

# Improving Maintenance Operation through Transformational Outsourcing

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## Abstract

*Outsourcing maintenance to third-party contractors has become an increasingly popular option for manufacturers to achieve tactical and/or strategic objectives. Though simple in concept, maintenance outsourcing is difficult in execution, especially in a cost-sensitive environment. This project examines the Full Service business under ABB Ltd to understand the key factors that drive the success of an outsourced maintenance operation. We present a qualitative causal loop diagram developed based on the case study of Kinleith Pulp and Paper Mill in New Zealand. The diagram describes the interconnections among various technical, economic, relationship, and humanistic factors and shows how cost-cutting initiatives can frequently undermine labor relationship and tip the plant into the vicious cycle of reactive, expensive work practices. The model also explains how Kinleith achieved a remarkable turnaround under ABB, yielding high performance and significant improvements in labor relations. A case study of Tasman Pulp and Paper Mill provides a contrasting case where success has been more difficult. Results point to the importance of creating sufficient resources (“slack”) to implement improvement activities and pace implementation based on pre-existing dynamics on site.*

## Introduction

From multi-million dollar IT systems and Lean methodology to smaller-scale initiatives around organizational design or human resource development, companies continue to search for ways to better performance. Outsourcing, once seen as pure cost-reduction, is increasingly viewed as an option with considerable strategic value. For example, Dr. Jane Linder [2004] proposed the concept of transformational outsourcing and suggested that, if done right, outsourcing can produce “rapid, sustainable step-change improvement in enterprise-level performance.” This study develops a holistic view of the underlying structure that governs an outsourced maintenance operation and proposes ways to improve contract performance for the customer and the outsourcer involved in similar arrangement. It is based on a 6-month internship at ABB Full Service (FS) sites in New Zealand and United States.

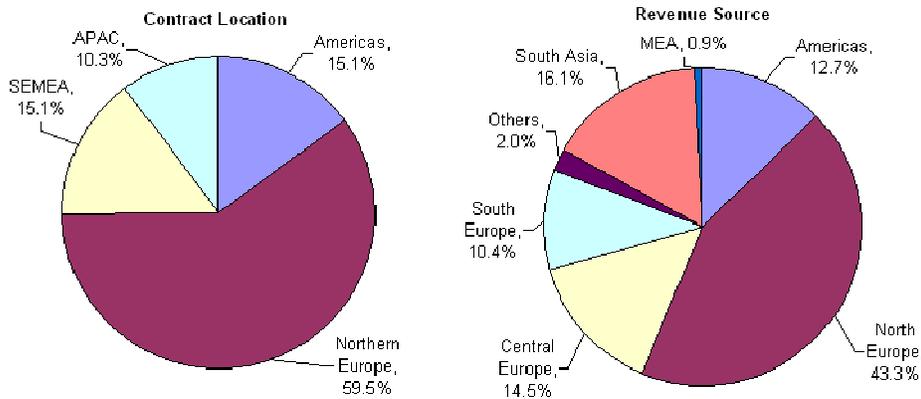
The study examined the outsourcing initiative at Kinleith Pulp and Paper Mill, a softwood kraft pulp and containerboard producer with annual sales of NZ\$450 million and an output of 597,000 metric tons. The mill had over 50 years of difficult labor relationship, high cost structure, and inability to earn return on its cost of capital. In 2003, the mill outsourced its maintenance operation to ABB, and within 2 years, the site achieved impressive turnaround in both performance and work culture. We seek to understand what it was that worked at Kinleith Mill and whether its success can be replicated. The study also looks at a similar Full Service implementation effort at Tasman Mill to draw additional insights.

The research method follows a case based approach. Approximately 210 research hours were spent on gathering data from primary sources, and more than 70 interviews were conducted. Refer to Appendix A for details.

In the sections below, we will first introduce ABB Full Service organization and product concept; then using the Kinleith case study, we will explore the pitfalls a commodity manufacturer faced and why maintenance outsourcing was “transformational” at Kinleith. Finally, we will present the governing dynamics, lifecycle, and success factors at an outsourced maintenance environment and suggest ways to improve an outsourcer’s ability to implement such contract.

# ABB Full Service®

Formed in 1988, ABB Ltd. provides power and automation technologies to utility and industry customers worldwide. ABB Ltd started to offer Full Service (FS) for heavy industry customers in the 1990s. Today, Full Service is part of the product portfolio managed by the Automation Technology Process Automation (ATPA) Services group. Of the 9,000 plus service professionals employed by ATPA Services, 55% are in the FS group. In 2004, ATPA generate \$1.76 billion USD in annual revenue, and FS group generates roughly 25% of it in basic yearly contract value. There are currently over 150 FS contracts. Figure 2-1 shows the contract location and revenue breakdown by region in 2005.



**Figure 0-1: Full Contract Location and Revenue Source Breakdown**

An ABB Full Service contract is a long-term, performance based agreement between ABB and the customer with agreed productivity improvements. During the term of the contract, ABB provides technical and managerial personnel to look after the performance and reliability<sup>1</sup> of customers’ production equipments<sup>2</sup>, taking over responsibilities over maintenance related activities, equipments, and personnel. Appendix B offers more discourse on the organization, product concept, and implementation process of the Full Service group.

Based on discussions with senior managers from ABB and its clients, the Full Service model has the following advantages and disadvantages for a customer compared to doing maintenance in-house:

Advantages	Disadvantages
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<sup>1</sup> Reliability in this study primarily refers to equipment reliability, which can be measured by Overall Equipment Efficiency (OEE).

<sup>2</sup> At a FS site, ABB is responsible to maintain all equipments regardless whether the equipment is manufactured by ABB or not.

<ul style="list-style-type: none"> <li>• Provide profit incentive to lower cost and increase Overall Equipment Efficiency (OEE)<sup>3</sup> as opposed to budget maximization</li> <li>• Provide strong catalyst to produce “step-change” in culture and performance</li> <li>• End-to-end management</li> <li>• Improve maintenance personnel development and management focus;</li> <li>• Provide access to best practices, critical skills and resources</li> <li>• Share risks</li> <li>• Enhance service level</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for redundancy, such as overlap of resources</li> <li>• Silo-ing of maintenance operation</li> <li>• Sole partner, increased risk</li> <li>• Possible cultural clash, us versus them</li> <li>• Possible reduction in core competency, if it used to be manufacturing or product design and manufacturing integration</li> </ul>
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**Table 0-1: Advantage and Disadvantage of a Transformational Outsourcing Contract**

However, as of today, the FS business has yet to gain traction. ABB has the third largest market share (0.13%), with its customers as the largest competitors, owning over 97% of the market. In a risk-averse environment, such as heavy industries, a change initiative of such scale based on a relatively unproven model suggests significant strategic and operational risks and even personal risk for the customer executives who sanction the deal. Therefore, a customer often chooses to embrace these risks out of necessity only, such as the case of Kinleith Pulp and Paper Mill.

## Case Study: Kinleith Transformation

On March 26<sup>th</sup>, 2002, Carter Holt Harvey (CHH), the owner of Kinleith Pulp and Paper Mill, New Zealand’s largest industrial site which contributed the same value to economy as the country’s entire wine industry, announced its intention to outsource all maintenance functions to a contractor and cut more than 50% of its workforce<sup>4</sup>. “If we did nothing,” said Brice Landman, the chief executive of CHH, in an interview<sup>5</sup> shortly after the announcement, “there wouldn’t be a future.”

Despite large investments in productivity over the years, Kinleith lagged the competition. Modern mills in Chile, China, and Russia had an estimated \$200 per ton cost advantage. A directly competitive mill in Australia was reputed to have a cost structure that was 75% that of Kinleith’s. In 2001, Kinleith’s EBIT was negative, and its 5-year cash flow return on investment (CFROI) averaged only 5% against a cost of capital of 12%. Management recognized that the mill’s inability even to service long term debt would ultimately result in its closure [Linder, 2004]. On top of the financial hardship, the mill had become known as “an industrial relations nightmare.” High absenteeism, abusive overtime practices, and resistance to any change initiatives unless paid were only few examples of the issues that mill management faced everyday.

Uneconomic and inefficient, Kinleith reached a make-or-break point by the end of 2001. To save the mill, CHH management decided to outsource maintenance, reduce production headcount, and negotiate a new collective agreement, i.e. a labor contract that applies to all members within the group, with unions. Maintenance was targeted because it had worse labor-management relations. After more than a year of difficult and litigious process, during which the union challenged the outsourcing decision in court, in January 2003, ABB took over maintenance in Kinleith.

<sup>3</sup> OEE = Time Availability (%) x Speed (%) x Quality (%). This is a standard industry indicator of how a machine, production line, or a process is performing; real-time measurement of OEE can provide powerful insights in how to increase productivity and reduce operating costs.

<sup>4</sup> At the time, Kinleith had a total of 772 people. CHH’s original intention was to lay off 369 of them, and 190 of them would be re-hired by ABB.

<sup>5</sup> Source: Radio New Zealand Ltd, May 27<sup>th</sup> 2002, Document ID 72945.3

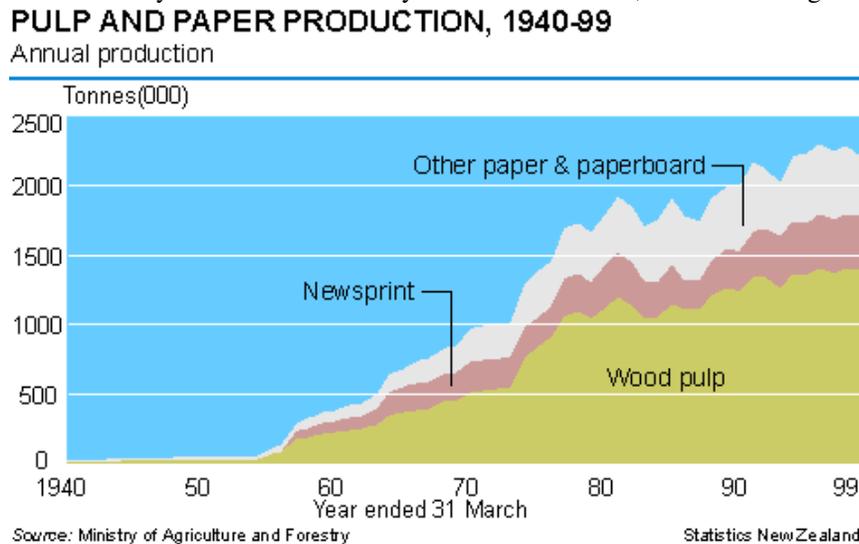
By 2005, compared to the performance level at the start of the restructuring, OEE went up by 17% on one fibre-line, maintenance cost went down by 20%, total mill output increased 15% with minimal capital investment, and maintenance overtime dropped by 50%. Collective agreement negotiation took only 2 days, compared to the usual contentious process drawn out over 4 to 5 months in the past.

To understand how Kinleith accomplished this transformation, we will first examine what led Kinleith to its crisis.

## ***Pre-Restructuring: The Vicious Cycle of Cost Cutting***

### **Reliance on Extrinsic Rewards**

The New Zealand government started to develop a planned production forest starting in early 1900s. By the late 1930s, the government’s vision for the forest industry had expanded from merely satisfying domestic demands to becoming a major economic sector that could earn foreign exchange from exports. Therefore, to encourage investments from the private sector, the government offered a range of incentives and support mechanisms, such as import control, trade tariffs, and state subsidies from the 1940s to the early 1980s<sup>6</sup>. The industry bloomed as a result, as shown in Figure 3-1.



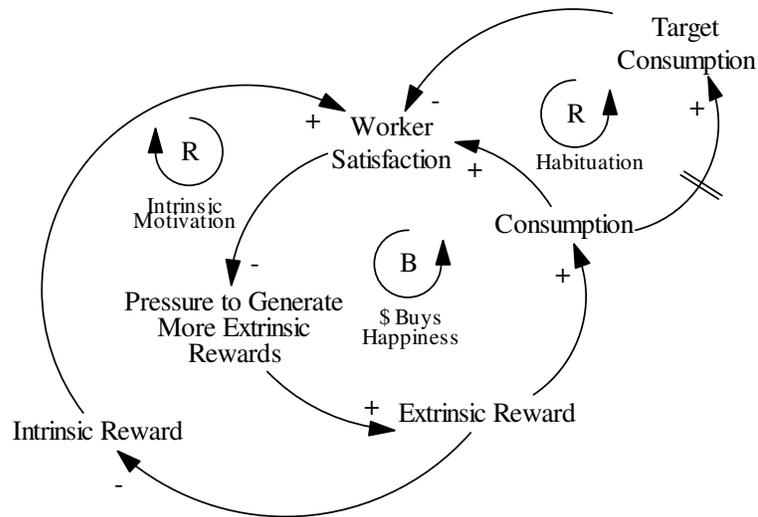
**Figure 0-1: 1940-1999 New Zealand Pulp and Paper Production**

Built in 1953 by New Zealand Forest Products (NZFP), Kinleith enjoyed tariff protection for the first three decades. Without cost pressure, the mill offered generous compensation packages to attract labours. At its peak, the mill employed more than 4000 workers, and the local community, Tokoroa, prospered. More importantly, operating in a near-monopoly environment had significant consequences on negotiation with unions.

“This mill has a long history and the history was of a cumulative nature, meaning the terms and conditions were built upon the past... The employment negotiation was ... always about what [the workforce] need to add to existing terms and conditions... Over a period of 40 or 50 years, it got to the point where it was very difficult to operate. A lot of restrictive practices... Remember for the first 30 years... business was subject to tariff protection so we had a cost-plus environment. [If] workforce demanded something and was prepared to go on strike for it, we had the decision to make – well, do we resist it and cost ourselves money or do we perpetuate it and just add a little bit more price to the product.” – CHH Manager at Kinleith

<sup>6</sup> Source: Griffiths, James, <<http://www.fao.org/docrep/W6127E/w6127e0g.htm>>

As a result, wages and benefits spiraled up. This trend not only led to a high cost structure that eventually forced NZFP into massive debt but also undermined employee motivation and relationship with the mill management. Modern psychology research [Lord, 2003] suggests that habituation and rivalry effects cause people to engage in a self-defeating pursuit of higher level of income; more money does not necessarily mean more happiness unless their income is more than what they have become used to and what other people make. As the workers' compensation rose which allowed them to enjoy higher level of consumption (i.e. living standard), their target level of consumption also went up, dampening the initial increase in satisfaction brought by the raise. To make the matter worse, studies [Deci, Koestner, & Ryan, 1999; Beilock & Carr, 2005] have shown that intrinsic interest in a task – the sense that something is worth doing for its own sake – declines when someone is rewarded extrinsically to do it. Subconsciously, people believe that if they have to be paid to do something, then the task itself must not be interesting. Instead of focusing on the task, people will shift their goal to maximizing the reward. In Kinleith, workers started to feel entitled to compensation increase, making each negotiation between the union and mill management more difficult. This kind of “hedonic treadmill” is captured in the causal loop diagram (CLD) below.



**Figure 0-2: Extrinsic vs. Intrinsic Rewards Impact on Worker Satisfaction CLD**

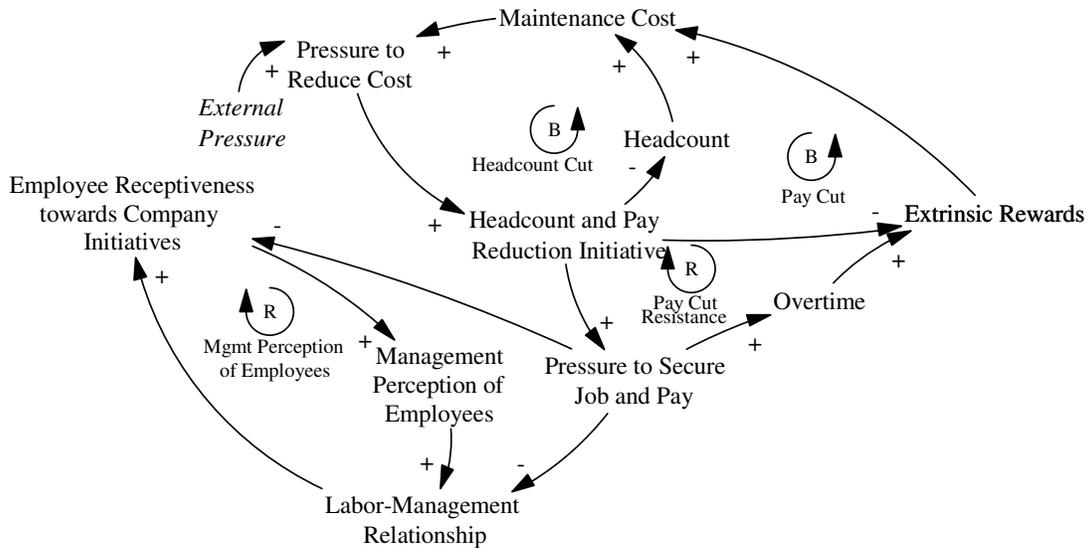
In addition, union's escalating demand undermined the mill management's perception towards the unions and workers. "It was a bottomless pit," said one frustrated middle manager, "how much money do you have to ram down these guys' throats before they choke?" Negative perception led to increasing antagonism in the mill.

This mode of operation might have persisted if it were not for the currency crisis in 1984, which drastically changed the macroeconomic environment of the forest industry in New Zealand. The crisis convinced the government to adopt free-market principles [Linder, 2004] and initiated a series of deregulation programs and unilateral tariff cuts, resulting in increase in foreign competition and immense pressure for companies to cut cost. The industry began to consolidate, and Kinleith came under Carter Holt Harvey (CHH) in 1990.

To remain competitive, NZFP and CHH both made substantial capital investment to improve productivity from 1987 to 1998. The most recent investment in 1998 totalled NZ\$313 million and increased production by nearly a third while reducing 300 jobs. The mill went from 6 paper machines and 2 pulp dryers producing 1200 tons per day in 1987 to one paper machine and one pulp dryer producing 1600 tons per day in 1998 [Linder 2004].

Due to cost pressure and increased productivity, Kinleith trimmed its workforce multiple times, through voluntary attrition occurred in 1987, 1991, 1998, and 2001, from 4000 under NZFP to about



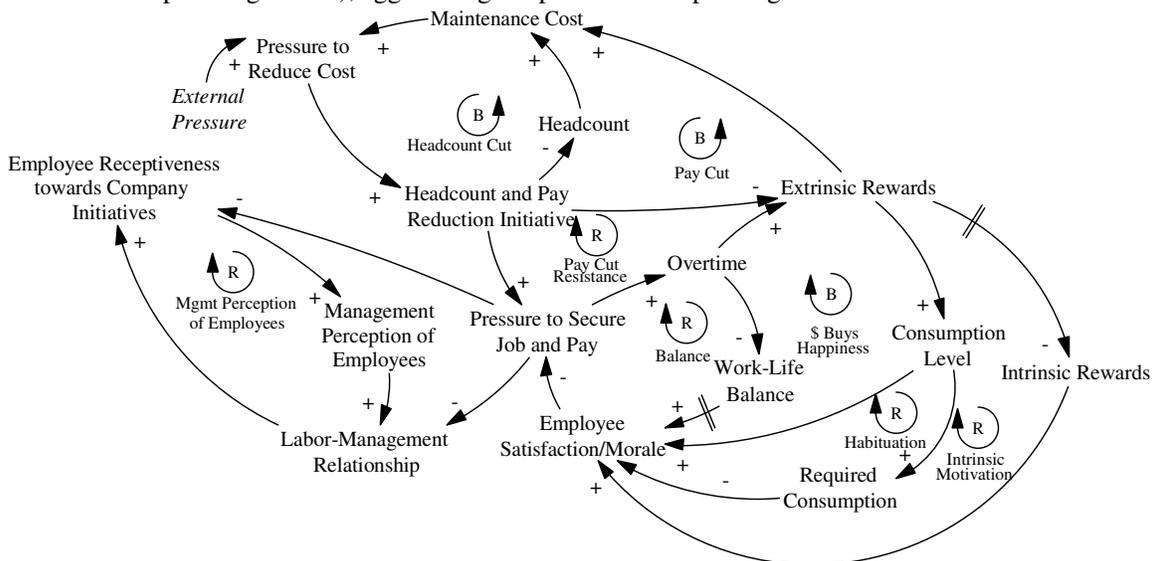


**Figure 0-5: The Reinforcing Nature of Management Perception towards Workers CLD**

On the other hand, these cost cutting initiatives caused workers to rely even more on extrinsic rewards and incentivised them to abuse overtime pay (see Figure 3-6). They wanted to generate additional income to make up for the reduced work conditions and to make up for job satisfaction lost due to poor labor relationship and reduction in company motivational programs, such as training, recognition events, leave parties, and Christmas parties. Moreover, the terms of the collective agreement, a cumulation of negotiation results over several decades, permitted ample opportunities to generate overtime pay:

1. A quarter of the workforce was scheduled to work every weekend, regardless work needs. Double time was paid out.
2. The entire workforce was allowed to work on the 11 statutory holidays, regardless work needs. Workers effectively receive four times the normal rate.
3. Workers could informally arrange mutual shift change. Double time was paid to those who came in on their days off.

And as people relied on the “\$ Buys Happiness” loop, tradesmen work-life balance suffered (see “Balance” loop” in Figure 3-6), aggravating the problem of depending on extrinsic rewards.



**Figure 0-6: Dependence on Extrinsic Rewards Damaging Work-life Balance CLD**

Overtime cost soared. Compared to the salaried production workers, Kinleith maintenance workers worked 100% more overtime. “People were just milking [the company]... they used to drag the jobs and then just stay around doing nothing till eight,” said a tradesman. These practices confirmed mill management’s negative perception towards workers, labor relationship worsened, and the organizational culture spiraled downwards.

Plant performance also suffered due to higher labor costs. Figure 3-7 shows that, as the mill’s costs rose, the management tried harder to cut cost, triggering undesirable dynamics that eroded the mill’s maintenance capability, i.e. maintenance quality, efficiency, and know-how. As capability eroded, the maintenance group became more reactive and had to pull resources away from proactive work, such as preventative maintenance and investment in better maintenance technology (refer to the “tradeoff” and the “Synergy & Capability” reinforcing loops). More breakdowns led to higher maintenance cost, and Kinleith was right back to where the problem started.

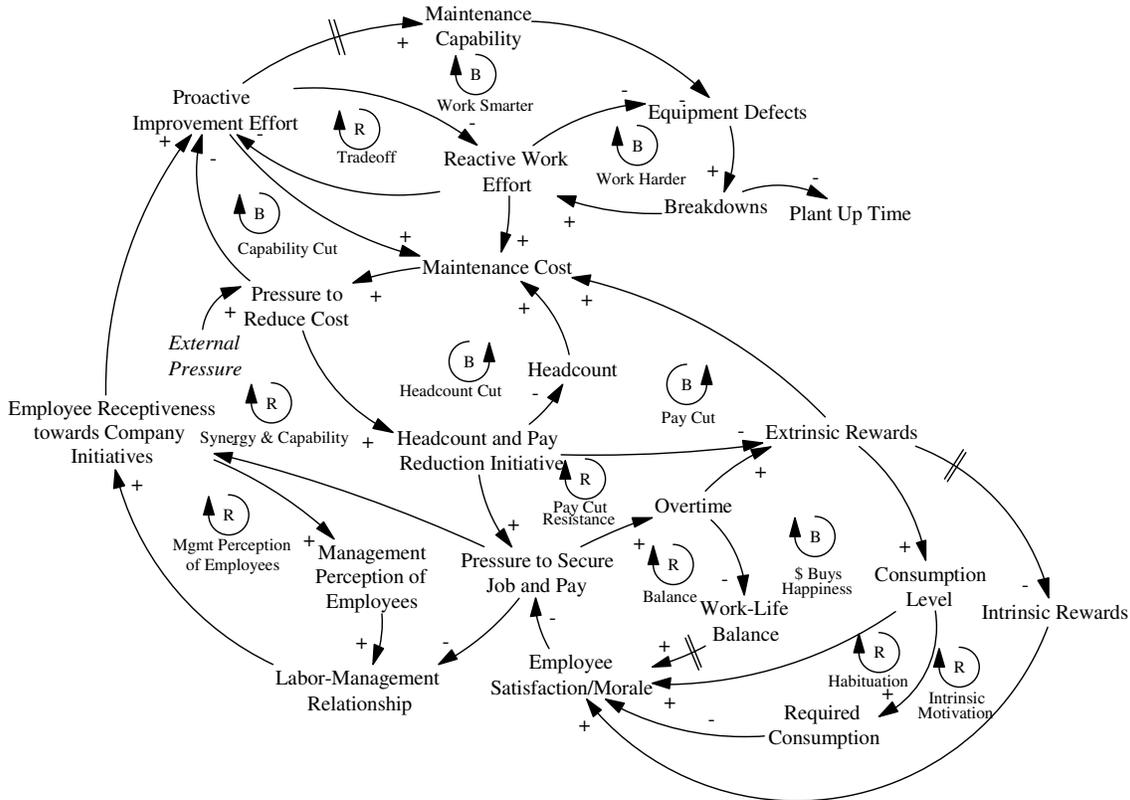


Figure 0-7: Erosion of Maintenance Capability CLD

Other than the dynamics shown above, other issues worsened the situation. Firstly, although tradesmen worked a lot of overtime, the plant did not enjoy more work output since managers and supervisors were not present during overtime hours and could not ensure reasonable productivity. “People just milled around doing nothing,” said one middle manager, “or they worked on their own projects... fixing tractors, radios.” Secondly, the difficult labor situation in the maintenance group caused some managers and engineers to leave the mill. Higher turnover rate meant loss of knowledge and further erosion in maintenance capability. Thirdly, the more workers resist in getting involved in improvement initiatives unless paid, the less they could rely on work itself to generate intrinsic satisfaction, resulting in less satisfaction and less receptiveness. Finally, as people left the town, the Tokoroa community suffered. Real estate price dropped, and people with means started to consider living elsewhere and commute to work instead. Since most of them were at the management level, the mill workers developed the impression that managers did not care about the local community or the long-term future of the mill.

## Summary

Kinleith's crisis started with a workforce highly dependent on extrinsic rewards, and therefore, when the mill encountered rising financial pressure, problems quickly spread to all aspects of the operation. By reducing headcount and work conditions to curb rising cost, the company undermined the labor-management relationship. As relationship deteriorated, work culture suffered, eventually impacting the plant's performance and aggravating its financial trouble. This is a classic case of "policy resistance," the tendency for interventions to be defeated by the response of the system to the intervention itself [Sternman, 2002].

## ***Post-Restructuring: Reversing the Cycle***

So how was Kinleith able to get out of the valley of death it traversed for years and achieved such spectacular turnaround in merely two to three years? Interestingly, not even those who were integral to the transition process could agree on an answer. Most attribute the success to one or a combination of the following:

1. The "agents": the leadership and skills of the ABB managers<sup>9</sup> caused the transformation. The 360 degree feedback survey of the ABB managers in 2003 suggested the ABB managers showed a strong orientation towards "constructive" styles, which is more conducive to positive working relationship, based on the Human Synergistic Lifestyle inventory (see Appendix I and J).
2. Management policies/actions: activities such as Forest Camp<sup>10</sup>, staff development reviews with tradesmen, or other programs in the Organizational Development Plan (which structured the implementation from 2003 to 2006) effected the improvement.
3. The act of outsourcing: outsourcing provided an "intense, transformational experience" that serves as "a tipping point where new identities are weighed, where values are examined and strengthened or replaced" [Ancona, 2005]. The Learning History [Sun & Scott, 2004] identified that the tradesmen at Kinleith had three key identities: a unionized workforce, the caretakers of the mill, and the caretakers for the township of Tokoroa. The ABB management team at Kinleith strengthened these identities with various actions and behaviors. The redundancy also helped to reduce the number of strong unionists who were highly resistant to change and dispelled the belief that people were irreplaceable.
4. The FS contract: the performance-based terms and the model of running maintenance as a business incentivize maintenance personnel to deliver higher performance

While each of these theories may contain elements of truth, they failed to explain how these specific interventions addressed the root causes of the problems on site and reversed the pre-existing dynamics. The research pointed to two major factors behind the transformation: shifting workforce motivation from extrinsic to intrinsic factors and providing sufficient "slack" to stabilize the mill's physical condition.

### **Shifting to Intrinsic Motivation**

Several factors helped Kinleith to shift the workforce motivation from extrinsic to intrinsic. Firstly, the new collective agreement eliminated policies that encouraged excessive overtime and instituted tighter control on overtime approval and scheduling procedures. Although the elimination of these terms meant a reduction of 10% to 20% of people's income, other factors worked together to ensure worker satisfaction and morale did not erode.

About 90% of ABB's employees at Kinleith were previously employed by CHH, with an average tenure of 20 years. Therefore, the redundancy package was quite substantial, average around NZ\$0.25 million per person. This lump sum allowed many to pay off loans and change lifestyle such

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<sup>9</sup> The management team of ABB Kinleith in 2003 consisted of 2 managers taken over from CHH and 8 ABB managers who previously worked for ABB in New Zealand or other parts of the world.

<sup>10</sup> "Forest Camp" is an off-site team building event that ABB has standardized during Full Service implementation.

as moving out of Tokoroa to a more affluent town or purchasing weekend houses. Less financial pressure, need for longer commute, and the desire to enjoy the new lifestyle reduce incentives to work overtime. Moreover, ABB managers decided to accept the workers' proposal of having the choice to work a four-by-ten<sup>11</sup> or a five-by-eight schedule. Half of the tradesmen choose the former.

“The workforce is generally older. Cause’ they’re older, a lot of them got good redundancy... So they came out with a lot of money. There wasn’t really a lot of desire to work overtime anymore... You are aware of our 14-day roster? That comes about because people want more lifestyle balance... They wanna be at home. Ninety percent of people have beach houses... That’s where they wanna go on the weekend... That’s why the roster is quite important to what we’re trying to do. It’s what the guys wanted... In the end, money wasn’t everything.” – ABB tradesman at Kinleith

ABB stipulates that each business unit is allowed to keep such schedule flexibility only if they are able to meet monthly performance targets, such as preventative maintenance compliance and % of planned vs. emergency work . People thus are incentivized to keep unscheduled breakdowns at a minimum to ensure they have the schedule option as well as to avoid interrupting their long weekends for work. Such effort attracted public recognition. In 2006, ABB Kinleith won the prestigious Work Life Balance award, given by the New Zealand government to companies showing outstanding performance and offering work-life balance for their employees. Additionally, ABB took on other initiatives to help people reap intrinsic rewards from their work (see Appendix E).

As a result, overtime fell from 30% to around 11% after the restructuring, which helped ABB to control costs and break the “hedonic treadmill” mentioned before. One tradesman remarked how he used to not take a vacation for years because it was lucrative to work; after restructuring, he started to learn golf and finally realized what he had been missing for the past 25 years. Happier workforce and more collaborative labor relationship enabled ABB to implement projects that help reduce breakdowns.

### **Stabilizing the Organization**

However, changing employee motivation alone could not propel Kinleith out of its vicious cycles. As mentioned before, site maintenance capability deteriorated over the years, and at the onset of the restructuring, Kinleith maintenance group had little time to do anything other than fixing immediate problems. Therefore, stabilizing the physical condition at the start of the contract is another reason behind Kinleith’s transformation.

To stabilize the organization, there must be enough “slack,” i.e. extra resources or time. On top of the fact that the mill was already suffering from frequent breakdowns, ABB had to deal with all the logistics and administrative tasks of setting up a new organization, such as installing IT and payroll systems and hiring new resources at contract start-up. All of this had to be done by a significantly smaller maintenance team that was 79% of its original size. With fewer people and more work, Kinleith could have been pushed deeper into firefighting mode. Therefore, ABB management’s effort to leverage the excess time provided by the 3-month production strike, occurred from March to June 2003 shortly after contract start-up, was critical to the success of the implementation.

During the strike, production activities ceased. ABB obtained the support from CHH to pull the annual shut forward so to minimize the strike’s impact on the plant and to maintain the momentum of the restructuring. This 3-month window had several desirable effects:

1. It allowed the team to catch up on maintenance issues and to perform preventative care.
2. It delayed ABB’s implementation of new projects since the mill’s future was uncertain and allowed the employees to concentrate on getting out of firefighting.

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<sup>11</sup> Four-by-ten: work 4 days a week and 10 hours each day, leading to a long weekend from Friday to Monday every second week

3. It helped to build goodwill in the maintenance group since workers recognized ABB's effort in keeping employees working and paid.
4. It quickly de-oriented the ex-CHH maintenance employees from previous organizational identity and propelled them to form synergy with the new ABB management [Sun 2004]. Prior to restructuring, maintenance and production workers had always gone on strike together. After the maintenance workers signed a separate agreement with ABB, they did not participate in the strike. Walking through the picket line held by past colleagues sent a powerful signal to the maintenance group that they had departed from the past.

In short, if the plant were not stable enough, the new ABB organization would not be able to persuade its employees to spend more time on preventative maintenance, to adopt new work processes, or to participate in team building initiatives.

## A Systemic View of Maintenance Outsourcing

### Governing Structure and Dynamics

So what are the general insights on maintenance outsourcing can we draw from the Kinleith case study? The causal loop diagrams shown earlier can be expanded to describe an outsourced maintenance operation, such as a Full Service site. The variables in the diagram can be divided into four parts – Partnership-related, Physical, Economic, and Humanistic – which describe the important dynamics that govern the maintenance performance at a site (see Figure 4-1). The sections below will describe each of the four parts in detail and also show how the part in discussion links to other parts in the CLD.

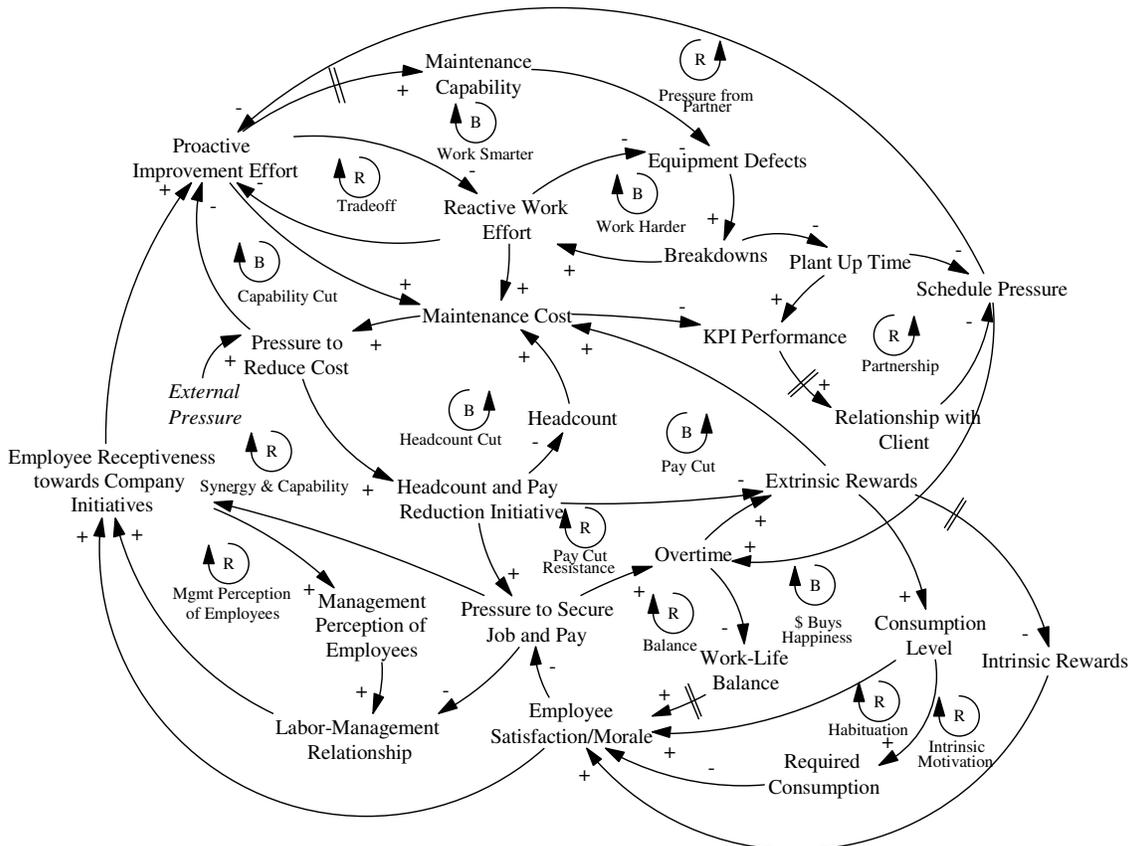


Figure 0-1: High-Level CLD for an Outsourced Maintenance Operation

### Partnership-related

Compared to traditional in-house maintenance, the relationship between production (client) and maintenance (outsourcer) in an outsourced maintenance environment plays a more significant role in the site's maintenance performance. Since a FS contract is performance based, the Key Performance Indicators (KPIs) are the primary determinant of the client-outsourcer relationship. The better the relationship, the less the client will interfere with the maintenance partner's work practices and schedule.

In Figure 4-2, plant uptime and maintenance costs are the two primary KPIs in this environment. The worse the KPI performance, the less trust the client has towards the outsourcer and would feel compelled to micromanage the maintenance partner.

“It's disheartening sometimes. [The client] said this equipment is down. You need to get some parts to do it right... But [the client] want you to just do it this way. And you say, okay, I can do it another way, not good, but still better. [The client] said 'NO, do it this way, I want my equipment back'” – ABB supervisor at Mansfield

However, as such pressure increases, it becomes harder for the maintenance group to improve performance. As the client dictates maintenance practice, holds more meetings, or demands more frequent status updates, it directly impacts maintenance quality, cost, employee morale, and ongoing improvement initiatives, such as documentation and training.

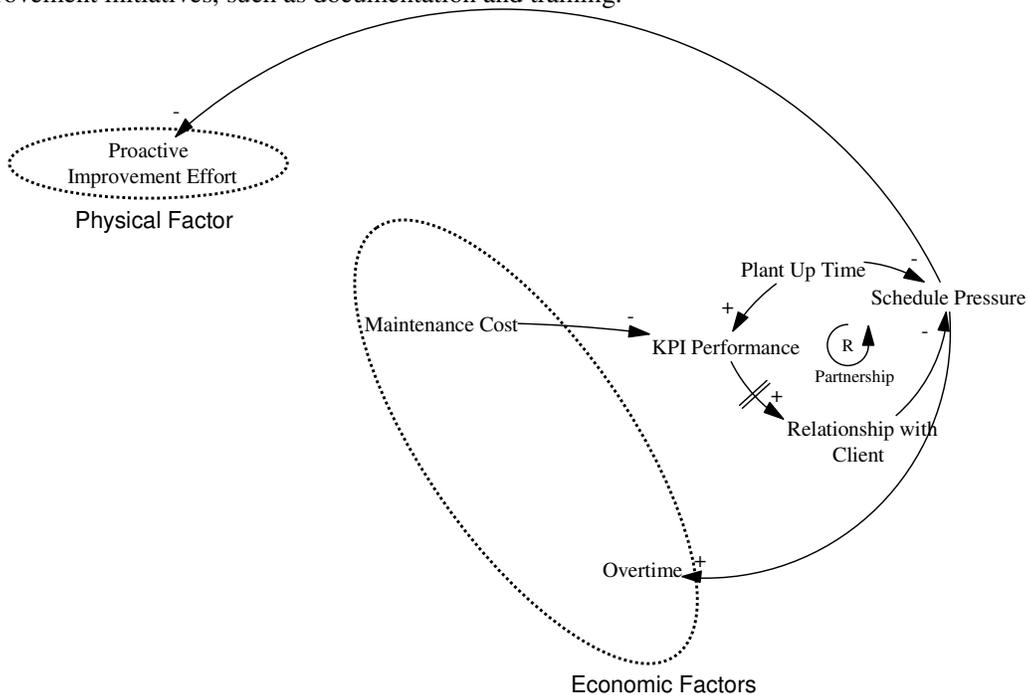


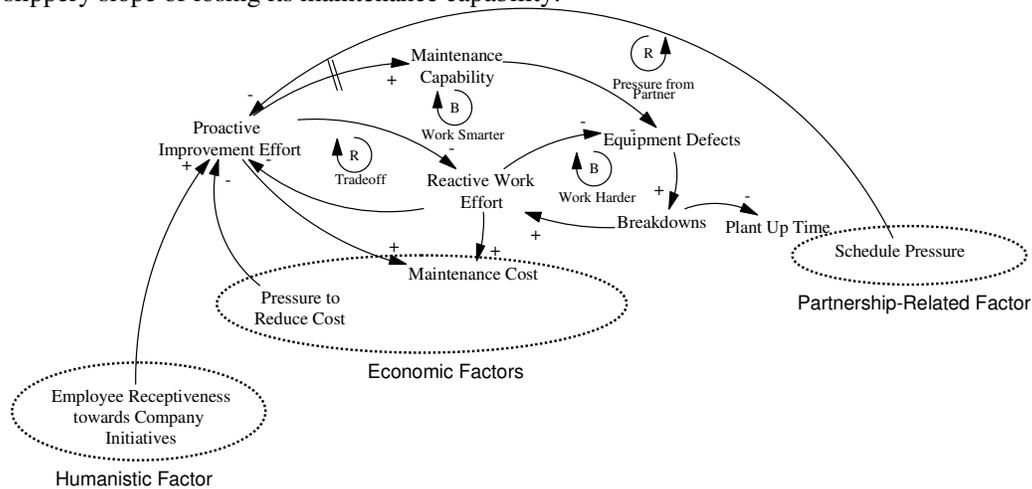
Figure 0-2: Partnership-related Factors of an Outsourced Site

In Kinleith, after ABB began to improve performance, it became easier to negotiate with CHH to fix breakdowns occurred during the weekend on a weekday instead. Contrarily, another interviewed site logged more than 500 hours of overtime during one weekend because the client insisted that the entire ABB team be on site in case of any breakdown.

### Physical

This portion of the causal loop diagram (Figure 4-3) is based on Sterman's work in 2001 and 2004. Maintenance capability is defined as the level of work quality, know-how, and practices; having high maintenance capability suggests making fewer mistakes and taking better care of the equipments, resulting in fewer breakdowns and higher plant uptime. Reactive Work Effort simply gets rid of a

problem as it arises but does not address its root cause. Although investing in Proactive Improvement Effort yields more lasting benefits, it involves significant time delay (6 to 8 months or longer) between investment and actual increase of capability. Therefore, while most managers intuitively understand that it is better to work smarter than harder, it is easy, for example, to resort to scheduling more overtime to deal with problems rather than spending the already tight resources on root-cause analysis or a reliability project. When deciding where to cut cost, it seems logical to cut an improvement initiative which does not pose any immediate impact. As the company becomes more reactive, however, maintenance cost rises; managers have greater pressure to reduce cost, leading to further decrease of maintenance capability. So it is not hard at all for a company to quickly go down the slippery slope of losing its maintenance capability.



**Figure 0-3: Physical Factors of an Outsourced Site**

The operational nature of an industry also has significant impact on the “degree of incline” of the aforementioned slippery slope. In a continuous process industry, such as pulp and paper, chemicals, and pharmaceuticals, the production equipment is often large, inflexible, and has high fixed capital cost. Because there is no buffer inventory between production steps in such environment, compared to discrete manufacturers, a continuous manufacturer faces more severe consequence when equipments break down; the entire system shuts down, and the plant’s output is immediately impacted. Also, some of the processes cannot be stopped immediately, resulted in wasted materials and hours of clean-up activities. Therefore, a continuous flow manufacturer strives to keep the machines running as long as possible. Stopping and restarting equipments is not only hugely expensive (costing more than \$12000 NZD per hour) but time-consuming and risk-prone. For example, thermal equipments such as power boilers take around 6 hours to ramp down and another 6 hours to ramp up. Also, because ingredients must be combined under precise conditions, production during the first few hours of starting the equipment is usually scrapped. It is no wonder that manufacturers have much incentive to minimize downtime.

However, such mental model may lead to erosion of maintenance capability since the need to increase plant uptime makes plant management reluctant to take machines down for preventative maintenance or proactive improvement projects. Without investment in proactive improvement, maintenance capability drops. Refer to Appendix C for more discussion and a causal loop diagram on how the needs to minimize plant downtime can become self-defeating.

### **Economic**

As shown in Figure 4-4, compared to the other three parts, the Economic aspect has the most causal connection with other parts, 11 external links as opposed to 5 for Partnership-related, 5 for Physical, and 6 for Humanistic part, and it is located in the center of the overall CLD (Figure 4-1). These characteristics combined with the nature of the business often make the economic dynamics the driving force at an outsourced site.



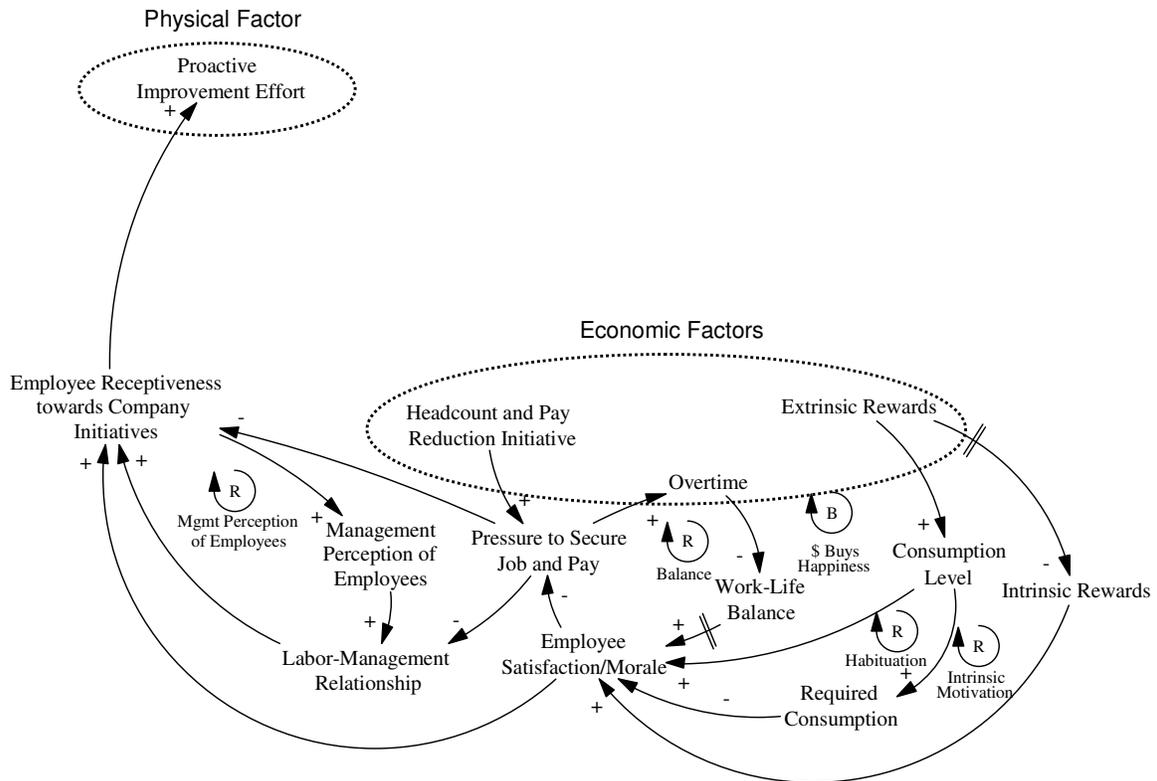
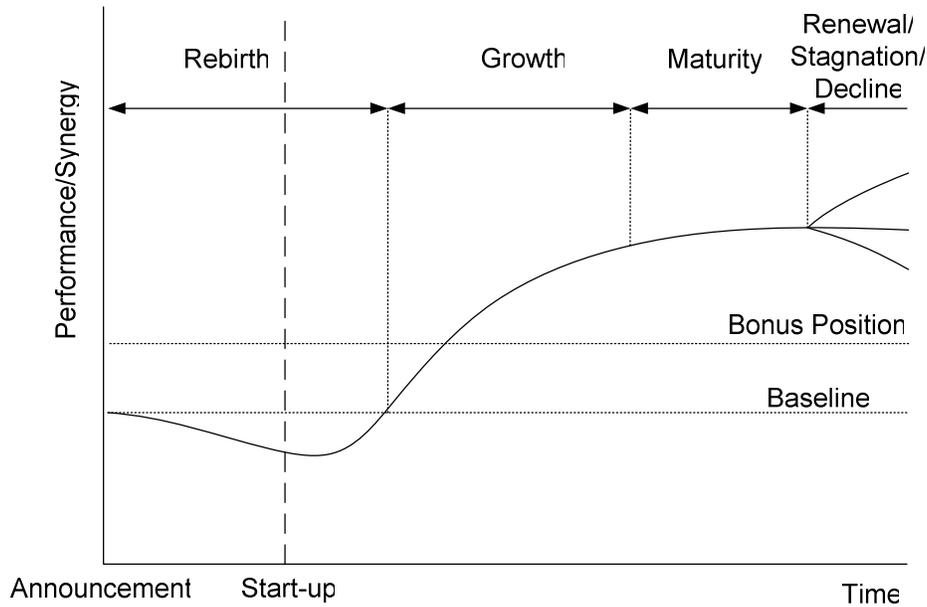


Figure 0-5: Humanistic Factors of an Outsourced Site

## Critical Success Factors

### Rebirth to Growth – Anticipation of Worse-Before-Better Phenomenon

The first critical success factor is to acknowledge, understand, and plan for the “worse-before-better” (WBB) phenomenon that occurs at the start of a FS contract lifecycle. Figure 4-6 plots the client’s plant performance and organizational synergy against time and depicts the typical lifecycle of a FS contract starting from the announcement of the decision to outsource maintenance to the client’s organization. There are four main phases of a FS contract: Rebirth, Growth, Maturity, and Renewal/Stagnation/Decline. The WBB phenomenon refers to the point when the performance and organizational synergy actually dropped below the level prior to outsourcing (i.e. the Baseline).



**Figure 0-6: Full Service Implementation Lifecycle**

When the outsourcing decision is announced, both the performance of a site, such as reliability or budget compliance, and the client’s maintenance organizational synergy, i.e. Employee Receptiveness towards Company Initiatives, drop because of:

1. Psychological disruption: restructuring or outsourcing inevitably causes anxiety in an organization. Besides fearing for job loss, people are also nervous about having new management team, becoming a “contractor” rather than a permanent employee, and dealing with potential changes in compensation, positions, and responsibilities. Such psychological disruption lowers morale and could potentially trigger negative dynamics depicted previously. Also, due to such disruption, the longer the lag between the announcement of the outsourcing deal and start-up, the more maintenance issues a site may experience maintenance issues at contract start-up.
2. Physical disruption: this type of disruption comes from loss of experienced resources during the restructuring, the learning curve effect of new personnel joining the site, and, more importantly, inadequacy in resources when workload peaks at the beginning of a contract start-up as the outsourcer sets up a completely brand new organization at the client site and attempts to deal with the cumulated maintenance workload.

The charts below (Figure 4-7, 4-8, and 4-9) plot the actual OEE performance at Kinleith, Tasman, and Mansfield mills within the first year of implementation. Notice the dip in OEE at all three sites.

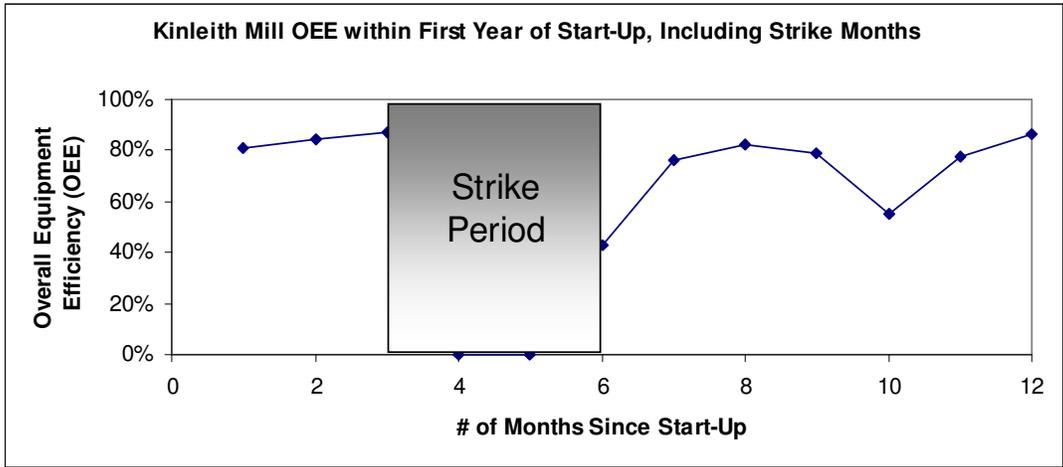


Figure 0-7: Kinleith Mill OEE during First Year of Implementation

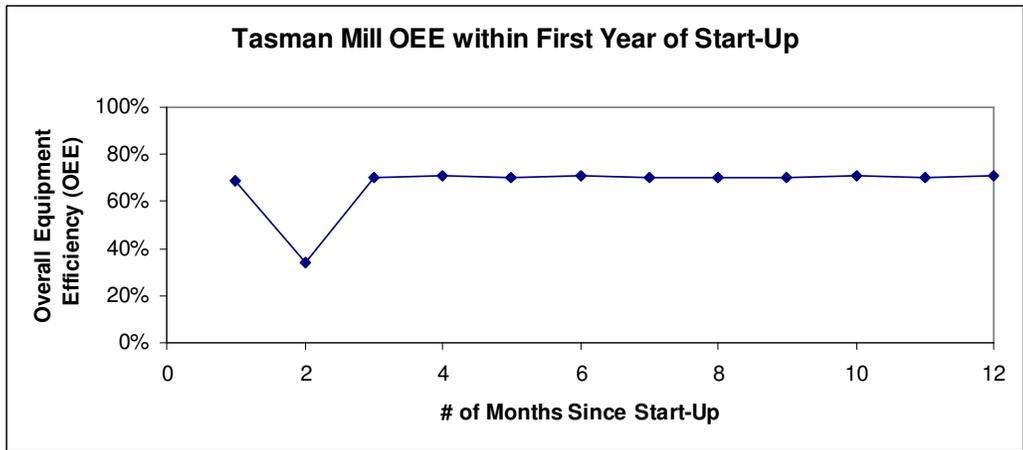


Figure 0-8: Tasman Mill OEE during First Year of Implementation

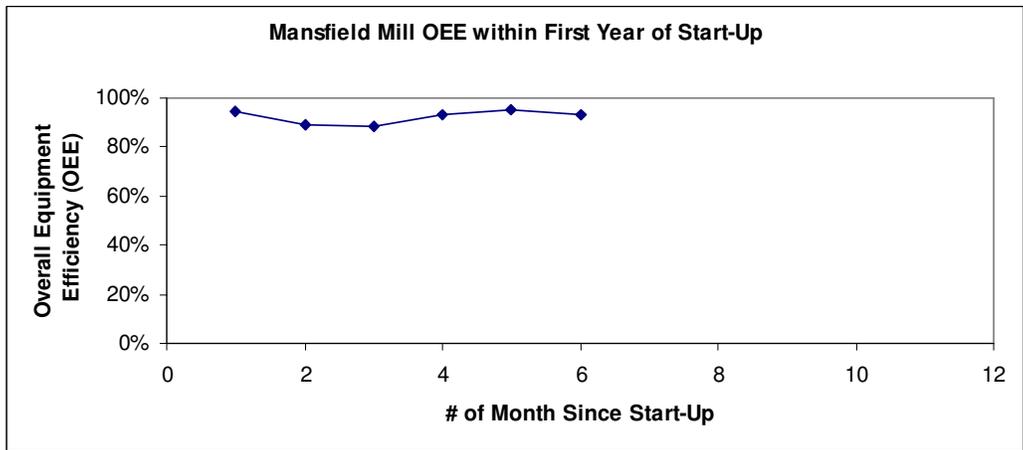
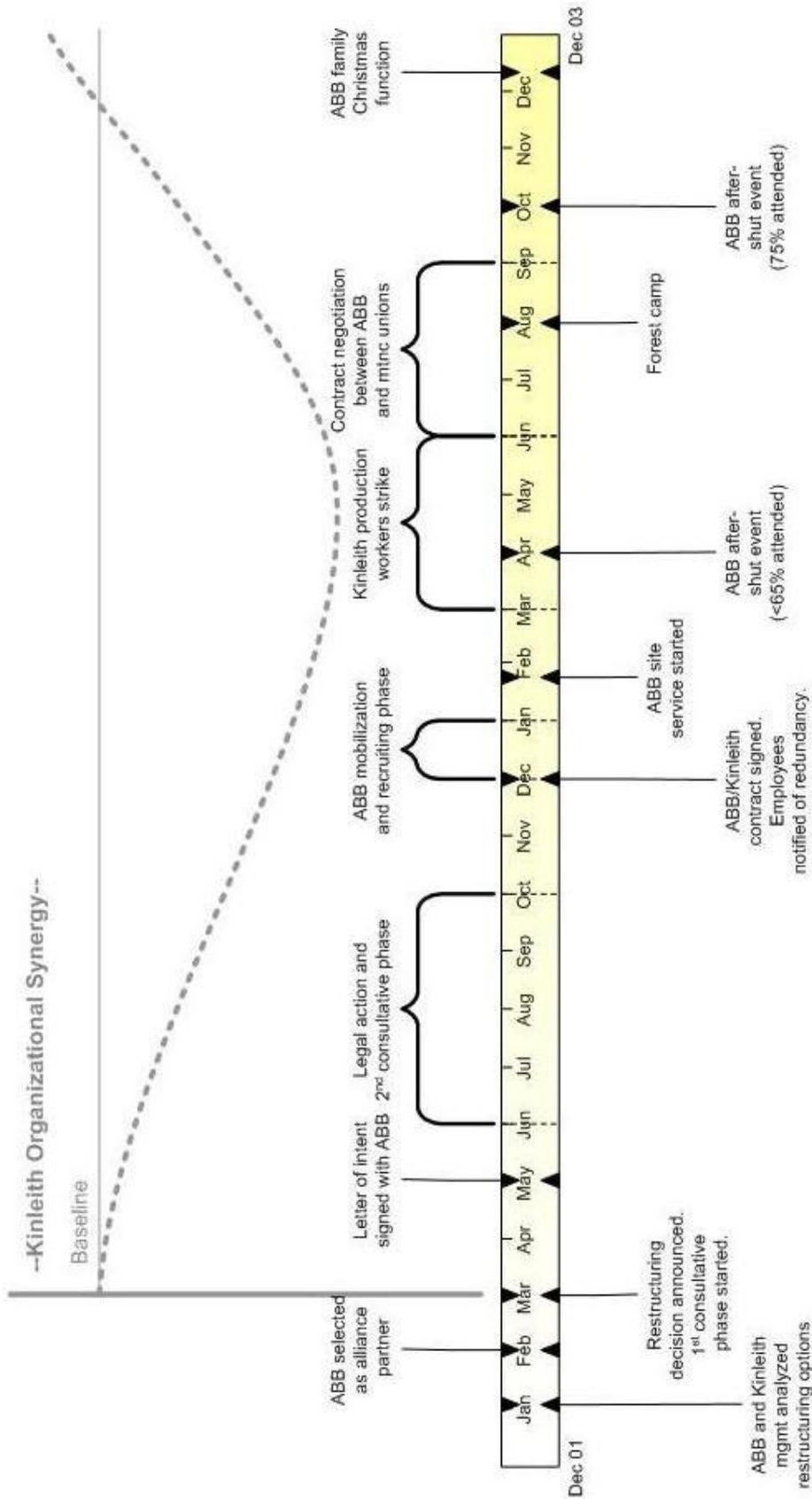


Figure 0-9: Mansfield Mill OEE during First Year of Implementation<sup>12</sup>

<sup>12</sup> Since Mansfield was a new contract, it did not have 12 months of data at the conclusion of this project. The OEE calculation in Mansfield is different from that in Mansfield and Tasman. Rather than using an absolute measure for equipment speed, Mansfield uses a relative measure by comparing the actual speed to a “standard speed.” Therefore, Mansfield’s OEE can sometimes exceed 100%.

In Kinleith's case, we can also observe the WBB phenomenon in its organizational synergy, defined as "the extent of common cognitive maps between the individuals in the distinct social groups for the issue at hand" [Sun, 2004]. Sufficient level of synergy allows an organization to respond as a collective to rapid changes in the external environment. Sun, a Waikato Management School researcher, spent 6 months to study how ABB at Kinleith developed its organizational identity after restructuring. Figure 4-10 qualitatively captures the change in synergy level described in his research against the restructuring timeline.



### **Figure 0-10: Kinleith Restructuring Timeline with Organizational Synergy Trendline**

Several factors impact the depth and duration of the dip we observed previously:

1. Amount of slack, i.e. time and resource, at contract start-up: to avoid pushing a site into firefighting dynamics, the team needs extra time and/or resources at the onset of the contract to stabilize equipment conditions at a site. In Kinleith's case, the 3-month strike and the additional subcontractors and ABB start-up resources served the purpose.
2. Pace of implementation: depending how significant the surge is in workload at contract start-up, ABB should pace the implementation of new projects and initiatives accordingly. Pay special attention to how to sequence new initiatives. For example, because there was major labor issue at the onset of the Kinleith contract, the site management focused on cultural transformation in 2003 and delayed introducing many productivity improvement projects (refer to Kinleith Organizational Development Plan in Appendix E).
3. Leadership's understanding of pre-existing dynamics on site: depending on whether the site is already in firefighting mode and the reasons behind the drop in motivation, the contract implementation team would have to adopt different approaches. In Kinleith's case, one of the main issues was that workforce had become extrinsically motivated. Therefore, changing the terms on the collective agreement and emphasizing more on intrinsic motivation work for this site. The same solution may not be applicable for other sites that have different histories and dynamics.
4. Percentage of change agents vs. original employees: reduction in original employees can lead to a temporary drop in organizational knowledge because the learning curve for new maintenance employees in heavy industries is usually quite steep. However, to improve culture and introduce new work practices, ABB needs a certain percentage of people who are supportive of the restructuring and the "ABB Way." This idea is best captured by the "word-of-mouth" effect described in the research done on Total Quality Management (TQM) initiatives by Sterman, Repenning, and Kofman (1997). People who embrace a change initiative in an organization will communicate their support and enthusiasm to others through word of mouth and thereby increase the levels of commitment and receptiveness of other workers.
5. Amount of effort invested in change management before contract start-up: how much effort ABB team invests in building relationship with clients and garnering support for the outsourcing contract prior to start-up influences how quickly ABB team can move the contract beyond Rebirth phase into Growth phase.

"Success depends a lot on how much work the client did to prepare organization [before contract start-up]. CHH at Kinleith made a lot of effort to educate their people... CHH at Tasman didn't prepare their people prior to re-structuring so they don't understand how contract works." – ABB Manager at Tasman

During the 11-month lag between the announcement of the outsourcing to contract start-up, ABB team at Kinleith effectively leveraged this period to build a strong coalition with client senior and middle managers. Also, both the clients and ABB invested significantly in public relation effort targeting the Tokoroa community. After the contract started, the strong relationship between the management teams as well as their shared interests and goals gave the maintenance partner the flexibility and room it needed when the implementation encountered roadblock early on.

### **Maturity and Beyond – Continuous Improvement and Change Management**

After the contract reaches the stable Maturity phase, sustainability of the contract becomes the next question. It is not infrequent to hear that, sometimes, ABB teams were able to achieve fantastic results within the first year or two but the client would later choose not to renew the contract. There is also the question whether ABB can keep up with the increasing contractual performance targets from year to year.

There are primarily three factors which impact sustainability. Firstly, the outsourcer needs to make continual investment in technology and human resource. The implementation team

should budget enough resources so the organization can cover reactive daily issues and improvement initiatives. A part of the “savings” in terms of resources and budget that ABB generates from year to year should be reinvested back into the maintenance operation to bring in more sophisticated maintenance technology and work processes. Secondly, the outsourcer should continue to invest in change management effort towards external partner and internal organization. Managing client perception on the transferability of ABB team’s competency is critical to sustaining the contract because there is the tendency for client to save ABB’s margin for themselves if it perceives that the maintenance performance improvement comes from processes and tools that can be easily transferred or already implemented. Therefore, the implementation team needs to emphasize that the improvement comes from a holistic approach to managing maintenance operation, which is much more difficult to be replicated or transferred. Additionally, since ABB will continue to roll out new projects to improve maintenance performance, its senior and middle management should be well-versed in change management models. Thirdly, contractual design sets the “degree of freedom” that a client has with respect to contract renewal. The more completely the business processes and personnel are transferred to ABB’s ownership and the more integrated ABB’s operation is with the client’s, the less likely the client would elect in-sourcing maintenance.

There are other external factors that can impact contract sustainability but are outside of the control of ABB implementation teams, such as change of ownership at the client side, which are beyond the scope of this study.

### ***A Strategy that Wouldn’t Travel***

It is all too tempting to look at the success at the Kinleith Mill and say “Great! Now, replicate that!” What happened to ABB’s FS contract implementation at Tasman mill illustrates the importance of obtaining a holistic understanding of the site rather than copying Kinleith’s management actions at face value.

Tasman Mill is another CHH paper mill located two hours away from Kinleith in the township of Kawarau; it is roughly half the size of that of Kinleith. Witnessing Kinleith’s success in improving its performance and culture, the top management at Tasman Mill decided to outsource maintenance to ABB in September 2004. At the time, both ABB and CHH believed that they could obtain a lot of synergies since the two mills are geographically close and share some personnel already. To ensure success, Tasman drafted a similar contract and adopted a similar implementation plan. But the timeline and redundancy effort was much more aggressive. Two years after start-up, plant OEE did not improve, labor relationship was strained, and animosity had built up between the two partners. At the conclusion of this study, CHH wanted to “restart” the implementation and a major restructure of ABB team.

#### **Inadequate investment in change management effort prior to start-up**

Compared to Kinleith, ABB team spent less than 20% as much time at Tasman site before the contract started.

“The journey of how to contract has proved to be very important. It builds relationship and contextualizes the contract. It puts reasoning in what the contract says... Tasman’s contract development was too fast. [As a result], there was no relationship and no social interaction [between ABB and CHH teams]... In Kinleith, the question was ‘how do we make it work, how do we make it better.’ In Tasman, the question was ‘how do we blame someone else.’” – Ex-CHH Manager

The lack of a strong partnership made ABB’s implementation effort more difficult and, later, when maintenance performance dipped below baseline level, ABB had to deal with much stronger pressure from CHH compared to the situation at Kinleith.

### **Aggressive pacing of implementation despite constraints from pre-existing dynamics**

Moreover, the implementation team did not fully investigate the pre-existing dynamics on site. It turned out that Tasman was quite different from Kinleith because Tasman did not have the same problem of an extrinsically motivated workforce due to its salary-based compensation policy and team-oriented organizational structure. Also, the plant was deep in firefighting, and the maintenance group solely focused on reactive work.

Failing to identify these pre-conditions, the implementation team pursued an aggressive timeline which pushed the mill further into firefighting.

“We tried to have too many things done in too short of a time frame. They tried to cram things in in the first year but only got enough done... Just stress things out and people lost confidence. They created a high expectation for everyone then didn’t implement.” – ABB manager at Tasman

“It was difficult at the beginning to deal with all the issues that happened and implement those things straight away... When ABB took over a new site, they bring in new people and it’s not people who understand ABB’s way and philosophy... So they have to train those people and still keep the plant running as before... Plus they have to deal with resistance at CHH and tradesmen level. [It was just] too difficult to implement long-term projects at the same time.” – ABB Team Lead at Tasman

Because the site’s reliability condition was not stabilized, tradesmen were torn between old firefighting practices and ABB’s mandate in “doing maintenance the right way.” In the end, due to operation team’s pressure, ABB had to give in.

“Guys believed ABB got good systems and if you implement them fully, you’ll get world class maintenance... But because there aren’t enough people..., the guys who tried to do PM are dragged off to fix breakdowns. We are encouraged by ABB to say to CHH that this is not what these people are for... But CHH just go to the boss and ABB would give in and tell people to do breakdowns.” – ABB Team Lead at Tasman

ABB’s inability to be consistent in its approach damaged the tradesmen’s perception towards ABB management. They started to doubt ABB’s management capability and believed it took on the outsourcing deal to realize short-term profit rather than long-term benefit of the mill. Resentment built, and at the time of interview, Tasman union was seeking legal action against ABB. As labor and management relationship deteriorated, tradesmen resisted ABB’s initiatives. Referring back to Figure 4-1, Tasman started to turn the “Synergy & Capability” reinforcing loop in the negative direction, and like what we have seen in Kinleith’s case, losing Employee Receptiveness would eventually lead to further dependence on reactive work (the “Work Harder” cycle). Moreover, as ABB struggled to deliver satisfactory KPI performance, the Partnership reinforcing loop turned negative as well.

One CHH manager commented that the managers ABB brought to Tasman were “too young, too mobile, [and] have no maintenance background. They need to improve their relationship with the workforce but still be firm and consistent... They can’t just cave in and roll over.” This loss of confidence in ABB propelled the client to apply more pressure and interfere more frequently, making it even more difficult for ABB to do its job and control costs, resulting in poorer KPI performance. So the vicious cycle continued.

## Proposed Next Steps

Reflecting on the analysis and what we have learned from the two case studies, there are 5 steps ABB can consider adopting to improve its ability to implement a FS contract.

1. **Formalize “sense-making” step for the implementation team:** although ABB currently conducts “Feasibility Study” to learn about a client site prior to implementation, the report is seldom leveraged during actual implementation because the study is oftentimes developed for sales purpose, conducted by those who are not on the implementation team, and focuses primarily on maintenance performance assessment. Therefore, ABB might consider incorporating a formal data-gathering step after contract start-up to fully comprehend pre-conditions and customize an implementation plan accordingly.

“Before taking over site, spend enough time to understand the current culture on site and what the site does have in place in terms of maintenance... look for the physical evidence for those... Need to understand what is driving the people... and existing relationship between operation and maintenance.” – ABB manager at Tasman

The following table provides some sample diagnostic factors:

Category	Factors	Implications
Physical	Current reliability vs. resource utilization	Implementation pace
	Difference in structure, work processes, and performance among subdivisions within the maintenance group	Implementation pace
	In-depth verification of each subdivision's preventative maintenance practice	Implementation pace
Economic	Past cost cutting initiative	Possible pitfalls - occurrence of negative dynamics
	Past redundancy effort	Possible pitfalls - capability erosion, relationship damage
Humanistic	Existing work culture	Implementation pace
	Leadership style of future maintenance mgmt team	Possible pitfalls - disconnection with existing site culture
Partnership	Outsourcing motivation	Vision creation
	Amount of knowledge overlap between new maintenance and production teams	Sustainability, interference, collaboration...etc
	Stakeholder analysis	Coalition building

**Table 0-1: Sample Diagnostic Factors**

2. **Build a regional support team to facilitate new site start-up:** this team serves two purposes – increase the amount of “slack” during start-up and the percentage of change agents. The outsourcer can consider building a regional support team or a network of people who can join site start-ups at a short notice; it should include a cross-section of talents needed in a typical maintenance organization, from experienced manager, engineer, to planner. At the tradesmen level, the new site can consider hiring subcontractors to help deal with the initial surge of workload. This team can also enhance the dissemination of new concepts to all levels of the organization.
3. **Build a humanistic “toolbox”:** a central data repository can be created to store know-how, best practices, and templates around the “soft issues” of implementation. Sample contents are templates or online tools to diagnose and develop culture and leadership, descriptions of team building events deployed at existing sites, references to internal and external experts on human resource development activities, stories of good management practices, or academic research such as the deliverables from this study.

4. **Develop a core process of change management:** change management can be defined as a planned approach to implement changes in an organization. Because managing organizational change is at the heart of the Full Service business, ABB should consider formalizing change management as a process and incorporate it into its implementation process map. The Organizational Development Plan for Kinleith can be used as a basis. Existing change management models, such as the 8-step approach developed by Kotter and the ADKAR model developed by Hiatt, are included in Appendix F for reference.
5. **Incorporate Systems Thinking into Training Program:** although the current site management training program provides comprehensive discourses on topics such as finance, customer relationship, and people management, there is no information on how these subjects interact to shape the overall site performance. Therefore, ABB should consider incorporating systems thinking concepts into its leadership development program to promote a holistic understanding of how things work and help managers form “a perspective for going beyond events, to looking for patterns of behavior, to seeking underlying systemic interrelationships which are responsible for the patterns of behavior and the events.” [Bellinger, 2004] Refer to Appendix G for the training program proposal.

## Conclusion

So in conclusion, can the success of one site be replicated to others without experienced site managers taking over each site? The answer is yes. However, one cannot do so by simply copying the actions of the successful management team but its approach in gaining full understanding of the existing dynamics at a site in all aspects and then customizing the implementation content and timeline accordingly. As for a maintenance outsourcer like ABB, it is perhaps worthwhile to remember that building the capability around “how to implement” is as important as if not more than “what to implement.”

## Bibliography

- "About ADKAR." *Purdue University*. 16 Dec. 2006  
<[http://www.purdue.edu/onepurdue/change\\_management/about\\_adkar.shtml](http://www.purdue.edu/onepurdue/change_management/about_adkar.shtml)>.
- Ancona, D., Thomas Kochan, Maureen Scully, John Van Maanen, and Eleanor Westney. "Leadership in an Age of Uncertainty." *Managing for the Future: Organizational Behavior and Processes*, Module 14, 3<sup>rd</sup> ed. Mason: South-Western College, 2005.
- Beilock, S., and T. Carr. "When High-Powered People Fail: Working Memory and 'Choking Under Pressure' in Match." *Psychological Science* 16 (2005).
- Bellinger, G. "Systems Thinking: an Operational Perspective of the Universe." 2004. 21 June 2006 <<http://www.systems-thinking.org/systhink/systhink.htm>>.
- Change Management Learning Center*, Prosci. 16 Dec. 2006 <<http://www.change-management.com/tutorial-adkar-overview.htm>>.
- Deci, E., and R. Ryan. "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being." *American Psychologist* 55 (2000).
- Delaney, E. "The Human Touch." *Utility Week*, Vol. 23, No. 13 (2005).
- Eisenhardt, K. "Building Theories From Case Study Research." *Academy of Management Review*, Vol. 14, No. 4 (1989): pp. 532-550.
- Griffiths, James. "New Zealand." *Thirty-Eighth Session: Proceedings of the FAO Advisory Committee on Paper and Wood Products*. 21 June 2006  
<<http://www.fao.org/docrep/W6127E/w6127e0g.htm>>.
- Herzberg, F. "One More Time: How Do You Motivate Employees." *Harvard Business Review*, Jan. 2003.
- Hiatt, J. *ADKAR: a Model for Change in Business, Government and Our Community*. Prosci Research, 2006.
- Idhammer, C. "Contract Maintenance or Not?" 21 June 2006  
<[http://www.reliabilityweb.com/art05/maintenance\\_contracting.htm](http://www.reliabilityweb.com/art05/maintenance_contracting.htm)>.
- King, D. "Massive Maintenance Restructuring Revives Struggling Mill." *PaperAge*, Jan.-Feb 2005.
- Kohn, A. "Studies Find Rewards Often No Motivator: Creativity and Intrinsic Interest Diminish If Task is Done for Gain." *Boston Globe*, 19 Jan. 1987. 16 July 2006  
<<http://www.gnu.org/philosophy/motivation.html>>.
- Kops, D. "Why Outsourcing is Happening?" presented at the Facilities Management Conference, 2002.
- Kotter, J. "Leading Change: Why Transformation Efforts Fail." *Harvard Business Review*, Mar.-Apr. 1995: pp. 59-67.
- Laurent, J. "Culture Change Pays At Kinleith." *ABB Internal Paper*

- Linder, J. "Clean Skin At Kinleith." *Global Outsourcing Strategies: an International Reference on Effective Outsourcing Relationships*. Peter Barrar. Ed. Roxane Gervais. Hampshire, England: Gower, 2006.
- Linder, J. "Transformational Outsourcing." *Supply Chain Management Review*, May-June 2004.
- Lord, L. "Income and Happiness: Rethinking Economic Policy." *Center for Economic Performance, Lecture 2*. 27 Feb. 2003. 16 July 2006  
<<http://cep.lse.ac.uk/events/lectures/layard/RL040303.pdf>>.
- McNickle, R. "The Maintenance Game-Changer." Presentation, Carter Holt Harvey Internal Document Newsmonitor Services Ltd, Transcript From Radio New Zealand Ltd, Document ID 72945.3. 27 May 2002.
- "Organizational Culture Inventory (OCI)." *Human Synergistics International*. 2005. 25 Feb. 2007 <<http://www.humansyn.com/site/index.php?doc175128464>>.
- O'connor, T. "Qualitative Social Science Research Methodology." *North Carolina Wesleyan College. Lecture Notes 9*. 6 Jan. 2004. 20 July 2006  
<<http://faculty.ncwc.edu/toconnor/308/308lect09.htm>>.
- "Poll: More Companies See Skilled Labor Shortage." *The Associate Press*, 2005. 7 July 2006  
<[http://www.usatoday.com/money/jobcenter/workplace/2005-07-18-skilled-workers-poll\\_x.htm](http://www.usatoday.com/money/jobcenter/workplace/2005-07-18-skilled-workers-poll_x.htm)>.
- Repenning, N., and S. Sterman. "Nobody Ever Gets Credit for Fixing Problems That Never Happened: Creating and Sustaining Process Improvement." *California Management Review*, Vol. 43, No. 4 (2001).
- Repenning, N., F. Kofman, and J. Sterman. "Unanticipated Side Effects of Successful Quality Programs: Exploring a Paradox of Organizational Improvement." *Management Science*, Vol. 43, No. 4 (1997).
- Repenning, N., P. Goncalves, and L.j. Black. "Past the Tipping Point: the Persistence of Firefighting in Product Development." *California Management Review*, Vol. 43, No. 4 (2001).
- Senge, P. *The Fifth Discipline*. Doubleday, 1990.
- Sterman, J. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. The McGraw-Hills Companies, Inc., 2000.
- Sterman, J. "Maintenance Game." Lecture Presentation. Sloan School of Management At Massachusetts Institute of Technology. 2004.
- Still, D. *Still Pictures Professional Photography*. 20 July 2006  
<[www.davidstill.com/industrial.htm](http://www.davidstill.com/industrial.htm)>.
- Sun, P., and J. Scott. "Transformational Outsourcing: a Pickle of Identities in Search of a Distinctive Taste (Learning History for ABB Kinleith Maintenance Service Ltd)" University of Waikato. 2004.

"The Looming Labor Crisis." Article 1, NASE. 14 July 2006  
<<http://www.entrepreneurialconnection.com/skills/Module29/one.asp>>.

"Timber and Forest Products." Statistics New Zealand. 16 July 2006  
<<http://www.stats.govt.nz/quick-facts/industries/timber-forest-prdcts.htm>>.

## Appendix A – Research Methodology

The research methodology is primarily a theory-building case study approach, which begins with little theory under consideration and no hypothesis to test and seeks to draw general insights on Full Service business based on detailed examination of few FS sites. As suggested by Eisenhardt [1989], this project employed the 8-step approach:

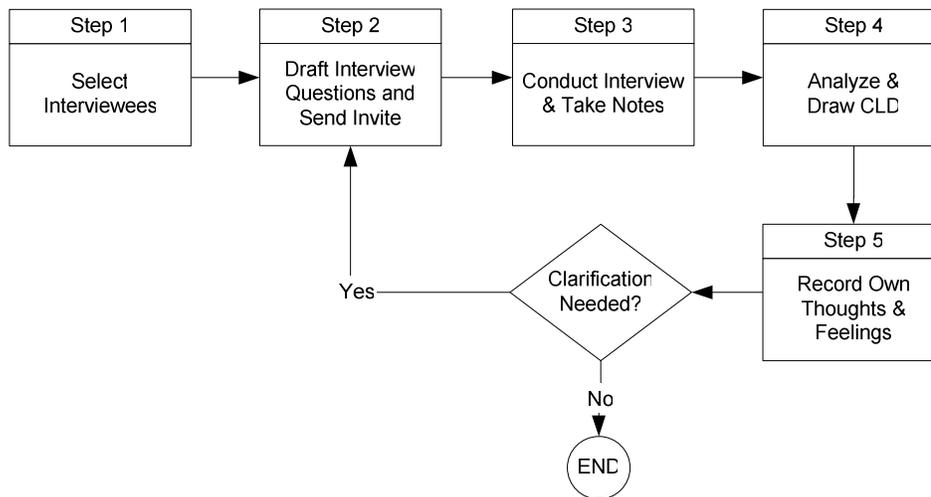
1. **Specifying research questions:**
  - a. What is it that worked at Kinleith Pulp and Paper Mill, a highly successful FS site?
  - b. Based on the case study, what conclusions can be drawn on critical success factors to implement a Full Service contract in general?
  - c. Can success of a Full Service site be replicated without requiring successful site managers taking over each new site?
  - d. How to improve existing leadership development program and increase the group's overall capability to implement FS contracts?
2. **Selecting cases:** The cases were selected for theoretical rather than statistical reason. To get a holistic view of the structure and patterns behind the maintenance performance of a FS site, three types of cases were selected based on performance level and lifecycle phase: outperforming (Kinleith), struggling (Tasman), and new (Mansfield). Some interviews with managers who worked on FS contracts that were already terminated (3 European and Portugal locations) were also performed to supplement the research. Table 7-1 summarizes background information for the 3 main cases.
  - a. Kinleith Pulp and Paper mill in New Zealand formed the main base for the study. It is selected for its dramatic transformation within a relatively short amount of time in culture and maintenance performance.
  - b. Tasman mill shared many similarities with Kinleith. They are both owned by Carter Holt Harvey, located about 100km apart, and share some resources and information. CHH granted the Tasman maintenance contract to ABB because of Kinleith's outstanding performance. However, the site is struggling, and the ABB team in Tasman was unable to obtain the same level of performance 1 year into the contract as achieved by Kinleith in the same amount of time. Therefore, Tasman provides a very interesting case to contrast with Kinleith.
  - c. Mansfield mill in Louisiana, US was only 3 months into its contract at the start of this internship. Kinleith, again, played a large role in helping ABB securing this contract. Mansfield also utilized some resources and information from Kinleith. This case provides a chance for the researcher to observe ABB's processes and site culture and performance change during the early phase of a Full Service contract at a large mill.
  - d. Three contracts (in Finland, Italy, and Portugal) that were terminated by customers were selected to provide end-of-life perspective on FS contracts.

	<b>Kinleith</b>	<b>Tasman</b>	<b>Mansfield</b>
Location	Tokoroa, NZ	Kawerau, NZ	Louisiana, US
Current Owner	Carter Holt Harvey	Carter Holt Harvey	International Paper
Established Since	1953	1955	1980
Market Pulp (metric ton)	275,000	280,000	N/A
Containerboard (metric ton)	330,000	N/A	1,470,400
Total # of Employees (incl ABB personnel)	600	360	685
Total # of ABB Employees	170	85	198
% Interviewed (excl client)	11.7%	5.7%	12.1%
ABB Contract Start Date	01/2003	09/2004	12/2005
Type of Site	Outperforming	Struggling	New

**Table 0-1: Interview Dataset**

**3. Crafting research instruments and protocols:**

- a. Structured interview: Each interview lasted 60 to 90 minutes. If the interviewee agreed, the conversation would be recorded using audio device and typed notes. Interviews were iterative (see Figure 7-1), and questions were open-ended at the beginning and more specific as the hypothesis took shape later in the project.



**Figure 0-1: Interview Process**

- b. Direct Observation: Followed the ethnographic research protocol, I would sit in meetings (within ABB, ABB and client, ABB and union...etc), walk around the mill, and participate in specific events, such as the after-shut party, to directly observe people’s behaviour and interaction with each other. The idea is “universe in a dewdrop”, that each person is a reflection of their culture in that all their gestures, displays, sayings, and everything else have some implicit, tacit meaning for others in that culture [O’Connor, 2004]. During observation, detailed, descriptive notes were taken. Afterwards, these notes were reviewed, and evaluative comments and summaries were separately documented.
  - c. Review of internal and external documents
- 4. Collecting data:** Approximately 210 research hours were spent on gathering data, and more than 70 interviews were conducted, which formed the basis of the analysis. Data collection took place between February and July 2006. Interviewees were drawn from all levels and across all business units of ABB and client organizations at each FS site. Several senior managers in ABB global service development group were also interviewed to provide background, organizational culture, and business strategy information.

5. **Analyzing data:** After each interview, I went through the notes to search for themes and patterns and draw causal loop diagrams to describe the feedback dynamics. The data collected at each of the 3 main sites were analyzed separately. Then I looked for cross-case similarities and differences.
6. **Shaping hypotheses:** This was an iterative process that compared hypothesis with data and built evidence to support the emerging hypothesis. For example, specific causal loop diagrams gradually merged and expanded into a more general diagram to better fit the data and provide a broad perspective of a Full Service site.
7. **Reviewing theoretical literature:** Since transforming the performance of Full Service site involves a broad range of issues, from technical to humanistic, theoretical literature of four main categories were reviewed to compare and contrast with the hypothesis formed in this project:
  - a. System dynamics articles related to maintenance and change programs
  - b. Leadership and organizational development
  - c. Previous academic work regarding the Kinleith outsourcing deal
  - d. Previous academic work regarding the maintenance operation
8. **Reaching closure:** Data collection and hypothesis testing stopped after several presentations to various ABB groups. Feedbacks were solicited to verify the analysis.

## Appendix B – Additional Information on Full Service Business

### Organizational Chart

The figure below shows where the Full Service group fit within the overall ABB Ltd organization.

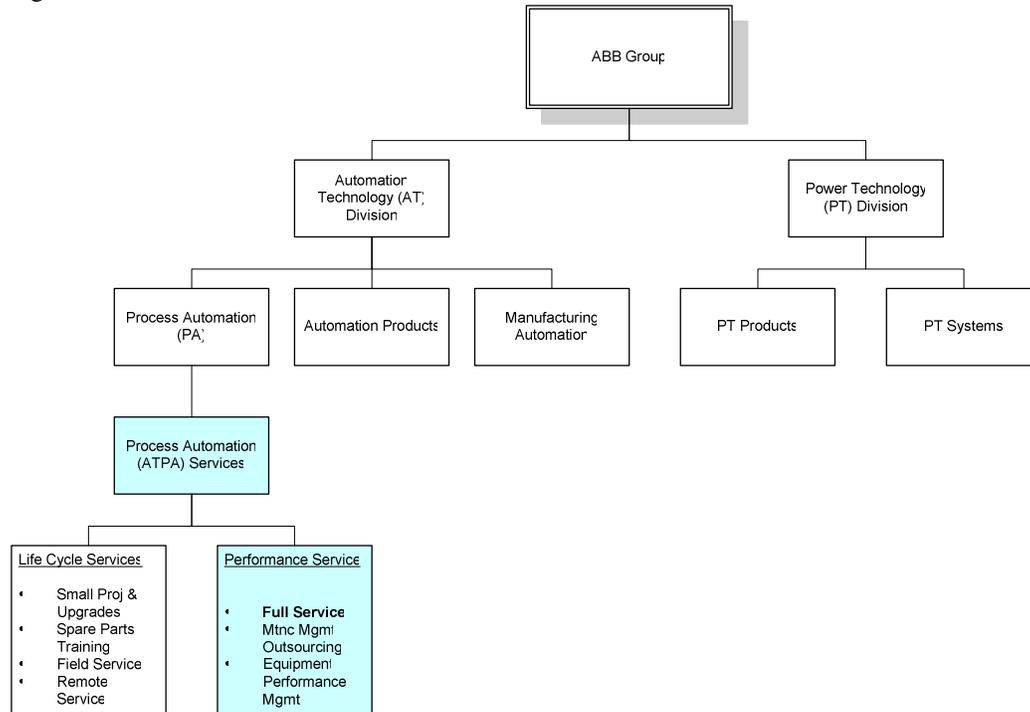


Figure 0-1: ABB High Level Global Structure

### Full Service Implementation

To implement a Full Service contract, there are 6 phases as shown in the figure below. ABB first presents the business concept to potential clients to determine fit and, if agreed, will go to the client site to do an in-depth study of the site's reliability performance, i.e. Overall Equipment Efficiency (OEE). This evaluation primarily focuses on identifying improvement opportunities in maintenance competency and practices and potential dollar saving under FS. If the client decides to proceed, the two companies will develop a contract and a high-level implementation plan.

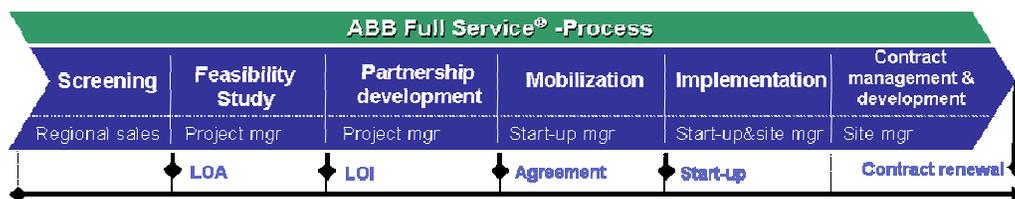


Figure 0-2: ABB Full Service Implementation Process<sup>13</sup>

During Mobilization, ABB begins to set up site organization and facilities. The contract formally commences at the start of the Implementation phase, which is when ABB assumes complete responsibilities over site maintenance. Generally, the new group has fewer

<sup>13</sup> LOA stands for Letter of Agreement; LOI stands for Letter of Intent. These are two formal outputs from the Screening and the Feasibility phases, respectively.

headcounts than before; the reduction in labor cost represents the largest upfront saving for the client. Additionally, the majority of the new group is consisted of the original employees from the site, and very often, an individual can have the same role, work in the same area with the same people, and report to the same supervisor as before the restructuring. On top of this, the sites that ABB has to deal with are often fraught with issues because a client would not normally consider as dramatic of a change as Full Service unless it has major problem with its existing maintenance operation, and after the highly disruptive restructuring, workers are often demoralized and antagonistic towards their new employer, ABB. Therefore, under such challenging circumstances, how to transform the behavior and culture of a workforce while quickly implementing technical initiatives to achieve performance improvement for the customer becomes a critical point of analysis in this thesis.

The contract and ABB performance are to be reviewed periodically, normally once a year, to determine contract renewal. Depending on the labor environment at the site, it can take considerable amount of time from Screening to Implementation. In Kinleith's case, the process took over 15 months.

### **Full Service vs. Traditional Outsourcing**

While Full Service is a form of outsourcing, it differs from the two traditional types of outsourcing commonly seen in a maintenance environment, "out-tasking" and "functional sourcing" in content, execution, and objective [Linder, 2004] In terms of content, the customer outsources the entire maintenance function along with the related business processes for multiple years to one partner. In terms of execution, ABB acts as a collaborative partner rather than simply running a support function for the customer. More importantly, it is the objective for a customer to undertake Full Service that distinguishes Full Service as a form of "transformational outsourcing" from traditional outsourcing. During the initial customer development period, ABB sought to screen and educate potential customers to ensure that customers would engage with the mindset that ABB would act as a collaborative partner to help improve bottom line performance. This is a major departure from conventional outsourcing which is to obtain incremental cost saving while retaining the same level of performance.

## Appendix C – Impact of the Needs for Scale Economy on Maintenance

The figure below is a causal loop diagram showing how the incentive to minimize downtime, or in other words, the Need for Scale Economy erodes maintenance capability and pushes the plant down the slippery slope of firefighting.

Further, how well a plant does its annual shut has serious repercussion on overall plant performance and reliability condition during the subsequent year since most of the major maintenance activities and projects take place during this time (refer to Subcon Quality and Shut Duration Adequacy reinforcing loops). As companies reduce annual shut duration, they need more skilled subcontractors working during a shorter period of time. However, due to skilled labor shortage problem in many parts of the world<sup>14</sup>, it becomes highly challenging to find a large number of qualified labors who are willing to work shorter durations. For example, Mansfield mill decided to shorten the shut by scheduling major jobs in parallel. However, this required double the number of workers in a week. As a result, the mill had much trouble finding enough subcontractors and had to compromise on their qualification and use more in-house resources to supervise and double-check the subcontractors' work.

Additionally, as maintenance personnel find themselves under constant pressure to work faster, they eventually resort to shortcuts, reducing work quality and the plant's reliability. Some companies even institutionalize and strengthen such dynamics by, for example, measuring employee performance based on the number of completed work orders.

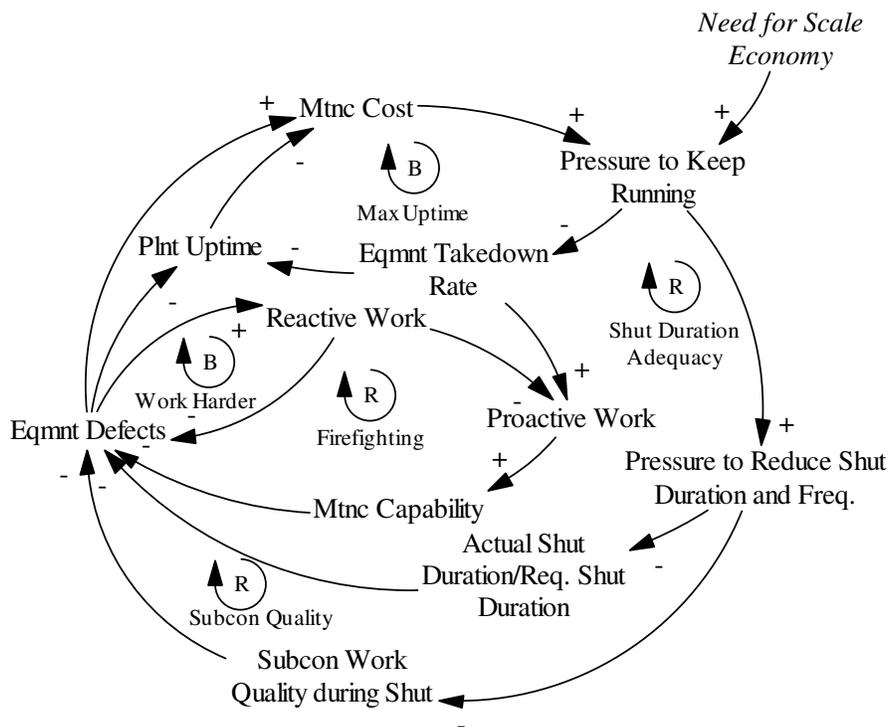


Figure 0-1: Need for Scale Economy Impact on Maintenance CLD

<sup>14</sup> In US, for example, National Association for Business Economics reported in a 2005 survey result that the proportion of respondents reporting skilled labor shortages had risen 10% to 35%. That surge has occurred despite a steady increase in the proportion of businesses reporting increases in wages and salaries, according to the survey. This also coincided with the report from U.S. Bureau of Labor Statistics, estimating a shortfall of about 10 million workers within the next six years.

## Appendix D – Kinleith Production Process & Images

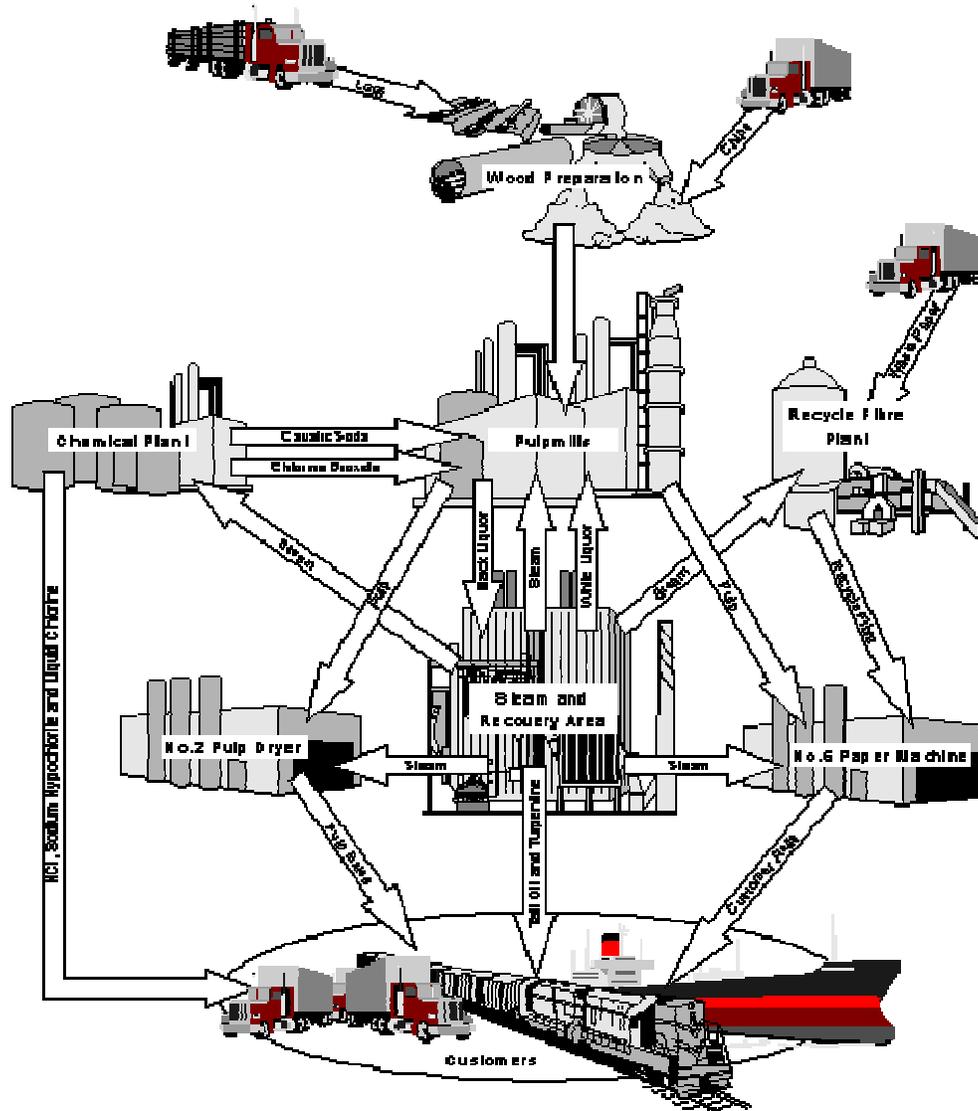


Figure 0-1: High level Kinleith Production Process<sup>15</sup>

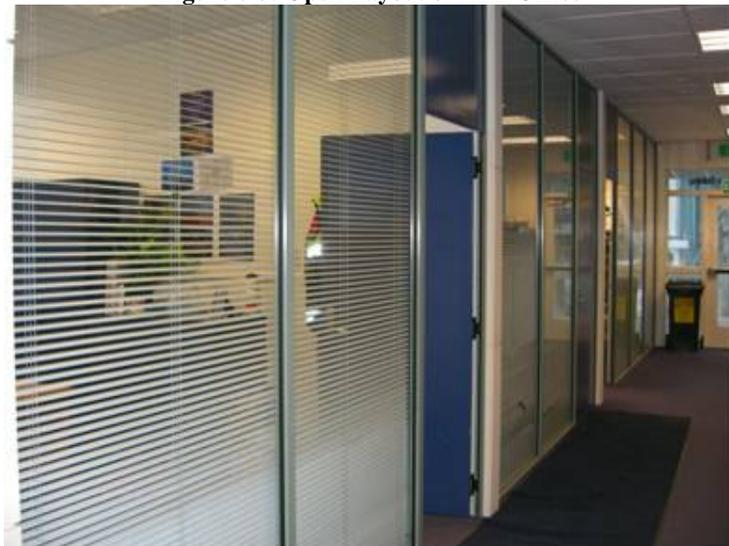
<sup>15</sup> Kinleith Internal Document



**Figure 0-2: Mill view from parking lot**



**Figure 0-3: Open Layout of ABB Office**



**Figure 0-4: ABB Managers' Offices**



**Figure 0-5: Closed Layout of CHH Offices**



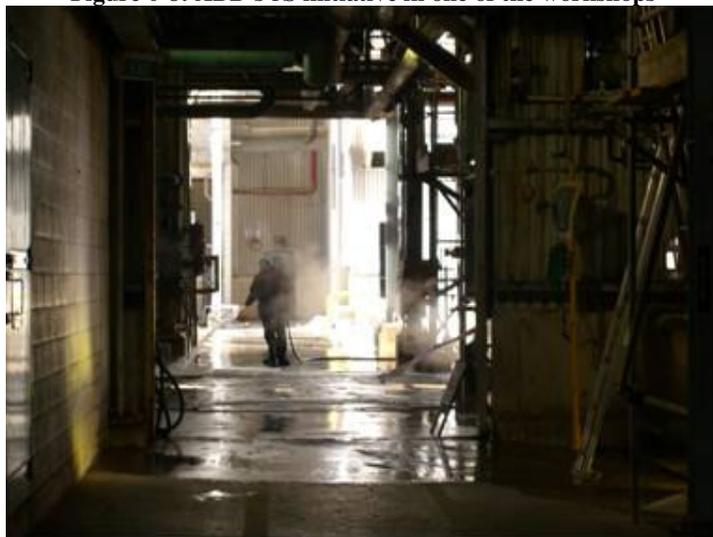
**Figure 0-6: Steam and Recovery Facility**



**Figure 0-7: One of the ABB workshops; layout designed by tradesmen**



**Figure 0-8: ABB's 5S initiative in one of the workshops**



**Figure 0-9: Plant View – 1**



**Figure 0-10: Paper Machine**



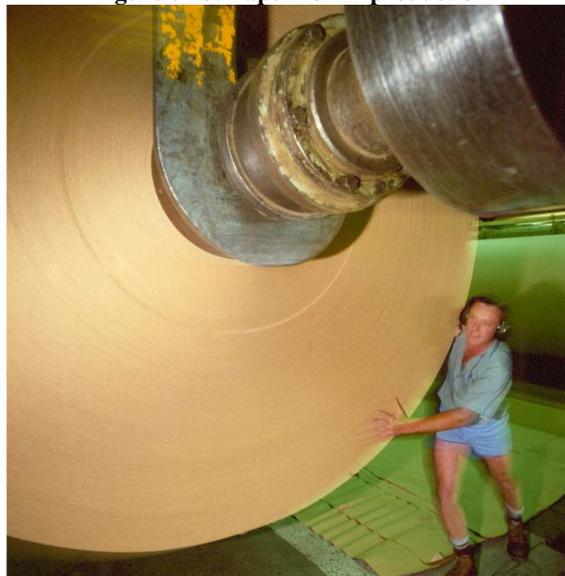
**Figure 0-11: Close-up of Paper Machine Drying Process – 1**



**Figure 0-12: Close-up of Paper Machine Drying Process – 2**



**Figure 0-13: Paper roll in production**



**Figure 0-14: Paper Roll<sup>16</sup>**

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<sup>16</sup>Still, D., Still Pictures Professional Photography, Available at <[www.davidstill.com/industrial.htm](http://www.davidstill.com/industrial.htm)> Accessed on 20 July 2006.



**Figure 0-15: Paper Roll Warehouse**



**Figure 0-16: White Liquor Tank**



**Figure 0-17: Kinleith Tradesman in ABB Uniform**

## Appendix E – Kinleith Organizational Development Plan

According to the Two Factor Theory of human motivation in workplace developed by Herzberg (2003), there are certain factors (motivators) that lead to satisfaction and psychological growth whereas others (hygienic factors) lead to dissatisfaction. There are five basic categories for motivators, Achievement, Advancement, Growth, Recognition, and Responsibility. The ABB management team at Kinleith developed an Organizational Development Plan using this theory and the understanding that a “passive-defensive” culture as found on the Kinleith site in 2003, necessitates that programs have to focus on Recognition and Responsibility in the first two years before they shift to Achievement and Growth. The plan outlined a multitude of motivational programs and their implementation sequence for a period of 4 years. The execution of these programs was effective in shifting workforce motivation from extrinsic to intrinsic and transformed the “passive defensive” culture and that once dominated the site into a “constructive” culture over a period of 3 years. These programs are briefly described in the table below:

Program/Policy	Description	Motivators Involved
Future leader program	Tradesmen can apply to participate in this year long training program. Upon acceptance, the participants will receive management training and have greater chance for advancement opportunities. The program provides a vehicle for demonstration of new behaviour and values and prepared the organization for the change in leadership style.	Achievement, Advancement, Growth
Periodic team discussion of KPI results	KPI results are reviewed by each business unit every month. This process increases tradesmen's business acumen and ties individual activities to organization goals and results.	Achievement
Staff Development Review SDR with tradesmen	It is a quarterly structured discussion between the supervisor and tradesman around training needs and individual performance. ABB took care to review and follow up people's training needs. Therefore, even though CHH used to have similar training development process, ABB distinguished itself by actually fulfilling people's training needs.	Achievement, Growth
Roster trial based on fulfilling KPI targets	Upon achieving and maintaining the group's KPI targets, the tradesmen can choose to work either four 10-hr days per week or five 8-hr days per week. This flexibility is so desirable that it creates a great incentive for tradesmen to strive to achieve their KPI goals.	Achievement
After-shut Action Review (AAR)	It is a discussion between trades and supervisor on a very specific performance challenges for individual trades during the two annual shuts.	Achievement
After-shut parties	After each of the two annual shut, ABB management provides the funding to hold off-site parties to recognize employee efforts beyond monetary incentives	Recognition
Christmas party	Off-site Christmas party is organized and paid for every year by ABB-Kinleith. ABB further demonstrates that it values what its people value and recognizes the support given to its employees by inviting family members as well. Up to 400 people attend these parties, organized by the	Recognition

	Pathfinder team of ABB Kinleith	
Involvement of tradesmen in shut planning	ABB managers are pushing to involve tradesmen more into shut planning, such as on isolation process. This increases people's responsibilities, sense of ownership and buy-in of their roles during the shut, and quality of information.	Responsibility
More "Step-up" opportunities and avoidance of motivating by money	ABB encourages tradesmen to step up to assume supervisory roles when necessary. Only if a worker assumes the role for more than 3 days, then a temporary increase of salary will be granted. Employees are advised that stepping up is primarily for personal and career development reason.	Responsibility
Establishment of Pathfinder group	A group of voluntary tradesmen and managers who developed the vision, mission and values of ABB-Kinleith. It is also responsible to organize employee events, such as monthly newsletter, after-shut, Christmas party and Employee Satisfaction Survey including the presentation to everybody on site. By having this group, it fosters the sense that improving employees' life is not just the management's job. The bottom-up approach combined with top management support reinforces the idea of joint ownership and responsibility of the mill.	Responsibility
Rework measured on personal basis	After repairing the equipment, the person who did the work would write his name onto the work form that accompanies the equipment to go back to its designated business unit. Therefore, if rework occurs within an abnormally short amount of time, ABB can trace the responsibility back to the individual tradesman.	Responsibility
Team problem solving training and opportunities for tradesmen	Third-party trainer was hired to provide the tradesmen with tools and skills to team problem solving. ABB managers withhold from giving orders to employees but involve them in joint decision making.	Responsibility, Growth
Creation of team leader role	It is a role that takes on supervisory responsibilities while remaining covered by the Collective Employee Agreement (CEA). Unionized trades people have the opportunity to be responsible for budgets and performance. This also helps to break the barrier between union and management.	Advancement, Responsibility
Leadership training for ABB managers	ABB hires external consultants to work with managers individually to improve their leadership and behaviour style (coaching based on NLP techniques)	Growth
Common negotiation training for union delegates and ABB managers	ABB paid for negotiation training for both its managers and union delegates together as team. This helps to increase the trust between the two parties and establishes a common language for the actual CEA negotiations.	Growth
Opportunities to work at ABB sites across the world	Kinleith management was supportive to send its employees to other ABB sites in other regions (such as US and Brazil) for knowledge exchange purpose.	Growth
Engineer Assessment and Individualized Development Plan	A third-party consultant will assess the capability of the site engineers in 20 areas and create an individualized development based on the	Growth

	outcome.	
Yearly action planning off site day	ABB invites every member of the organization to a one off site action planning day at the beginning of January. The goal is to create the buy-in from trades people for action plans for the next 12 months. Trade people take on the responsibility for action plan execution especially in the Health and Safety area	Achievement Responsibility
Monthly 4.15 meeting with the site manager	The site manager invites every employee to a once a month information meeting around site KPI and other information related to the organization	Recognition Achievement
Yearly Community days for the township of Tokoroa	Every ABB employee at Kinleith works one day a year on a specific community project paid by the company. This is both a team building exercise and a way to strengthen the ties of the company with the local community	Recognition Achievement

**Table 0-1: Kinleith Organization Development Plan Summary**

## Appendix F – Sample Change Management Models

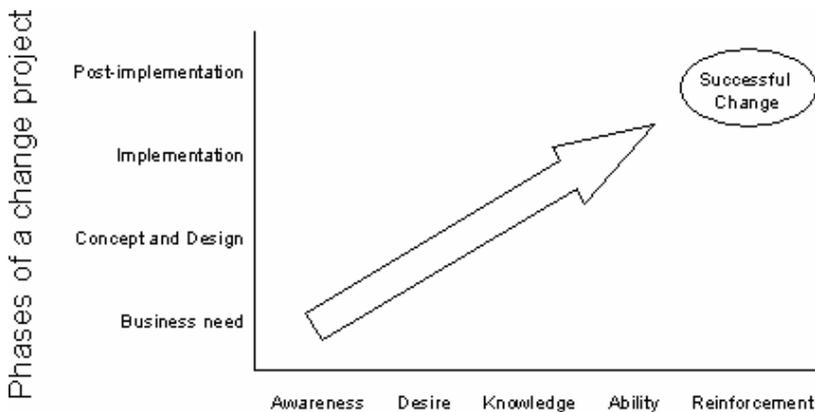
### Eight Change Phase Model by John Kotter (1995)

1. Increase urgency - inspire people to move, make objectives real and relevant.
2. Build the guiding team - get the right people in place with the right emotional commitment, and the right mix of skills and levels.
3. Get the vision right - get the team to establish a simple vision and strategy, focus on emotional and creative aspects necessary to drive service and efficiency.
4. Communicate for buy-in - Involve as many people as possible, communicate the essentials, simply, and to appeal and respond to people's needs. De-clutter communications - make technology work for you rather than against.
5. Empower action - Remove obstacles, enable constructive feedback and lots of support from leaders - reward and recognise progress and achievements.
6. Create short-term wins - Set aims that are easy to achieve - in bite-size chunks. Manageable numbers of initiatives. Finish current stages before starting new ones.
7. Don't let up - Foster and encourage determination and persistence - ongoing change - encourage ongoing progress reporting - highlight achieved and future milestones.
8. Make change stick - Reinforce the value of successful change via recruitment, promotion, new change leaders. Weave change into culture.

### ADKAR Model by Jeff Hiatt (2006)

ADKAR is a goal-oriented change management model that allows change management teams to focus their activities on specific business results. The term “ADKAR” stands for the five stages that individuals should go through when making a change<sup>17</sup>:

1. Building **A**wareness of why the change is needed
2. Creating **D**esire to support and participate in the change
3. Developing **K**nowledge of how to change
4. Fostering **A**bility to implement new skills and behaviors
5. Providing **R**einforcements to sustain the change



Phases of change for employees

**Figure 0-1: ADKAR Model<sup>18</sup>**

<sup>17</sup> Purdue University. [http://www.purdue.edu/onepurdue/change\\_management/about\\_adkar.shtml](http://www.purdue.edu/onepurdue/change_management/about_adkar.shtml).

<sup>18</sup> Change Management Learning Center. <http://www.change-management.com/tutorial-adkar-overview.htm>.

## Appendix G – Site Manager Training Proposal

### What Changes are Suggested

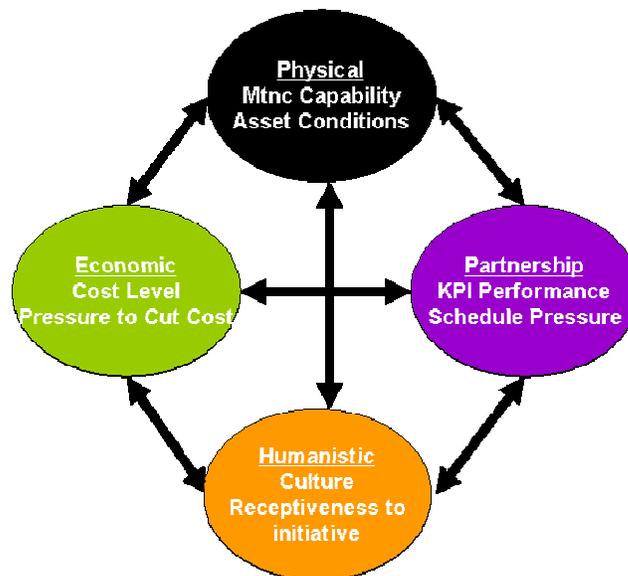
**Enrich teaching method:** Other than the activities described in this document, ABB can consider incorporating a variety of methods to educate the participants, such as:

- Case study – present different business problems/scenarios that actually occurred at a site and ask the participants to discuss possible solutions or approaches; the discussion can be facilitated by the actual managers of the case study
- Guest speakers who have SM experience – share personal leadership experience
- Site visit – bring participants to a full service site to make observation; this can be part of the case study
- Reading assignment & discussion – assign articles on relevant topics for participants to read outside of training classes and hold a discussion forum to discuss insights from the reading

**Incorporate systems thinking related activities:** The “Description of Additional Training Activities” section will describe the activities ABB should incorporate into its existing SM training program.

**Present the training program in an overall framework:** On the training program agenda, group training activities into the following categories: The Big Picture, Physical, Economic, Humanistic, Partnership, and Systems Thinking. From the MIT-ABB project, we found that a Full Service site is consisted of 4 components (see figure below). By presenting all training materials in this framework, ABB can reinforce the idea that a site manager must be able to manage the interaction of all aspects of a site to achieve desirable outcome rather than only focusing on a particular part at any given time.

**Full Service Site = A Complex System**



**Table 0-1: High-Level Full Service System Overview**

### Description of Additional Training Activities

#### 1) Leadership Assessment & Debriefing Session

##### a) Objective:

- To personalize the training experience and provide opportunities to utilize leadership concepts taught in the training immediately. Most current business

training programs (including all major MBA schools) utilize this method to teach students concepts on leadership and organizational development.

- To deepen the learning. By having their personal leadership assessment results on hand, participants will be much more attentive to the leadership concepts discussed in the training program. Otherwise, lectures on “soft topics” such as leadership can easily be dismissed.

b) Description:

Participants should complete a 360 degree leadership assessment online prior to coming to training. The activity should be conducted by a third party provider and the results should be strictly confidential, viewable only by the individual participant. To encourage participation and accurate feedback, ABB must avoid using the results for any performance appraisal purpose, including selection for future site managers.

During the debriefing session, participants will receive and learn how to interpret their assessment results. The facilitator should help the participants to identify areas of improvements. ABB can either employ an external facilitator to lead the discussion or train internal personnel to do so. Usually, the online assessment provider will provide “train-the-trainer” service or debriefing guides.

c) Suggested Duration: Taking the assessment survey will take less than 1 hour prior to the training. The debriefing session, which takes about 1 hour, should be conducted prior to introducing the leadership concepts during the SM training program.

d) Reference:

- Life Styles Inventory (LSI)  
<http://www.humansynergistics.com/site/index.php?doc175116847> – used by ABB-Kinleith through independent organization development facilitator, John Laurent [johnlaurent@xtra.co.nz](mailto:johnlaurent@xtra.co.nz)
- The Leadership Circle Profile (TLCP)  
<http://theleadershipcircle.com/site/index.htm>
- Leadership Practices Inventory (LPI)  
<http://www.josseybass.com/WileyCDA/WileyTitle/productCd-0787967270.html>

## 2) A Systemic View of FS Implementation Presentation

a) Objective:

- To illustrate how systems thinking applies to the Full Service business
- To provide a holistic view on Full Service implementation, its potential pitfalls and challenges, and suggestions for managers

b) Description: This session will define a full service site as a complex system, reveal the governing structure and dynamics of a site, present the behavior (contract lifecycle) of the system, and offer insights on FS implementation in general.

c) Suggested Duration: 1 hour. The session should be held during day one of the training program to provide a framework for participants to understand subsequent courses. This session also sets the stage for the beer game and debriefing session.

d) Reference: see file “Sample Training Slides – Systemic View of FS Implementation.ppt”. Possible presenters: Juergen Link, Barry Klein

## 3) The Beer Game<sup>®</sup>, Debriefing Session, and Systems Thinking Training

a) Objective:

- To provide hands-on experience with a non-linear system designed to produce fixed, chaotic results regardless how hard people try to effect a different outcome
- To provide systems thinking concepts
- To introduce method of drawing simple causal loop diagram
- To illustrate that participants' values and beliefs comprise a significant portion of the system structure. This realization will lead them to new choices in the design of their own thinking as well.

b) Description:

The Beer Game<sup>®</sup> was developed to introduce concepts of system dynamics. It is an interactive cardboard game during which players experience the pressures of playing a role in a complex system and can see long range effects of their actions. Each player participates as a member of a team that must meet its customers' demands. The object of the game is to minimize the total cost for the team, and the team with the lowest cost wins the game.

While the game is widely used to teach supply chain concepts such as the bullwhip effect, it can also be used to teach the more general concepts of systems thinking – why we behave the way we do and what we can do to change. ABB should employ a facilitator who is experienced in leading discussion in terms of general systems thinking principles. Please see the Reference section to find additional information on the Beer Game<sup>®</sup>.

After the game, the debriefing session serves the important purpose of drawing out insights from the game and to educate participants on systems thinking. Participants will discuss their experience, the pressure they feel, and the reasons for their behavior during the game. Then they will learn about the concept of systems thinking and its application in Full Service. Please see the Reference section to find information on external consultants who can provide this type of training.

Although the beer game can be played online, I highly recommend ABB using an experienced facilitator and run the game interactively. The hands-on experience will heighten the learning. There are many providers in the market, from academia in local universities to consultants. It should be relatively easy for ABB to find a local facilitator in most countries.

Other than the Beer Game<sup>®</sup>, there is another game that focuses more on production and maintenance activities, called The Manufacturing Game<sup>®</sup>. It was developed by the manager, Winston Ledet, who transformed Du Pont's maintenance operation in early 90s. This game seeks to draw similar insights about systems thinking but focuses more on the issues around production and maintenance work. However, since this game is proprietary, it is not as widely available as the Beer Game<sup>®</sup>. Therefore, it might be more difficult to find local facilitators near the training location. Please see the reference section and Appendix A for the content and pricing of the Manufacturing Game workshop.

- c) Suggested Duration: 1 day. The training coordinator can consider running the game and the debriefing session later during the program so that the participants can use the insights gained in the game to put the various training concepts into perspective.

d) Reference:

- Additional information on the Beer Game<sup>®</sup>:  
<http://www.systemdynamics.org/Beer.htm>

- Powerpoint presentation on the supply chain concepts taught in the Beer Game®: <http://faculty.darden.virginia.edu/GBUS885-00/Documents/beergame.pdf>
- Sample outline for the Beer Game® debriefing session: [http://en.wikipedia.org/wiki/Beer\\_Distribution\\_Game](http://en.wikipedia.org/wiki/Beer_Distribution_Game)
- System Dynamics Society: <http://www.systemdynamics.org/Beer.htm>. Contact the executive director, Roberta Spencer, at [sds@albany.edu](mailto:sds@albany.edu) for a list of facilitators near the training site
- Two-day training program offered by MIT Executive Education by System Dynamics Department: <http://mitsloan.mit.edu/execed/epp/courses/system-dynamics.php>
- Sample consulting company and training program: [http://www.csmintl.com/strategic\\_thinking.htm](http://www.csmintl.com/strategic_thinking.htm)
- Sample agenda for a 2-day systems thinking training workshop led by an external consultant company: [http://www.csmintl.com/pdfs/sst\\_purposes\\_agenda.pdf](http://www.csmintl.com/pdfs/sst_purposes_agenda.pdf)
- Sample individual facilitator: <http://www.michaeljosephradzicki.com/beer%20game.htm>
- Information about the Manufacturing Game® and facilitator: <http://www.manufacturinggame.com/index.html> (see Appendix A for sample cost info in running this game)

# Appendix H – Detailed Full Service Implementation Causal Loop Diagram

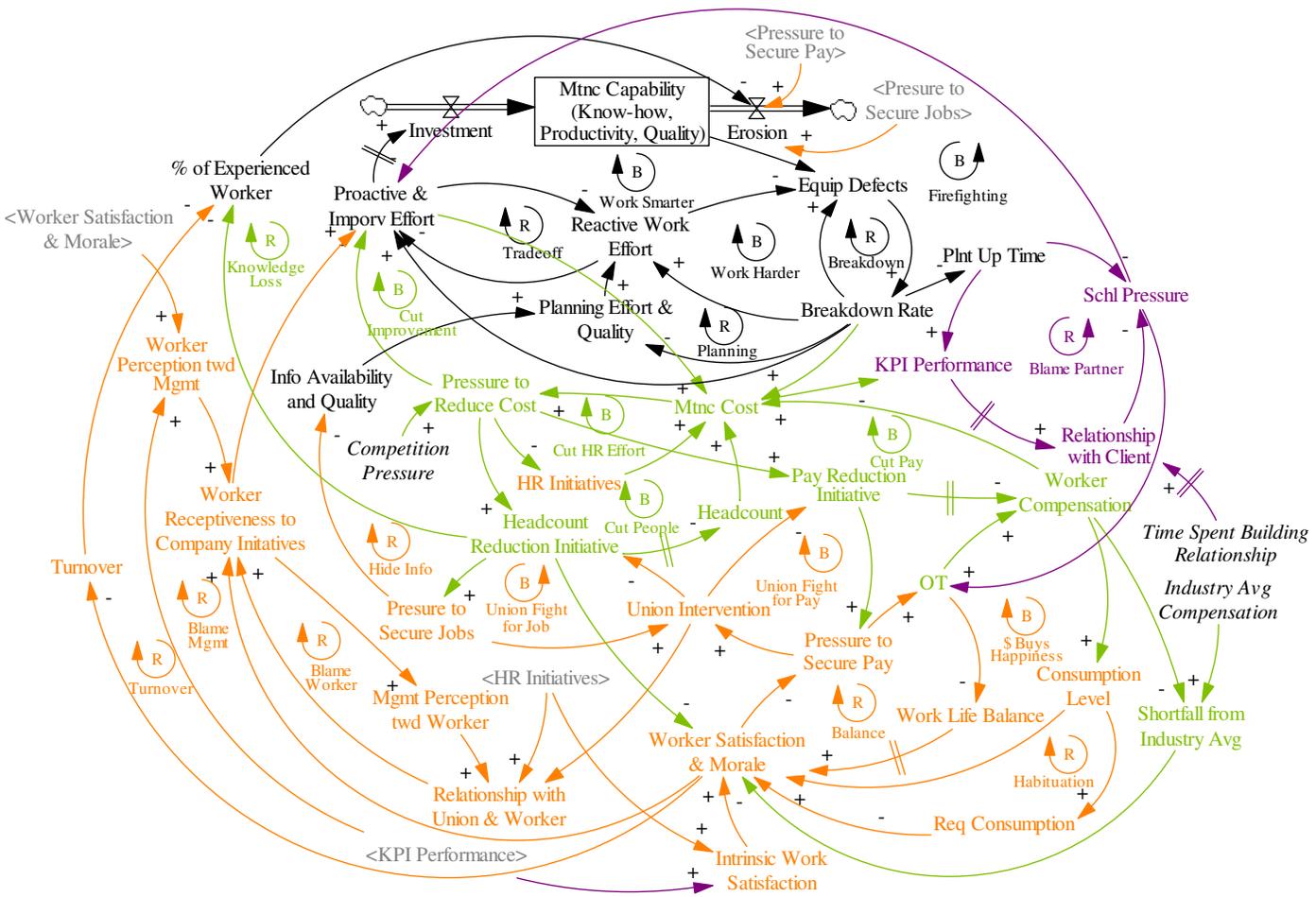


Figure 0-1: Detailed Full Service Implementation CLD

# Appendix I – Kinleith Organizational Culture Inventory (OCI)

## OCI Overview

“The OCI is recognized as one of the most widely used and thoroughly researched organizational surveys in the world. The OCI provides a picture of an organization’s operating culture in terms of the behaviors that members believe are expected or implicitly required. By guiding the way in which members approach their work and interact with one another, these “behavioral norms” determine the organization’s capacity to solve problems, adapt to change, and perform effectively.”<sup>19</sup>

Kinleith OCI Score in 2003 = 168

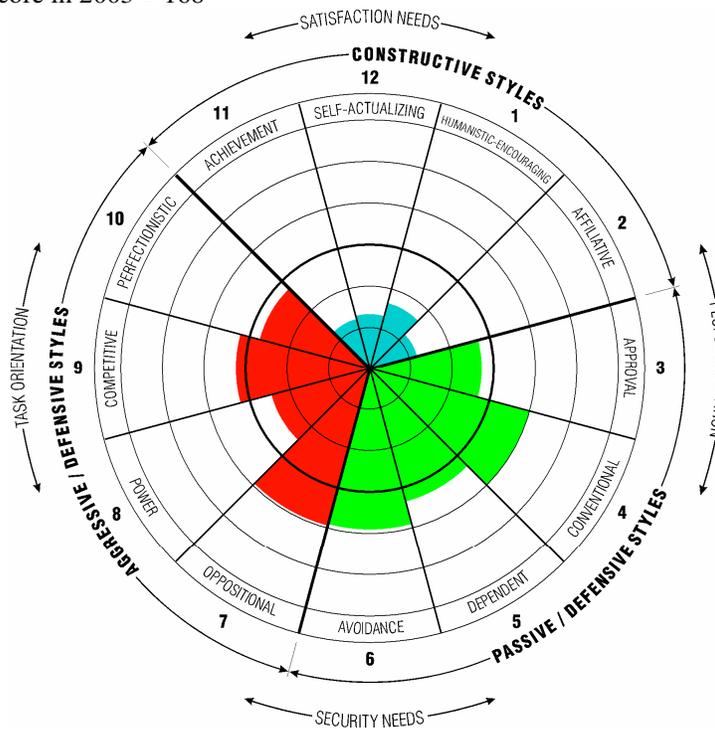
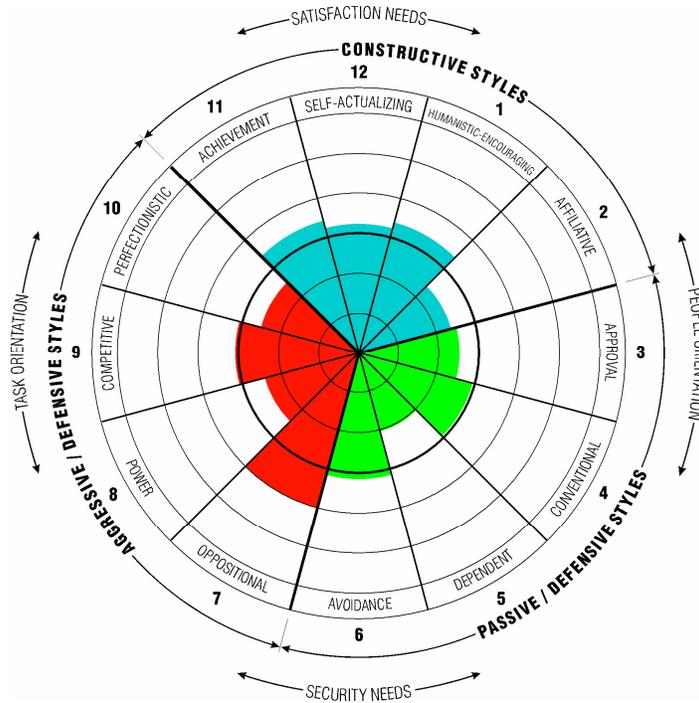


Figure 0-1: Kinleith OCI Profile in 2003

Kinleith Culture 2005 N= 178

<sup>19</sup> Source: <http://www.humansyn.com/site/index.php?doc175128464>.



**Figure 0-2: Kinleith OCI Profile in 2005**

## Appendix J – Average ABB Kinleith Manager OCI Profile

The OCI diagram below shows the profile of an average ABB Kinleith manager. The results came from a 360-degree feedback questionnaire filled out by 50 people for the 10 manager of the ABB Kinleith management team in 2003.

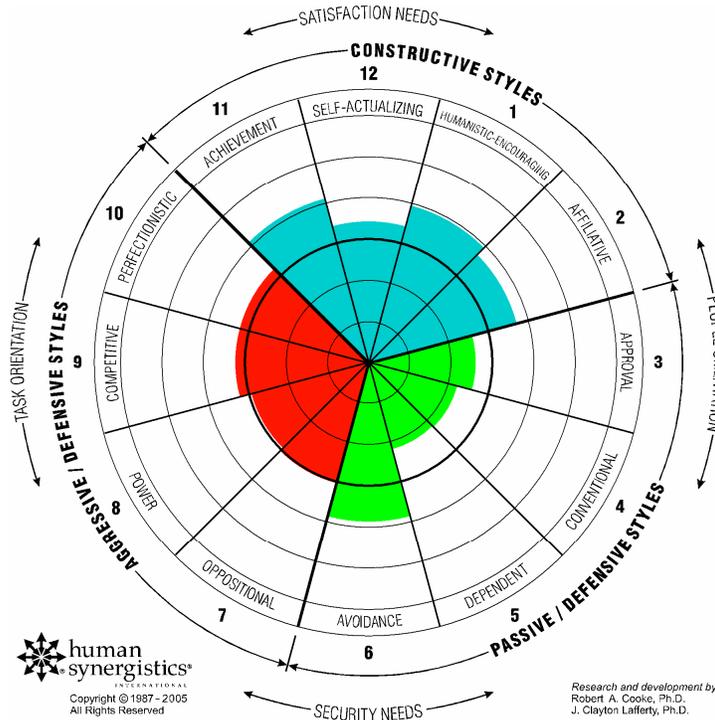


Figure 0-1: Average Kinleith Manager OCI Profile