisation;
- information processing;
- financial issues (purchasing, inventory, and production scheduling plans);
- high return mechanical replacement.

The analysis not only provides a short-term plan for improving the economic efficiency of the business unit; the analysis and data it collects establishes the limiting parameters of the unit from a process quality, organisational and mechanical perspective. The existing baseline becomes the reference point for calculating the economic costs and returns for changes evolving from longer-range business and strategic plans.

Natural consequences of the PIP analysis are therefore, an operations optimisation plan, a short and intermediate term prioritised capital spending plan, a product rationalisation plan and organisational recommendations.

Long-Range Strategic Plan

The long-range strategic plan is designed to provide a strategy to reposition the mill in its business environment by making the appropriate changes to the existing business concept and mill configuration.

Identification of Repositioning Options

Based on the strategic asset review and market outlook, various repositioning opportunities are identified and screened to select the most promising options. The screening process will be done taking into consideration markets, resources, facility fit, competition and quality requirements.

Evaluation of Repositioning Options

The viability and financial attractiveness of the most promising options is evaluated taking into account required facility modifications, required capital investment, revenue, manufacturing costs, return on investment and other issues such as technical, commercial and financial risks. Financial results will be compared to the base case scenario.

Revised Business Concept and Strategic Plan

An optimal long-term business concept for the mill is developed along with an evaluation of the required investment, an implementation schedule and strategy.

TEAM

A multidisciplinary team composed of senior specialists with superior experience in technical, commercial and financial analysis and business planning renders the proposed services. All senior members of the team have long-standing experience in mill optimisation.

COMPANY PROFILE

General

KSH Solutions Inc. (KSH) is a Canadian consulting, engineering and EPCM services company, founded in 1923 in Montreal, having global reach and extensive experience in the pulp and paper and forest sector. Operating world-wide, KSH has the skills, experience and organisation needed to assist clients improve their asset performance and to develop and execute capital projects of all sizes and complexities, with its consulting, engineering and construction management expertise. In addition, with its European partner and key shareholder, MAN Ferrostaal in Germany, KSH offers its clients the ability to implement their projects under a turnkey / EPC contract customized to the clients' needs.

Built from its long history and strong presence in North America, KSH has expanded its capabilities by providing expertise and services on projects in Europe, Asia, Australia and South America, giving the company a global perspective, as well as the knowledge, track record, and ability to execute projects anywhere in the world.

The entire group provides access to a vast network of resources and offices giving KSH the support to evaluate undertake and execute projects anywhere in the world.

KSH Consulting

KSH Consulting is the consulting arm of KSH Solutions Inc. Our mission is to assist clients make positive, lasting and substantial improvements in their performance.

We have the global insights, consultants and tools to offer objective and sound solutions to various business problems for companies engaged in the pulp and paper and wood processing industries, governments, financial institutions, investors, lenders and sector organisations.

Our integrated services cover the whole supply chain, from raw material to end-use markets, and focus particularly on the following areas:

- ***Resource, Energy and Environmental Management:*** studies pertaining to resource supply, demand, cost, and end-use; regional resource comparisons; audits and benchmarking of forest, environmental and energy management practices; development of corporate strategies for sustainable development; development of regional resource management and master plans; and, government policy advice on sustainable developments.

- ***Product Management:*** rationalisation and optimisation of existing product-mix; product and manufacturing process design; process and product trial management and product launch assistance.
- ***Marketing:*** market analyses, market research, development of marketing plans and market launch strategies, customer satisfaction studies and introduction to key buyers.
- ***Logistics:*** distribution logistics planning and optimisation.
- ***Mill Development:*** performance audits, benchmarking, optimisation programs and long term development plans for existing assets and mills. Operations, maintenance, and plant management assistance.
- ***Technology Management:*** assistance in R&D activity planning, technology assessment and selection, strategic alliance/technology transfer assistance and technological risk management.
- ***Investment Analysis:*** opportunity and feasibility assessments, due diligence, asset valuations, business plan development, financial analysis and planning, lender's consultant, owner's consultant, strategic alliance identification, as well as economic and sector studies.

KSH Consulting has acquired strong expertise in consulting and strategic planning in the forest product industry with numerous completed studies. Some relevant mill development studies involving KSH Consulting team members are described below.

SELECTED EXPERIENCE

Positioning and Development of the Dolbeau-Mistassini Paper Mill (2008). Following the merger of Bowater and Abitibi-Consolidated (ACI), municipal and regional economic development officials of the MRC Maria-Chapdelaine mandated KSH Consulting was mandated to develop and a better understanding of the business environment of the Dolbeau mill and to identify solutions that would improve the competitive position of the mill. To this end, KSH Consulting has carried out a review of AbitibiBowater's assets, a market review of the company's products as well as a review of the Dolbeau mill itself. Consequently, KSH has identified several development paths for the mill that resulted in several strategic proposal initiatives.*(5C4-001/002, CLD Maria-Chapdelaine-Dolbeau-Mistassni)*

Review & Validation of PPPC's Expansion Plan (2007). KSH Consulting was mandated to provide a review of the technical concept developed by Phoenix Pulp and Paper to expand the two existing pulping lines at their kraft mill located in Khon Kaen, Thailand, from 230,000 ADt/a to 340,000 ADt/a and to provide the investment cost associated with the proposed upgrade. This concept entailed the addition of new wood handling and chip making facilities, a new continuous digester, upgrades to the fiberlines including conversion to ECF bleaching, new chemical recovery island including recovery boiler, evaporators, lime kiln and re-causticizing; a new 28 MW steam turbine generator, chemical plant upgrades including a new ClO2 plant, as well as associated power distribution and DCS improvements*. (5C5-001, Phoenix Pulp & Paper)*

Assistance on PM14 Vacuum System Analysis (2007). KSH Consulting was retained by Domtar Ottawa to assess the operation and capacities of the vacuum system on PM14. Problems included wet felts, press nip rewetting and vacuum level oscillation. KSH provided recommendations for the correct vacuum requirements for each machine component, a flow balance diagram and sized the "new" equipment (vacuum pumps) and piping. KSH then found the required equipment and motors in Domtar's inventory and set-up a construction plan to implement the changes without a major shutdown. KSH also provided information and methods for reconfiguring the internals of the main suction press roll to improve dewatering. From start to finish, KSH completed all of this work in less than 12 hours. *(5C2-001, Domtar Inc.)*

Performance of Heat and Power Balances for Various Power Generation Scenarios (2007). ACI retained KSH Consulting to perform several heat balances including scenarios using the existing 50 MW steam turbine generator operating alone or together with the existing 50 MW (nominal) gas turbine generator as well as an additional future 15 MW (nominal) condensing steam turbine generator*. (5BZ-001, ACI Fort Frances)*

Veracel Celulose BEKP Mill Capacity Increase, Brazil (2006). The Brazilian Veracel BEKP mill started up in 2005 with a rated capacity of 900,000 ADt/y. KSH Consulting was mandated to assess the feasibility of increasing the mill capacity to 1.2 million ADt/y by 2009 with a step approach. *(Veracel Celulose, 5BG-001)*

Technical Assistance on Super TMP (2006). This bleached TMP mill located in eastern NA mandated KSH Consulting to provide technical assistance in converting the mill to the production of 45 mL TMP with superior bonding properties. The intent was to produce SCA+ from this pulp in combination with 10-15% groundwood but zero chemical pulp. KSH determined the required the paper furnish mix based on pulp and paper properties. KSH developed the flowsheet and assessed the results of pilot plant trials. The project was not implemented due to the premature shutdown of the mill. *(Kathadin, Port Cartier, 5BE-002)*

Technical Assistance – Energy Reduction Initiatives (2006). A series of projects were developed at this North American East Coast, bleached TMP mill with the goal of a 15% reduction in manufacturing costs. KSH Consulting was mandated to assist the mill in their efforts regarding a replacement of a MC pump for savings in electricity and bleaching chemicals; optimization of DTPA dosing points; investigation of improved refiner controls; substitution of $Mg(OH)_2$ for NaOH in peroxide bleaching; pulp machine vacuum pump improvements; WinGems simulations to identify ways of reducing heat loss at the pulp machine; technical review of the dryer and press section for increasing capacity. The mills objectives were reached within three months. *(Kathadin, Port Cartier, 5BE-001)*

Technical Assistance (2006). PM14 at Domtar, Gatineau was experiencing random speed oscillation on the forming section which resulted in a high draw variance between the former and press which in turn resulted in sheet breaks and efficiency losses. KSH was mandated to find the cause of the problem and identify the solution. The variances were identified as being caused by the machine vacuum system and the problem solved during a shutdown for a felt change. *(Domtar Fine Papers, 5BD-001)*

Tissue Machine Sheet Run Upgrade (2006). KSH provided technical assistance to a tissue machine equipment manufacturer for the rebuild of a TAD machine sheet run to improve machine efficiency. Components for the new sheet run were custom built by the manufacturer according to KSH specifications. *(Confidential Client, 5BN-001)*

Technical Assistance - TMP Heat Recovery (2006). The TMP mill operates at 480 t/d, which has no facility to produce clean steam from the contaminated steam produced by the pressurized refiners. Some of this energy is recovered in the form of hot water and the balance is released to the atmosphere. KSH Consulting audited the mill to assess the potential to use the existing assets (idled evaporators) for use as a re-boiler to make clean steam. KSH also reviewed the existing turbo generator operation and identified potential uses low-pressure steam from a future TMP reboiler. *(Katahdin, Port Cartier, 5B8-001)*

PM2 Appropriation Grade Estimate, Capacity Upgrade (2006). KSH provided a preliminary engineering package for the #2 business unit capacity increase. Detailed engineering was commenced immediately after completion of the package. *(Solvay Paperboard, 5BT-001)*

PM2 MSF Study Upgrade (2006). KSH developed a study to identify current "best practices" technology and a feasibility grade capital cost estimate for the rebuild of the #2 business unit. The goal was to increase capacity, improve efficiency and product quality while increasing the mixed waste content of the sheet. The scope included the complete business unit from the pulper feed system through to the machine winder as well as the replacement of the DCS. *(Solvay Paperboard, 5BQ-001)*

Appropriation Grade Estimate for PM1 Linerboard Machine Capacity & Efficiency Improvements (2006). This appropriation grade study defined the optimum production goals for PM2 at Solvay Paperboard, identified the bottlenecks in the mill, selected the appropriate technology and established the +/- 10% capital costs. Fourteen technology packages were selected to upgrade the PM2 OCC plant, and machine, to increase production levels to 600 t/d and improve efficiency to 94%. Each package was assembled as a stand-alone project to be done either during a major or minor shutdown. All packages were installed as of mid July 2006 and all have met their criteria in terms of production and efficiency targets and all projects were "on time" and "on budget". (*Solvay Paperboard, 5B6-001)*

Tissue Machine Complex (2006). KSH Consulting was mandated to provide technical concepts and marketing/cost guidance for the installation of multiple tissue, napkin and towelling machines in various locations throughout the US. The machines include LDC, WC and TAD processes to meet a wide range of products for AFH and consumer "off take" agreements with major tissue manufacturers. (*ST Paper, 5B3-001)*

Business Plan for the Relaunch of the Chandler Coated Paper Project (2006). The $465 million project to rebuild the Chandler PM-1 to high quality MWC paper was stopped in February 2004. KSH was mandated to review and update the project business plan to attract a strategic investor and finalize its implementation.

Business and Development Plan for the New Richmond Kraft Linerboard Mill (2005). Following the shut down of the New Richmond kraft linerboard mill, KSH Consulting was mandated to review the mill business environment and existing assets and propose a development plan and path forward to ensure the long term viability of the mill. A proper business was then prepared to relaunch the operations. *(Smurfit-Stone, MDEIE)*

Opportunity Study to Increase Green Power Output at a Pulp and Paper Mill in Poland (2005). KSH Consulting conducted an assessment of new technologies to lower the moisture content of sludge and bark, burnt in a biomass boiler. The goal is to increase the efficiency of "green energy production" at the mill. *(PEP Poland, 5AU-001)*

Optimization Program for a Kraft Linerboard Mill in Thailand (2005). KSH Consulting carried out an audit of the Panjapol facility in Thailand and developed a "Path Forward" and capital plan to bring the mill up to its full capacity potential. *(Panjapol, Thailand, 5AL-001)*

Energy Audit for a Kraft Linerboard Mill (2005). Audit of the systems for cleaning the fibre with the objective of identifying means of reducing consumption of electricity. *(Smurfit-Stone, 5AJ-001)*

Mill Wide Energy Audit of a Fine Paper Mill (2005). Technical audit of a fine paper mill to identify areas of potential savings in regards to fresh water consumption and corresponding steam consumption reduction.

Technical Audit of the Sodium Sulphite Production System (2005). Investigated and recommended corrective actions to improve bleach chemical consumption for the generation of sodium sulphite at a newsprint mill in Quebec. *(Abitibi-Consolidated, 5AF-001)*

Mill Process Simulation for a Newsprint Mill, Chile (2005). KSH Consulting prepared a WinGems mass and energy balance of the existing TMP and paper machines of the Inforsa mill in Chile. The study also included creating a future case with new pulp washing equipment installed and determining the improvements required in the white water system to yield an acceptable temperature profile across the mill. *(Inforsa, 5A7-001)*

Development Plan for the Energy Island of an Existing Newsprint Mill in Poland (2004). KSH Consulting was mandated by an independent power provider (IPP) to prepare a development plan for the energy island of a newsprint mill in the context that the mill would be rebuilt as a recycled linerboard mill. The purpose of this mandate was to assist an IPP in preparing its outsourcing offer. *(PEP, Poland, 574-001)*

NCG Systems Audit of a 1,200 ADtpd BEKP Mill, Brazil (2004). Audit of the CNCG and DNCG systems of Ripasa's Limeira mill in Brazil to identify means of avoiding ambient odour under any circumstances. *(Ripasa, S.A., 5A3-001)*

Validation of a Capital Plan for a Coated Paper Mill (2004). KSH Consulting provided assistance in mapping out a strategic plan of an existing coated paper mill and validated the $20 million Capex program. *(Cascades Fine Papers, 583-001)*

Development Plan for a Czech Republic Integrated Packaging Paper Mill (2003). KSH Consulting was mandated by an IPP to prepare a development plan for the energy island of an integrated sack paper and kraft linerboard mill. The purpose of this mandate was to assist the IPP in structuring its outsourcing proposal. *(PEP, S.A., 575-002)*

Development Plan for a Pulp and Paper Mill in Brazil (2003). An integrated pulp & paper mill producing uncoated freesheet grades on the basis of Eucalyptus kraft pulp had completed an expansion program over the last few years. To further optimize the mill by taking full advantage of the excess pulping capacity, KSH conducted a feasibility assessment of an optimization concept proposed by the mill. *(Evergreen Plus Co., 573-001)*

Strategic Plan for a Newsprint Mill (2003). A newsprint mill serving the export market had problems in fiber supply and product quality. The mill awarded KSH Consulting the mandate for a long term development plan. The mandate included an analysis of the present situation for the whole supply chain from the fiber to the finished product. Further, it included the identification and analysis of development options, technically, commercially, and economically. *(Abitibi-Consolidated, Stephenville, 566-001)*

Development Plan for an Energy Island in Czech Republic (2003). This mandate was awarded by an independent energy producer to create a development plan for an energy island of a pulp and paper mill in the Czech Republic. The objective of this plan was to assist the energy producer in preparing his offer for energy services to the mill. *(PEP, S.A.)*

Development Plan for a Paper Machine (2002). A newsprint mill was shut down for competitiveness reasons. A development plan was designed to convert one machine to high value paper. The promoter requested an analysis to find out an optimal development scenario for the second machine. *(Papiers Gaspésia, Chandler, 544-001)*

Development Plan for the Quebec Pulp and Paper Industry (2001). Study to identify development scenarios for the Quebec pulp and paper industry. The study included an in-depth review of the fibre supply/demand balance in the various Quebec regions, an in-depth analysis of the global newsprint, P&W paper and market pulp markets, a review of the competitiveness factors and an analysis of the current competitive position of the various Quebec pulp and paper mills. Finally development scenarios for the various mills were identified and development priorities were established. *(SGF Rexfor/Hydro-Quebec, 534-001)*

Production Improvement Program for a Newsprint Paper Machine (2001). A newsprint producer located in Thailand was operating its paper machine at the limits of its design capacity and at a high overall efficiency. KSH was awarded the mandate to assess the opportunity of increasing the speed of the machine. The required modifications were identified and the project economics in terms of capital investment and financial returns were analysed. *(PanAsia)*

Performance Improvement Program for a CGW/UGW Paper Mill (1999). Technical audit of two small paper machines specialising in CGW and uncoated high bright papers and related process islands. The paper machine performance was analysed and low cost solutions to improve efficiency and production were proposed. *(Tembec, St. Raymond)*

Strategic Reinvestment Study for a Recycled Corrugating Medium Mill (1998). An important containerboard producer gave a mandate to identify an economic viable product/project for its recycled corrugating medium mill. A product screening approach based on key business factors such as product fibre match, fibre resources availability, market demand/supply and synergy of existing assets, etc. was used to reduce the originally proposed 20 paper/board products to four board grades offering promises for further study. A study on the market structure and trend on those grades was also carried out to help mill management get deeper insight of the opportunities and risks related to these grades. *(MacMillan Bloedel)*

Strategic Plan for a Market BKP Mill (1997). A market pulp manufacturer awarded the mandate to construct an optimisation base-case scenario in which the pulp mill operates as a 100% market pulp mill, with little or no affiliated sales and to systematically distil the many paper products options for integration down to the most promising scenarios. The integration options were measured against the base-case scenario and recommendations were made. This study measured each integration option according to after-tax IRR, perceived business risk and capital cost. *(Kimberly Clark, Terrace Bay)*

Distribution and Converting Optimisation Study (1997). The purpose of the study was to optimise the North American distribution of the products of a fine paper manufacturer, to assess the opportunity of increasing the volume of cut-size paper in the product-mix, to identify an optimal location to install such cut-size sheeter and finally to evaluate the profitability of such an investment. The project involved the modeling of transportation and warehousing costs, and analysis of the packaging requirements of copy paper end-users and an economic analysis of an investment in a new sheeter. *(Domtar Inc.)*

Strategic Plan for a Market BCTMP Mill (1996). A producer of market BCTMP awarded the mandate to analyse the current mill situation and to find the optimal integration opportunities for the pulp mill. A multidisciplinary team was assembled to identify the optimal pulp mill integration option taking into account paper and packaging markets, price trends, mill characteristics, capital cost, operating cost, competitiveness and financial returns. Discounted cash flow modelling was included in this analysis of investment options. *(Donohue Inc.)*

Performance Improvement Program for a Pulp Mill in Malaysia (1995). The mill built in the 1980's was designed based on 100% mixed tropical hardwoods (MTH) and was changed to a mix of 50% MHT and 50% acacia mangium. An audit of the mill was performed, department by department, to identify performance problems and the causes of such problems. Various improvement solutions were identified; some of them being operational and other requiring minor and major equipment modifications. Capital cost estimates were prepared for each of the improvements solutions requiring capital investment together with the expected financial benefits. A performance improvement program was recommended to the Client. *(Sabah Foundation)*

Benchmarking and Optimisation Study from Log Yard to Digester (1995). This study involved a technical audit of the log yard area to the digester of this state-of-the art UFS paper mill. The operations parameter of the existing systems were analysed and benchmarked against the best operations in North America, South America and Scandinavia. Based on the established benchmarks, an optimisation program was developed to improve the mill situation. In a first step, potential projects and operational improvement options were identified as well as the associated capital cost on an order of magnitude basis. In a second step, the best alternatives were selected and the associated capital investment and benefits were estimated with a better accuracy. *(Domtar Inc.)*

Energy Saving Program for a Kraft and Paperboard Mill (1995). An integrated paperboard mill jointly with its electrical power supplier mandated KSH to perform a technical audit of the mill to identify potential opportunities to reduce power consumption. The report described the identified energy saving measures, the associated savings in dollars and associated benefits such as reduced labour, quality improvements, etc. The capital investment required to implement the proposed measures was also estimated.

Identification of a Product Strategy (1992). The purpose of this study was to identify a product strategy, which would optimise the assets of a pulp and paper mill and ensure its long-term viability. Several products were identified and analysed based on the forest resources availability, the paper mill and organisational characteristics and finally economic and market factors. *(Alliance, Donnacona)*

TOOLS AND MODELS

In addition to our global insights, analytical skills and database, the proposed study team has access to various models to support its analytical process. Some of the models that are used are as follows:

- Distribution logistics optimisation.
- Financial model.
- Furnish optimisation model.
- Conceptual cost estimating.
- Cash cost curves.
- Econometric modelling.
- Mass & energy balance.

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Appendix 1
Approach to Strategic Plan Development - A Synopsis