SEVENTH GENERATION S-LAB

A Framework for ‘Make vs Buy’

Erasmus zu Ermgassen, Whitney Braunstein, Guillaume Fernet, Grace Montesano
Table of Contents

Abstract.....................................................................................................................................................................3

Introduction ..............................................................................................................................................................4

Seventh Generation wants to “walk the talk” in all parts of its operations.........................................................4

The S-Lab project developed a framework to evaluate the sustainability and financial viability of manufacturing options.........................................................................................................................................5

Framework..................................................................................................................................................................6

Impacts and Trade-offs to consider when deciding whether to centrally manufacture products or rely on a distributed network of manufacturing plants...........................................................................................................7

The supply chain is enormously impacted by centralization ...............................................................................9

Economies of scale could lead to significant impacts ........................................................................................10

Impacts and Trade-offs to consider when deciding whether to self-manufacture products, contract out manufacturing or form a partnership/joint venture ..............................................................................................11

Loss of Market Efficiency ...................................................................................................................................14

Captured margin and enhanced control ............................................................................................................15

Partnering: a good compromise?.......................................................................................................................16

Impacts and Trade-offs to consider when deciding whether to build, renovate or lease a manufacturing plant .16

An opportunity to reduce environmental footprint through process and systems design ..............................................18

Significant financial and risk management impact counter-balance the environmental opportunity .......... ....18

Integrated Strategies..............................................................................................................................................19

Recommendations.................................................................................................................................................20

Conducting an LCA will provide Seventh Generation with a baseline that can be used to identify environmental hot spots and measure progress ...............................................................................................20

Instead of looking back up the supply chain, the biggest environmental gains could be downstream ............22

Replace current Manufacturing Partner audits with quantitative ones that provide data on sustainability practices ..........................................................22

Conclusion...............................................................................................................................................................23

Appendix...............................................................................................................................................................24

Other opportunities for sustainability in Seventh Generation’s product chain.......................................................24
Abstract

Seventh Generation is a leading marketer of natural, non-toxic household products in the US. Based in Vermont, Seventh Generation’s business has focused on offering products that are hypo-allergenic and safe for long term use in the home, whilst also being environmentally sensitive – “Safer for you and the Environment.”

This project makes up part of Seventh Generation’s broader reassessment of the possible sustainability gains throughout the life cycle of their products. In particular, we will consider the sustainability and financial implications of current manufacturing models for liquid laundry detergents, which make up approximately 50% of Seventh Generation’s gross sales. The project will compare several alternative strategies for laundry detergent manufacture.

The S-Lab team developed a framework for evaluating investing in manufacturing plants versus continuing to contract out the production of Seventh Generation’s liquid products. This framework identifies the likely pros and cons of a number of manufacturing strategies according to financial and sustainability criteria (divided into environmental and social impacts). As such, the framework is intended as a tool both to shape the quantitative assessment of Seventh Generation’s manufacturing alternatives, and also to inform the consideration of future manufacturing strategies.

To fully evaluate the various options, Seventh Generation will need to be able to use its current production methods as a benchmark. An initial Life Cycle Assessment (LCA) of the liquid products would identify the company’s sustainability “hot spots” along the production chain, and allow Seventh Generation to concentrate its efforts on areas where it can have the most impact.
Introduction

Seventh Generation wants to “walk the talk” in all parts of its operations

Seventh Generation has successfully developed household products that exemplify healthy cleaning. For example, the Free and Clear Laundry Liquid is made of ingredients that “do not pose any chronic health risks and are safe for the environment.” After 21 years, however, the company’s commitment “to inspire a more conscious and sustainable world by being an authentic force for positive change,” is potentially threatened by its own success. The recent rapid growth of Seventh Generation has also been accompanied by increasing environmental impacts. In 2008 alone, as sales grew 50% and employee numbers expanded by 41%, Seventh Generation’s absolute carbon emissions grew more than 20%. Now – with a strong customer base and a proven product line – Seventh Generation is looking at other ways to meet its goals of operating in a way that has minimal impact on the Earth and on human health.

Seventh Generation’s initial efforts at integrating a broad definition of sustainability into their business began with a reassessment of the systems that were directly within their control. These initial initiatives included operating its headquarters out of a Gold LEED certified building in Vermont, creating incentives for employees to use more fuel-efficient vehicles, and switching to packaging containing higher percentages of post-consumer material. Changes made at this level are generally considered to be the “low-hanging fruit” of sustainability improvements because they are under the control of the management, they often generate cost savings, and they can be implemented quickly.

The team is now looking to extend their culture of sustainability to the entire cradle to grave process – meaning, they are no longer satisfied with selling a superior product, and they would like to examine the rest of the product manufacturing system from the “birth” of raw materials to the “final resting place” of the product after it is disposed of by the consumer. The cradle to grave analysis or Life Cycle Assessment (LCA) evaluates the processes for sourcing raw
materials, manufacturing, packaging, transportation, distribution, use, and disposal. This pushes companies to evaluate where their largest environmental impacts are and allows them to consider other options that might be less harmful.

**The S-Lab project developed a framework to evaluate the sustainability and financial viability of manufacturing options**

For the S-Lab project, the Seventh Generation team chose to focus on the manufacturing phase of production. The primary concern was how to evaluate whether or not Seventh Generation should manufacture its own products. At present, Seventh Generation contracts out or leases most of its production operations and runs sales, business development, research and design out of the Burlington office. Processes contracted out include product manufacture, bottling, transportation, and distribution, with seven Manufacturing Partners across North America producing their detergents and soaps. Seventh Generation is not a majority customer for any of its partners, and perceives itself as having limited negotiating power in its relationships. The team presented the S-Lab project as a chance to develop a framework to inform future manufacturing strategy decision-making. The developed framework would provide metrics for evaluating both the sustainability and financial impacts of bringing production in-house.

The initial hypothesis was that by owning its own facilities, Seventh Generation could develop a plant that is a model for sustainable manufacturing. They could set their own standards for emissions, waste, and water use, and closely control labor practices. However, to invest in even one plant, the company would have to raise capital and greatly shift the make-up of the staff by hiring manufacturing experts, managers and plant employees.

A secondary question presented by the Seventh Generation team centered on developing an entirely new method of manufacturing their liquid products. The team was concerned that there are unnecessary financial and environmental costs associated with shipping detergents that are mostly made up of water, compared to shipping a concentrated form of detergent, which is then bottled and diluted either at an end distribution site or at the consumer’s home.
Clearly, the possibility of developing a game-changing technology within the next 2-5 years affects the decision to own manufacturing plants and equipment, which could soon be obsolete. By continuing to contract production out to professional plants, Seventh Generation maintains a strategically nimble position.

**Framework**

For the S-Lab project, the question of whether or not to bring manufacturing in-house was divided into three areas:

1. Centralized manufacturing in one single plant, as opposed to the current distributed network of seven liquids and detergent Manufacturing Partners nationwide.
2. In-house self-manufacture versus the current strategy of out-sourcing manufacturing.
3. Whether an in-house manufacturing plant should be a new construction, a renovated existing plant, or a leased facility.

Each area is evaluated against three measures:

1. Financial impacts of each area, in terms of changes in costs and potential increases in earnings.
2. Reductions in the environmental impact that each area could provide.
3. Fit with Seventh Generation’s corporate culture and mission.

For the Environmental measure, S-Lab team identified a number of Environmental Performance Indicators (EPIs) that are in line with Seventh Generation’s sustainability goals for the environment and human health and also with ISO standards. Note that the Environmental measure would include human health issues in terms of the toxicity of emissions. The five indicators are as follows:

1. Energy consumption (in gigajoules)
2. Water consumption (in m³)
3. Emissions
   a. Greenhouse gas (GHG) emissions (in metric tons of CO₂ equivalents)
   b. Ozone Depleting Substances (ODS) emissions (in metric tons of CFC11 equivalents)
   c. Acidification emissions to the air (in metric tons of SO₂ equivalents)
   d. Emissions to water from manufacture effluent
4. Materials consumption (in metric tons)
5. Total waste (in metric tons).

Impacts and Trade-offs to consider when deciding whether to centrally manufacture products or rely on a distributed network of manufacturing plants

Centralizing manufacturing would have significant financial, environmental and cultural/social impacts. The framework developed for this project has been designed to give structure to a future data-driven analysis, and therefore any predictions should be evaluated against real financial and environmental information later on. That being said, we predict that centralization would have two major types of impact: first, impacts on the supply chain and second, impacts on economies of scale.
### Centralized vs Distributed

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Lowest</th>
<th>Low</th>
<th>Neutral</th>
<th>High</th>
<th>Highest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>increased mileage</td>
<td></td>
<td></td>
<td>pooling reduces inventory</td>
<td>reduced lead times</td>
</tr>
<tr>
<td>Inventory</td>
<td></td>
<td></td>
<td></td>
<td>direct orders from plant</td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
<td>economies of scale</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emissions (GHG, ODS, SO2)</td>
<td></td>
<td></td>
<td></td>
<td>reduce transportation emissions using rail</td>
<td></td>
</tr>
<tr>
<td><strong>Cultural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk &amp; Control</td>
<td></td>
<td></td>
<td></td>
<td>internal performance comparisons</td>
<td>easier to control</td>
</tr>
</tbody>
</table>

**Bubble legend:** The likely impact on the vertical axis criteria increases from detrimental to beneficial as you move from left to right.
The supply chain is enormously impacted by centralization

Centralization of manufacture would have both significant positive and negative impacts on the supply chain. Whilst a first qualitative view suggests that the financial trade-off would be negative, further detailed analysis is required to value the financial impact. Similarly, it is hard to conclude on the environmental impact without an in-depth assessment, although centralization could offer some definitive opportunities in this area.

The main stage of the supply chain affected by centralization would be transportation, both in-bound (between the landing port and the manufacturing plant) and out-bound (between the manufacturing plant and the distribution center).

From a financial perspective, it is almost certain to increase cost. Costs are expected to rise because centralization would cause increases in outbound mileage (moving into the opposite direction of the recent logistics changes) and lead times, with impacts on both inventory and customer satisfaction (in particular, shipping orders direct from the plant to the distributors will likely be more difficult). The recent assessment of mileage gains following the distribution of manufacturing capacity across the country suggests that centralization could increase outbound mileage by 8-12%. However most of the recent mileage gains (48% reduction in mileage from distribution centers to retailers) would not be affected.

Centralization would also offer some opportunities in the supply chain. Firstly, inventory levels at the plant would decrease (pooling\(^2\) effect), impacting both storage cost and energy use.

---

\(^1\) Raw materials supply transportation: We have not considered the impact on raw materials supply transportation from overseas to the landing port. It is unclear how raw material mileage (and therefore energy use and emissions) would change. It seems that, depending on the actual geography, the change could be one way or the other.
Further analysis is required to understand how much the associated financial and energy use gains would offset the increased cost and energy use in transportation. However, the total mileage for inbound raw materials and for outbound finished goods could be reduced, should the pooling effect also allow larger transportation batch sizes and therefore more fully loaded trucks. Secondly, when deciding the location of the centralized plant, Seventh Generation will have a unique opportunity to locate it in a region where water is abundant and/or near railways — allowing more transportation by train\(^3\). Similarly, larger transportation batch sizes would increase the financial viability of increased train transportation. Should these opportunities be available, it could significantly impact the environmental footprint across the cycle.

**Economies of scale could lead to significant impacts**

Whilst centralization would have a significant knock-on effect on supply chain, it also has a direct impact on economies of scale. These would have an effect on both financial and environmental performance. A detailed assessment is required to understand whether this effect would be positive or negative. Our first analysis suggests that this is process-specific and would lead to economies of scale. Under this hypothesis, the manufacturing of Seventh Generation products in each plant has a fixed cost specific to the products (e.g. a setup cost each time the plant starts a batch of laundry detergent bottles). When consolidating production to one central plant, the redundant set up costs in other plants will be eliminated, facilitating

---

\(^2\) **Pooling:** Centralizing inventory reduces the level of safety stock required in the system. For example, if a minimum level of 10,000 bottles is required in each of 3 warehouses to satisfy the variability in demand that each of these warehouses faces, strictly less than 30,000 bottles will be required as safety stock in one, central, warehouse serving the 3 demands. The actual safety stock saving depends on demand variability.

\(^3\) **Impact of transport mix: train or truck.** The trade-off between the two transportation modes remains unclear. Train is more cost-effective and produces fewer emissions. However it is less time effective and hence would increase lead-time. Combining the increase of transportation by train and centralized manufacturing would amplify the increase in lead-time. It is therefore unclear whether that would improve cost. From an environmental perspective (energy use and emissions) rail transportation is more effective. However the lead-time issue has subsequent effect on inventory levels (stored in a warehouse): either these levels have to increase or orders have to be more frequent (or both). This would have a detrimental effect on energy use and emissions (from additional storage or additional trains). Hence the trade-off is unclear.
economies of scale. These economies of scale would reduce unit cost, pollutants and emissions production, and resource consumption – including energy and water use.

Our second hypothesis would lead to diseconomies of scale. Under this hypothesis, each plant has a fixed cost that is spread across all the products it manufactures (from Seventh Generation and from other customers). The centralized plant is also smaller than the current plants under contract and Seventh Generation would therefore not be able to spread the fixed cost over as many products as the (large) distributed plants. The centralization would therefore lead to diseconomies of scales, until Seventh Generation’s own production achieves its own economies of scale.

One particularly beneficial aspect of centralization is that it would allow Seventh Generation to concentrate their attention to one place (and one relationship). This is likely to enhance risk awareness and improve mutual accountability (whatever the ownership structure is). This would also allow Seventh Generation personnel to be more involved with the manufacturing staff and identify opportunities within their processes or cross-process more easily. Downsides vs. having several manufacturing facilities include that Seventh Generation would lose the opportunity to compare performance between plants, and the higher financial risk of disruption to operations at a single plant. The lost opportunity of inter-manufacturer comparison is, however, currently relatively small, because Seventh Generation has limited information for comparison. With a distributed manufacturing network there is also a smaller financial risk should production be disrupted, whereas with a single plant, disruption would undermine product supply nationwide.

**Impacts and Trade-offs to consider when deciding whether to self-manufacture products, contract out manufacturing or form a partnership/joint venture**

The second question to consider – and this can be done independently from the centralization question, is the opportunity to switch to self-manufacturing. Our analysis suggests that such a
change would bring very significant environmental and social benefits. Entering a strategic partnership with a like-minded organization would help to mitigate the efficiency losses, particularly if the partner organization has experience in manufacturing.
Bubble legend: The likely impact on the vertical axis criteria increases from detrimental to beneficial as you move from left to right.
Loss of Market Efficiency

Switching to self-manufacturing would imply losing the existing market efficiencies Seventh Generation is currently taking advantage of. Because the number of manufacturing plants available to take orders is significant, Seventh Generation is able to negotiate a good price for its products. This currently gives financial benefits that would be lost if switching to self-manufacturing.

The first efficiency that would be lost is the capital allocation flexibility. Contract manufacturing allows for flexibility in that it allows for meeting demand exceeding the production capacity of the facility. If sales have been slow, the company is able to negotiate contracts to answer the decline in demand, or negotiate multiple ones if demand is exceeding supply. In the situation where Seventh Generation would self-manufacture their products, this flexibility would be limited, as the company would likely have more stringent capacity commitments.

The second type of efficiency that is likely to be lost is linked to the steadiness of cash flows. Once a machine breaks down in a plant, a cash infusion is necessary to carry out the repairs. These cash requirements would typically be leveled off in the prices a contract manufacturer charges, while they would show as one-off expenses if Seventh Generation were to self-manufacture. Cash flows would therefore be less predictable. This unpredictability could partially be mitigated through maintenance contracts but is likely to cost more for Seventh Generation than for a large contract manufacturer that can spread these cost over larger volumes.

Finally, operational costs are likely to be higher when self-manufacturing. The use of contractors currently allows Seventh Generation to take advantage of competitive market prices. Furthermore competition provides incentives to contract manufacturers to improve their efficiency. These benefits would be lost in the self-manufacturing scenario and Seventh Generation could face a double marginalization issue. Whilst this second effect can be mitigated through the implementation of appropriate incentives within the company, not relying on competition will most likely lead to higher operational costs.
Captured margin and enhanced control

Whilst vertically integrated manufacturing would allow Seventh Generation to capture the manufacturers’ margin, the greatest benefit of self-manufacturing is probably the direct control the company has over its corporate culture as well as their environmental practices.

Capturing the margins of contract manufacturers is a textbook argument for bringing manufacturing in house. However because of high competition in the manufacturing business, these margins are likely to be small, particularly for volumes such as those required by Seventh Generation. Furthermore, this has to be balanced with the efficiency loss described above and it is therefore most likely to have very little impact on the company’s financial bottom line.

Beyond the financial gains, self-manufacturing would offer significant environmental opportunities. For a company such as Seventh Generation that has built its corporation upon sustainable business practices and conservation of natural resources, having a direct say in sustainable initiatives is important in upholding the brand promise of the company. Furthermore with self-manufacturing, the plant can be designed for optimal efficiency in areas such as energy and water consumption, as well as emissions (air and water pollutants). These are areas where the existing Manufacturing Partner Annual Reports show significant room for improvement. Because the existing relationship does not allow Seventh Generation to obtain improvements from contractors in these areas, there is likely to be quick wins as well as more long-term gains from self-manufacturing.

Finally self-manufacturing opens interesting, and certainly more challenging, social/cultural opportunities. The company may not have to deviate from their own established social and cultural norms in regards to the new plant. This includes transferring of Seventh Generation knowledge, employment and hiring policies, salary scales, and risk/control policies from the parent corporation down to the plant. To our knowledge such an endeavor has never been undertaken in a manufacturing plant. It therefore carries significant social risk that could radically transform Seventh Generation’s culture. Should the company go down that route, we strongly recommend focusing specifically on this aspect of the transformation.
Partnering: a good compromise?

As a third solution, entering a strategic partnership can prove to be a better alternative and help resolve some of the major issues that Seventh Generation would face when bringing manufacturing in house. Should they find a suitable partner, this could fill the knowledge gap, mitigate financial risk and achieve efficiency scale in operations.

As Seventh Generation has currently very limited manufacturing knowledge, entering a partnership with a “manufacturing-savvy” organization could be very beneficial. Filling the knowledge gap would help the company to mitigate the operational cost efficiency loss described above and most of the financial risk in general. Combining both organizations’ volumes, the joint venture would be more likely to reach the market efficiency scale. By carefully choosing the partner company, it will be possible to implement some of the environmental and social improvements outlined above. However any cultural misalignment will likely be difficult to address, and would require a compromise between the two organizations. Strategy and cultural aspects will therefore be critical in assessing potential partners.

Impacts and Trade-offs to consider when deciding whether to build, renovate or lease a manufacturing plant

Once the decision to move to centralized manufacturing is made, the next question is whether to build a brand new plant, buy an existing one, or enter a lease agreement. Our analysis suggests that the higher the degree of ownership, the bigger the potential to improve the environmental footprint. However these benefits are likely to be counter-balanced with increased financial cost and risk.

\[4\] Pollutants and Waste: no significant impacts foreseen. Financial implications: please note case-by-case accounting rules may significantly alter the financial analysis.
**BUILD vs RENOVATE vs LEASE**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Lowest</th>
<th>Low</th>
<th>Neutral</th>
<th>High</th>
<th>Highest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FINANCIAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Outlay</td>
<td>high initial outlay</td>
<td>moderate initial outlay</td>
<td>less optimization possible</td>
<td>optimize transportation with plant location</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Assessment</td>
<td>assessments, legal costs</td>
<td>plant can be sold with minor retrofitting</td>
<td>none</td>
<td>flexibility</td>
<td>depreciation and local tax credits</td>
</tr>
<tr>
<td>Exit Options</td>
<td>long term commitment to customized facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ENVIRONMENTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>difficult to negotiate</td>
<td></td>
<td></td>
<td>enhance existing systems</td>
<td>design for optimal efficiency</td>
</tr>
<tr>
<td>Water Consumption</td>
<td>difficult to negotiate</td>
<td></td>
<td></td>
<td>enhance existing systems</td>
<td>design for optimal efficiency</td>
</tr>
<tr>
<td>Emissions (GHG, ODS, SO2)</td>
<td>difficult to negotiate</td>
<td></td>
<td></td>
<td>enhance existing systems</td>
<td>design for optimal efficiency</td>
</tr>
<tr>
<td><strong>CULTURAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk &amp; Control</td>
<td>owner’s risk and liabilities</td>
<td>owner’s risk and liabilities</td>
<td></td>
<td>fits with existing company culture</td>
<td></td>
</tr>
</tbody>
</table>

Bubble legend: The likely impact on the vertical axis criteria increases from detrimental to beneficial as you move from left to right.
An opportunity to reduce environmental footprint through process and systems design

The opportunity to reduce manufacturing environmental footprint increases with the degree of ownership. Although incremental when leasing, improvements to systems and process can become much more significant with full ownership of the plant. Should Seventh Generation have the opportunity to build a brand new plant, it could adopt an optimal process design and state-of-the art systems that minimize environmental impact.

The biggest environmental footprint reduction could be achieved by building a brand new plant. This would allow Seventh Generation to put in place optimal processes and systems. Case studies show that new building design reduce energy consumption by 20 to 70%, and water consumption by up to 70% compare to existing buildings. However these savings, accounted for over the life of the building, must be balanced with the initial environmental cost of construction (higher than the cost of renovation). A careful assessment, taking into account the useful life of an existing building and the efficiency achieved through renovation, must be carried out in order to understand which of the options is better for the environment.

Significant financial and risk management impact counter-balances the environmental opportunity

Whilst the opportunity to reduce the environmental footprint of manufacturing increases with the degree of ownership, so do the potential financial costs (with the exception of transportation cost). The capital to pay upfront when building a new plant can be a significant burden on the company’s finances. This burden will be only partially offset by the impact of depreciation on deferred taxes and potential local tax credits, and is likely to be an important obstacle to the decision to build a new plant. Furthermore Seventh Generation would incur siting costs if building a new plant. These include lawyers’ fees, planning permission cost, local communities environmental impact assessment studies cost, etc. There are no such expenses when buying an existing plant or entering a lease agreement.
A less straightforward financial liability to consider is the option to exit manufacturing and sell the plant. This is particularly important to consider given Seventh Generation’s lack of experience in manufacturing. Failure is always a possibility when a company branches away from its core competencies, so the options to exit should be carefully assessed. In the case of either building a new plant or renovating an existing plant, the structure and the equipment could be sold off, but the risk is being able to recover the initial amount paid. In the case of the lease, the exit costs are likely to be low, however this will heavily depend on the particular terms of the lease.

Similarly, the ownership of a plant implies total responsibility over what can go wrong. Whilst this resonates well with Seventh Generation’s culture and values, it is nonetheless an additional liability to take into account in the decision. To this respect, building a brand new plant is more risky than buying an existing one, which is likely to be more risky than leasing one.

**Integrated Strategies**

The team acknowledges that the three manufacturing questions identified are not independent, but can be integrated. Seventh Generation can therefore pursue strategies that incorporate aspects of two or more different strategies. Should product demand continue to grow, for example, Seventh Generation could establish a centralized plant for self-manufacture to meet the increased demand, while also maintaining their current contract-manufacture logistic framework. Such a strategy would allow the sustainability gains of centralization to be captured for the new plant, without the financial risks coming form “putting all your eggs in one basket”. Similarly, all manufacture could be centralized, with manufacture then being contracted out when the capacity of the centralized plant is exceeded. This strategy would allow high flexibility as Seventh Generation’s growth exceeded their centralized plant.
**Recommendations**

**Conducting an LCA will provide Seventh Generation with a baseline that can be used to identify environmental hot spots and measure progress**

Although the question of the sustainability of Seventh Generation’s current manufacturing strategy is a legitimate one, it is ambiguous whether changing Seventh Generation’s manufacturing strategy for laundry detergents will significantly reduce the total environmental impacts for this product, when considered from cradle to grave. The team, therefore, suggests that Seventh Generation carry-out a streamlined Life Cycle Assessment to quantify the potential sustainability gains of the various manufacturing strategies considered. In particular, the team feels that high resolution quantitative data should be collected on both Seventh Generation’s consumers’ behavior and the environmental impacts of their Manufacturing Partners’ practices.

Seventh Generation has begun the challenge of internalizing the environmental costs of their product manufacture, use, and disposal. To prioritize the actions that Seventh Generation can take to minimize the environmental impacts of their products requires quantitative assessment of the product’s life cycle, and a Life Cycle Assessment would provide the necessary foundation for best reducing Seventh Generation’s footprint. Or, as explained by N. Unger: “In order to design an environmentally benign product or service it is necessary to know where environmental hotspots lie. Environmental hotspots are stages in the life cycle, or certain factors, such as energy, that cause a high environmental impact of a product or service.”

At the outset of the S-Lab project, Seventh Generation provided an LCA for a laundry detergent made by a competitor. For an outline of a laundry detergents’ environmental footprint, Seventh Generation should not rely on this alternative LCA Case study. LCAs are temporally and

---

5 A review of ecodesign and environmental assessment tools and their appropriateness for electrical and electronic equipment (2008), N. Unger
spatially specific, and as such, the competitor’s case study applies only to a detergent produced in Europe in 2001.

Completing a new LCA will allow Seventh Generation to establish whether the gains to be made from changes in manufacturing strategy are worth the risks, or whether environmental savings would be better pursued elsewhere in the life cycle. As an example application of the Life Cycle Assessment, it could be used to answer the question whether Seventh Generation should pursue a centralized manufacturing model versus a dispersed model: although it is known that Seventh Generation products travel more than twice as many miles from distribution centers to retailers than from the manufacturers to distribution centers, the distance traveled by raw ingredients from suppliers to manufacturers is not known. Considering the gross environmental impacts of a centralized manufacturing model therefore requires knowledge of the entire lifecycle.

The team acknowledges, however, that LCAs are expensive and time consuming to conduct, and therefore suggests that initial LCAs are “streamlined”\(^6\). Streamlined LCAs are less data intensive, and would only provide an outline of Seventh Generation’s laundry detergent’s environmental impacts. Despite the need for quantitative data on manufacturer’s sustainability performance, the burden of data collection can be minimized both by not mandating the annual collection of quantitative data (rather conducting quantitative audits roughly every two years), and by avoiding collecting that minority of data which is disproportionately difficult or costly to obtain, in accordance with the “90% rule”: “data collection...can exclude minor quantities of data as long as the remaining figures cover at least 90% of the total and provide sufficient understanding for good decision-making.”\(^7\)

In the interests of this project, high-resolution data ought to be collected for the initial streamlined LCA on both the use and the manufacturing stages. The use stage is expected to have the largest footprint, and so it is critical that the actual size of the impact for this life cycle stage be properly quantified. This data could be collected through surveying Seventh

---

\(^6\) Ibid

Generation customers, which should not be a particularly onerous task given Seventh Generation’s active dialogue with their customers (“our customers are invited into our brand and invited to stay and participate”\textsuperscript{8}).

**Instead of looking back up the supply chain, the biggest environmental gains could be downstream**

Financial and ecological savings from changing the current strategy may be limited. Only a minority of the financial cost of laundry detergent production, and less than 3.5\%\textsuperscript{9} of the “environmental costs” arise in the manufacturing stage. On the other hand, roughly 90\% of the energy use occurs in the use stage\textsuperscript{10}. For laundry detergents, the use phase is characterized by the consumption of energy to heat water in washing machines and the resulting waste from the heating process.

**Replace current Manufacturing Partner audits with quantitative ones that provide data on sustainability practices.**

The S-Lab team’s second recommendation is that the manufacturing stage be quantitatively audited. Benefits of asking quantitative questions in the Manufacturing Partner Reports, besides informing the LCA, include that it impresses on the manufacturers Seventh Generation’s genuine commitment to sustainability, that it ensures manufacturers are taking energy, water and waste issues seriously, and finally, quantitative assessment provides a benchmark for both inter-annual and inter-manufacturer comparison. Inter-annual comparison allows Seventh Generation to monitor manufacturer’s progress on sustainability initiatives and to ask specifics (for example, why a particular manufacturer’s energy use is increasing). Inter-manufacturer comparisons, on the other hand, allow Seventh Generation to identify which manufacturers they may be interested in partnering more closely with, or even buying out (as

\textsuperscript{8} In Our Every Deliberation, (2009) J. Hollender

\textsuperscript{9} This figure is taken from an LCA for a similar product. The 3.5\% figure includes energy use in the formulation process, the disposal of spent wash water and the manufacturing of packaging raw materials.

\textsuperscript{10} http://www.seventhgeneration.com/get-out-of-hot-water
part the changes in manufacturing strategy outlined in our framework.) Inter-manufacturer comparisons may also encourage discourse and sharing of best practices between Seventh Generation’s Manufacturing Partners, a process that Seventh Generation promoted at the 2008 Sustainability Summit.

For example Seventh Generation could identify the manufacturers with the worst water usage and then put them in contact with better-performing manufacturers, in a bid to reduce the footprint of Seventh Generation’s products – which would presumably be published in the annual Corporate Sustainability Report.

**Conclusion**

In conclusion, changing Seventh Generation’s manufacturing brings sizeable financial risk and ambiguous environmental gains, as elaborated in our framework. To quantify the financial and sustainability benefits of the modeled manufacturing alternatives requires a quantitative baseline for comparison of current practices. Seventh Generation should therefore complete a streamlined Life Cycle Assessment for the laundry detergent product that is the subject of this project, and should overhaul the Manufacturing Partner Report to require quantitative assessments of their current sustainability practices.
Appendix

Other opportunities for sustainability in Seventh Generation's product chain

Beyond the immediate scope of the manufacturing frameworks developed, we have also considered a number of sub-strategies for increasing Seventh Generation's sustainability. We believe that Seventh Generation's efforts to internalize the environmental impacts of manufacturing should extend to the entire life cycle of the product, including considering the environmental impacts of transport in the Seventh Generation supply chain.

For example, Seventh Generation currently uses a broker to manage its inbound/outbound freight. In order to gain more control over their transport-related environmental impacts, one option would be for Seventh Generation to partner with the EPA Smartway program. Working with the EPA would facilitate calculating transport-related environmental performance, establishing improvement goals, and calculating cost savings.

When targeting the supply chain, Smartway strategies such as employing biofuels and hybrid vehicles throughout the transport fleet are recognized as having some of the largest and most cost-effective Carbon abatement potentials of any logistics strategy\(^{11}\).

This project also considered the potential to reduce the carbon footprint of the laundry detergent product through greater Internet sales and home delivery. This has the potential to cut the miles travelled by the product during the supply chain through "reducing nodes"\(^{12}\). Although Seventh Generation already offers internet sales, this is managed through an online retailer, "The Consumer Link". This sales strategy has a logistic strategy which mimics Seventh Generation's other strategies for products to reach more traditional markets: the product is

\(^{11}\) Supply Chain Decarbonization: THE ROLE OF LOGISTICS AND TRANSPORT IN REDUCING SUPPLY CHAIN CARBON EMISSIONS, report compiled by WBCSD

\(^{12}\) Ibid
transported from manufacturer to a distribution centre, and then from distribution center to the retailer, which handles sales. In any case, the potential for carbon abatement through increased internet sales appears to be low\textsuperscript{13}, and the small gains are only exacerbated by the current supply chain structure for online sales. The team therefore, proposes that sustainability gains do not play a strong role in Seventh Generation's consideration of the future potential for online sales.

Finally, when encouraging manufacturers to carry out quantitative assessments of their environmental impacts, Seventh Generation could consider approaching the EPA about a project within the EPA’s E3 program. This program (“Economy, Energy and Environment”) is intended to aid manufacturers with training and technical assessments of production processes. As such, they claim to provide:

- **A Lean Review** that leads to increased productivity and reduced costs
- **An Energy Audit** that provides tools and insights for reducing energy demand and costs
- **A Greenhouse Gas (GHG) Evaluation** that teaches manufacturers how to calculate GHG emissions and evaluate reduction strategies
- **A Clean Review** that results in water and energy conservation, reduced emissions, and additional cost savings
- **Post-Assessment Recommendations** that guide each facility toward improvements in overall efficiency, reduced waste, more efficient use of resources including energy and water, and cost savings.

\textsuperscript{13} The worldwide potential for supply-chain carbon savings of internet sales is only 13MT. This saving is low when considered against the potential of clean vehicle technologies, for example, with 175MT of savings; Ibid