Life Cycle Analysis and Sustainability Report

- Levi Strauss & Co. -
Jeans

("Life Cycle of a Jean")

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In 1853, in the height of the California gold rush, the first pairs of Levi Strauss and Co. denim jeans were crafted for rugged durability. Since their introduction, Levi's denim blue jeans have morphed into far more than ordinary 'work pants' (Levi Strauss and Co., 2004). With production beginning to grow in the 1920s and a boom in the use of their jeans in the 50s and 60s within youth culture, the company is now a global entity and symbolizes global culture (Levi Strauss and Co., 2004). Levi jeans are now present in all six populated continents, and are produced in many different countries.

In the early nineties, due to competition outsourcing their production, Levi Strauss and Co. followed suit and moved production overseas (Levi Strauss and Co., 2004). With providing a global population on its 'to-do' list, the company has greatly increased production since the 1990s, often with some detrimental impacts to not only the resource extraction process, but with societal impacts as well.

Recently, Levi Strauss and Co. has begun a green campaign involving a sustainable future, partnered with a line of green jeans crafted with organic cotton (Levi Strauss and Co., 2004). Juxtaposed to this is evidence of extreme disregard on a production level for the environment, and the company's employees. There are many important aspects of the life cycle and ripple effects of the production of Levi Strauss denim jeans that will be discussed, focusing on the effects of resource extraction, production, shipping, packaging, and 'after-life' of jeans when they are thrown away as waste. There are recommendations coming from corporate employees and policy makers as well as consumers to help create a sustainable future. We have provided possible recommendations for the corporate world and lawmakers to help so that they can provide consumers with a sustainable product. In addition we have provided ideas for consumers so they can also do their part in contributing to a more efficient life cycle of their Levi Strauss denim jeans.

End product Materials:

Levi Strauss & Co. Jeans	**Organic Hemp Jeans**
GM Bt Cotton	Organic Hemp
6 Copper rivets	6 Copper rivets
Metal Zipper	Metal Zipper
Metal button	Metal Button
Fake leather belt loop label	Belt label
Inside care label & product ID tags	Inside care label & product ID tags
Paper and plastic tags	Paper and plastic tags
Plastic leg sticker	Plastic Packaging
Plastic packaging	

Materials in Garment Treatment:

Levi Strauss & Co. Jeans	**Organic Hemp Jeans**
Pumice	Same as cotton if stonewashed
Chlorine	
Water	

Materials in Textile Production:

Levi Strauss & Co. Jeans	**Organic Hemp Jeans**
Synthetic indigo (C16H10N2O2)	Same as cotton jeans
Starch	
Bleaching Agents (i.e. potassium permanganate, sodium hypochlorite)	
Water	

Materials in Fiber cultivation:

Levi Strauss & Co. Jeans	**Organic Hemp Jeans**
Pesticides (16g/kg cotton)	Water
Fertilizer (457g/kg cotton)	Diesel
Defoliants	
Water (22200 l/kg cotton)	
Diesel	

The water use in the production of a pair of Levi 501 jeans is over 1,914 liters before consumer use.[1]

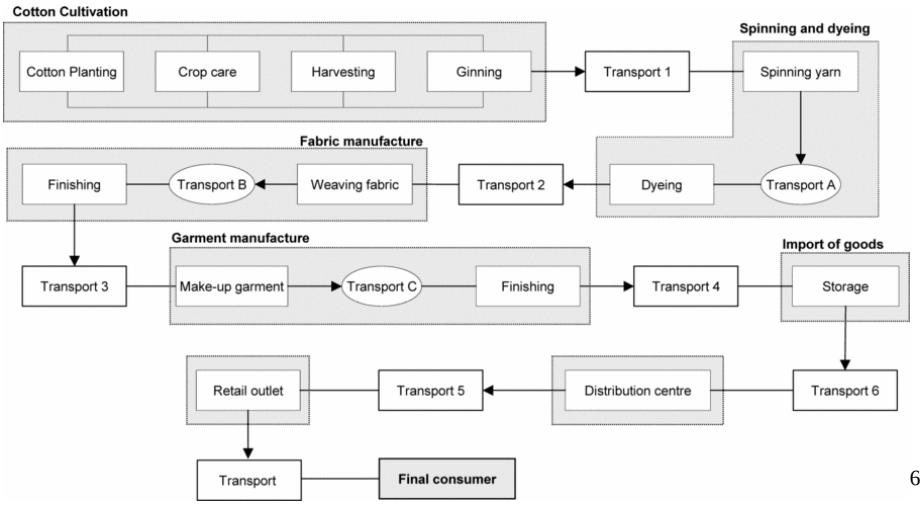
Levi Strauss & Co. Jeans have suppliers on every continent except for Australia and Antarctica. They 797 manufacturing contractors globally, and about a third (279) of those factories are in China.[2] Levi Strauss & Co. have a public list available of all "the names and locations of their active, approved owned-and-operated, contract and licensee factories that manufacture and finish" their products.[3] The chemicals used in the different stages of the processes are not limited to the examples above, since hundreds of different suppliers may use different practices, but LS&C has an extensive universal restricted substances list for all of their suppliers. The Restricted Substances List includes limitations on the use of:

-Aromatic Amines from Azo Dyes
-Disperse Dyes and Other Dyes
-Biocides
-Chlorinated Aromatics
-Isocyanates

[1] Levi Strauss & Co. *A Product Life Cycle Approach to Sustainability*
[2] Levi Strauss & Co. Factory Disclosure List.
[3] "Product Suppliers."

-Flame Retardants
-Metals
-Oranotin Compounds
-Solvents
-Phthalates
-Auxiliary Chemicals
-Polycyclic Aromatic Hydrocarbons
-Packaging
-RoHS – Electrical and Electronic Equipment Requirements[4]

Cotton is the world's most pesticide and chemical intensive crop.[5] In order to manufacture cotton, many stages of transport are necessary, and depending on the number of steps each supplier can do in one facility, the amount of carbon emissions will change. The figure below shows a potential pathway for cotton to consumer.



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Levi Strauss & Company (LS&Co.) enacted several programs in 2006 to address the company's internal and external environmental impacts throughout their product line. These programs included environmental compliance programs, supplier code of conduct program, global effluent guideline program, as well as their organic cotton initiative, which established what they claimed to be a more environmentally friendly line of products coined as their *Eco* brand. Around the time these programs were created, LS&Co. also began to conduct research on several of their products according to the "cradle-to-grave" methodology, where the full lifespan of a product is analyzed and the overall sustainability of that product is then rationalized through the assessment. This methodology is useful in sustainability analysis because it treats the wide

[4] Levi Strauss & Co. 2010 Restricted Substances List ("RSL").
[5] "Repair Your Jeans."
[6] Michael Browne, et al.

array of systems in creating the product as an aggregate system, useful in addressing the inherent complexity involved in synthesizing, distributing, and dismantling a consumer good. Their research led to a public report on their findings, which is posted on their corporate website as "A Product Lifecycle Approach to Sustainability," published on March 2009. Their lifecycle assessment, or LCA, was created to address the company's environmental sustainability and business sustainability.

In their LCA, the lifecycle of jeans from cradle-to-grave is reported as an collection of seven independent systems. These systems in their respective order are: (1) cotton production; (2) fabric production; (3) garment manufacturing; (4) transportation and distribution; (5) consumer use; (6) recycling, which then goes back to step (2); or (7) waste stream in a landfill. Under these headings, we examined the range of environmental and social impacts of jeans as they relate to sustainability, concluding with the recycling potential of this product at the end of its lifecycle. A wide array of sources, including newspaper articles, books, scientific journal articles, and web-based sources, such as the LS&Co. webpage, were used in this analysis. While our examination of each step in this products lifecycle is thorough and rigorous, it should be taken only insofar as the transparency of a multi-billion dollar worldwide industry in the might suggest.

(1) Cotton Production:

The cotton-growing component of jeans, necessary for the creation of the fabric, is perhaps one of the most resource intensive, politically heated, and socially unjust of all the individual systems involved in product's lifecycle. Because cotton growing is an agriculture-based system, it has sustainability factors rooted directly to the environment with respect to the land use, as well socially sustainable factors with respect to livelihoods of the farmers who cultivate the crop. These environmental and social components are dependent on each other, with changes either one of these having a linked affect to the other. For example, when farmers need a way to control pests from destroying their crop, they rely on the chemicals from the multi-billion dollar pesticide industry, where powerful companies create monopolies of these pest-controlling products by dominating the market in their sheer size. Many times, these products fail to prevent the pests from their adverse affects on crop quality, usually as a result of the pest's increased chemical resistance, and profit margins for the individual farmers are in term squashed from their chemical investments when their cotton is sold on the market. These are the scenarios that encapsulate the vast array of interacting components, both social (with respect to the farmers and their families livelihoods), and environmental (with respect to the many documented negative

affects of introducing harmful chemicals into the landscape), when understanding agricultural system sustainability.

Cotton is one of the worlds largest crops comprising somewhere between 3 to 5% of all the worlds cultivatable surfaces (Snyder, 2008 and Ransom, 1998). Worldwide, it is a 40 billion dollar industry where is grown in over 100 different countries with China, India, and the US accounting for more than two-thirds the global output (LS&CO Website, 2010). With more than 40 billion farms worldwide and about 270 million farmers making a living from growing cotton, it is definitely no small business (LS&CO Website, 2010). In the US, less than 1% of the nations $6 billion crop was organically cultivated cotton, which shows how little is actually invested in organic cotton as opposed to conventionally grown cotton (Adelson, 1997). This trend has continued into the present day, however the demand for organically grown cotton is steadily increasing (Lipke et al., 2007). Research suggested that conventionally grown cotton has historically been supported more by the governments where cotton is grown, with regards to financial backing and other government supported marketing arms. For example, Cotton Inc. is a nationally supported government institution in the US, which is financed by a $1.50 tax on each bale of cotton sold in the cotton market (based on 1997 data). Cotton Inc. determines where and how this money is funneled back into the cotton farms. However, even though organic cotton farmers are paying this tax, the money spent by Cotton Inc. is not allocated back in any proportional amount to support the organic farmers, leaving these farmers with the classic scenario of "taxation without representation." The bias towards conventionally grown cotton is also apparent in statements made by Cotton Inc., whose research claimed that conventional lawns use more water than cotton and that people generally misinterpret "organic" cotton as sustainable. Research conducted by Cotton Inc. claimed that the organic cotton farmers of the US, mostly located in the San Joaquin Valley of California and in the high plains of Texas, are not getting to spend money collected for the organic industry benefit (Adelson, 1997).

Fortunately for many of the smaller cotton farms in developing countries, the cotton necessary for jean manufacturing does not have to be of a particularly high quality. One of these small countries is Azerbaijan, which used to be the primary provider of cotton fiber for the Soviet Union before its collapse. Azeri cotton is often used by local fabric manufactures because they tend to grow it in high yields and low quality. The ripples of influence from the socialist empire still impact the agriculture in this country where most government leased land has been passed down to families with proportional assets of land delineated based on family size. Cotton was once a booming enterprise in this country that they coined "white gold," as their other main industry is

drilling for oil. Today, Azeri cotton farmers can't make enough to survive on their land alone, many farmers choosing other occupations such as teachers or factory workers to substitute for their family's income. Also, unlike US cotton farmers, who receive subsidies from the US government and whom global trade laws generally favor, the Azeri farmers are on their own (Snyder, 2008). Almost all smaller cotton farming communities tend to have strong opinions, generally negative, towards the US subsidized cotton market and is a fairly heated topic in the cotton industry as a whole.

Of all the insecticides sprayed worldwide, cotton spraying accounts for roughly ¼ of them, also consuming 10% of the worlds pesticides on an annual basis with an estimated cost of the pesticides totaling $2.6 billion (Snyder, 2008). Not only are the environmental impacts from these chemicals apparent within the industry, but also the social impact is very compelling and sometimes overlooked. For one, many of these chemicals have safety and precautionary warnings on their labels only in English. In developing countries, English is not always a first language for the farmers and they tend to disregard the warnings during their application. Of all the fatalities in the agriculture sectors of developing countries, 10% are related to pesticide poisoning (Snyder, 2008). In California too, cotton is the third highest crop responsible for workers illnesses because of the extensive amount of chemicals sprayed on the crop (Snyder, 2008). In fact, cotton uses higher volumes of pesticides than any other crop worldwide (Enting, 2009) and on the global stage, China has become the largest importer and exporter of cotton and, not surprisingly, have become the world's biggest user of pesticides.

The social impact of the staggeringly high priced pesticides was most appalling in India. In 2003 alone, more than 17,000 farmers committed suicide, the majority from cotton growing areas where the expensive chemicals and genetically modified cotton seeds "not only didn't work for farmers but left them deeply in debt" (Snyder, 2008). Their way out was to eat the pesticides.

The other alternative to conventional pesticide spraying is genetically modified cottons seeds, which again have been shown to pose many different threats to social and environmental sustainability. Genetic drift is the term used for the spreading of genetic information typically between genetically modified crops and non-GMO crops. The environmental impacts of potential large-scale genetic drift events are still relatively unknown besides the fact the synthetic genetic transcriptions are spread through the crop specie's gene pool. Theoretically, this is just another step towards the increasing homogeneity of our staple crops as well as the biological issues associated with bottlenecking a population in this way, including a diminished ability to deal with viruses, other diseases, and/or pests for example. In addition, companies such as Monsanto, the largest

international firm that markets these GMO seeds, have been the topic of heated debate regarding several court cases in which the company pinned organic farmers growing adjacent to GMO fields for stealing their patented seed technology during uncontrollable genetic drift events. Farmers involved in disputes with billion dollar corporations such as Monsanto don't have a standing chance. Ultimately, the large range of social issues regarding justice for these farmers and the possibly unethical practices of companies such as Monsanto are beyond the scope of this paper.

(2) Fabric Production and (3) Garment Manufacturing

These headings were grouped together because of the many similarities in their social and environmental impacts that are common between them. While these stages are explicit in the jean making process, they both typically take place in factories, they both need to be adjacent to water bodies for their effluent, chemicals are used heavily for both sectors, and they both employ low paid laborers.

Following the harvesting of cotton, it is transported from the farms to be made into cotton thread. The thread used to make jeans usually includes cotton sourced from multiple areas to keep it consistent on a month-by-month basis. A single foot of thread might contain fibers from farms in Texas, Azerbaijan, India, Turkey, and Pakistan (Snyder, 2008). As a result, the carbon dioxide and other greenhouse gas impacts from the transportation of these fibers are significant with respect to the global environment, with the ozone layer becoming increasingly depleted and ocean water levels rising.

The average pair of jeans carries about 3/4ths of a pound of chemicals (Snyder, 2008). To get that blue color in your pair of jeans, indigo dye is applied to the cotton fabric during these stages of the product's lifecycle. Although once a natural dye, the indigo color has mostly all been synthetically produced in the past century. Only a handful of countries, led by China and India, continue to produce natural indigo in notable quantities. Synthetic indigo was first produced for commercial use in 1897 by a German Company BASF (Badisch Anilin and Soda Fabrik) founded by Berlin chemist Adolf von Baeyer. This indigo was called "Indigo Pure" and subsequently used very heavily for jean manufacturing. In America, the only surviving manufacturer of indigo is in upstate New York at a company called Buffalo Color. This company produced 3,500 tons annually compared to BASF's 7,000 tons. The third largest is the company Bann, located in Brazil, which produced 3,000 tons (Sullivan, 2006). In 2004, Buffalo Color filed for chapter-11 bankruptcy protection because China was able to undersell them.

Any dye is a fundamentally polluting process (Snyder, 2008). Textile mills require a nearby water source for breaking down dyes, washing, and treating the fabric. Synthetic indigo dyes on the market today are usually sulfur based, which have serious detrimental effects to both the people that work with them, as well to natural environments where they are discharged. Sulfur dyes are the least expensive of dyes, which makes them a very enticing choice for those factories trying to cut excess expenses. In addition to sulfur based dyes, sodium hydroxide, hydrosulfate, and formaldehyde are chemicals typically used in the manufacturing processes.

Even if the color is removed from wastewater, this does not necessarily mean that the water is clean: sulfur dye residues tend to remain in wastewater even after treatment. Worldwide, the single biggest threat in textiles is the wastewater effluence (Snyder, 2008). Water quality regulations are typically based on measurements such as salt load content, toxicity, and dissolved oxygen content, which are all affected negatively when wastewater improperly treated (sometimes not even treated) is discharged into water bodies adjacent to these factories.

In addition to harmful environmental effects of the effluent, serious human health effects are also significant and not surprisingly, the link between textile workers and certain cancers, particularly bladder or nasal cancer, have long been known (Snyder, 2008). Benzidine, a chemical component of synthetic dyes, as well as many others in the industry have been listed by the EPA as being of "concern" and put textile workers at a much higher risk of cancer. Europe's initiatives directed towards determining chemical safety in the textile industry, in particular the REACH (Registration, Evaluation, and Authorization of Chemicals) program, are much more progressive than US initiatives. There are more than 40,000 chemicals identified by REACH that are in use in the textile industry (Snyder, 2008). Efforts such as these are crucial in ensuring that human health is being sustained in the global garment industry.

Stonewashing is a finishing process towards the end of the manufacturing in which the jeans are chemically treated to get the "faded" look. Such chemicals in these finishing processes, like potassium permanganate and sodium hydroxide, tend to appear in high concentrations in the wastewater effluent as well as high basic pH levels (Wambuguh, 2008). In order to minimize chemical concentrations, neutralize, and remove the color of the wastewater, it must go through treatments before it can be discharged into rivers or lakes. A study performed by Unlu et al. in 2008 suggest microfiltration through 0.45μm pore-sized membranes subsequently followed by ultrafiltration, which filters the water through an even smaller pore size, finally followed by nanofiltration, resulting in the removal of 99% of the color and 97% reduction of COD levels as well as significant salt reduction (Unlu et al., 2008). Research into these sorts technologies can

provide sustainable solutions for reducing the environmental impacts of effluent on the aquatic ecosystems by textile mills. In addition, techniques such as this increase the potential for recycling the wastewater to be reused in the mill itself and could provide significant relief on the water consumption of the textile industry as a whole.

On the Pearl River Delta in China, also dubbed the "world's factory floor," serious effluent and wastewater from the large number of factories and textile mills are causing serious problems with the river ecosystem. One tributary of the river, as reported by CNN reported Emily Chang in 2010, was a deep hue of hue; a testament to the operations of a nearby jean factory as it emptied its wastewater into the river with little to no treatment. The report, done from Guangzhou in China, shows a large scale example of the impact the blue jean textile mill effluent can have on the surrounding environment. With so many factories all located on the river, it is difficult to keep tabs on all of them. However, as the "blue jean capital of the world," the city of Guangzhou clearly is gaining a much different environmental legacy. And while this is only one example of a direct environmental impact of jean manufacturing, its scale and grandeur is surely worth noting.

Also worth considering is the water and energy consumption of textile mills in jean production. In a study done by Kocabas et al. in 2009, he suggested the necessity for mills to install flow meters to actually measure their water consumption so they could even begin to be progressive with conservation practices. Wastewater should be recovered whenever possible and salts such as sodium hydroxide present in the wastewater should be reused. In his observations on a large-scale textile mill in India, he also suggested reusing the steam from their reverse osmosis plant and compressor cooling waters, which provided a 29.5 % reduction in the total water consumption of the mill. Also, energy savings were cut when waste heat from wash-waters was recovered and better insulation was installed by 9%. In all, he was able to account for total amount of investment and total savings to be EUR 45,000 and EUR 987,000 respectively (Kocabas et al., 2009).

LS&Co. has a fairly compassionate reputation when if comes to upholding factory-working standards and human rights, and have actively prompted the removal of those factories to which those explicit standards weren't met, for example in both Burma and China. "When the company found child labor violations at one of its contractors in Bangladesh, they offered them education," reported David Ransom for the London *Guardian*. However, in almost all cases, the manufacturing of jeans is typically done in third-world countries where labor is abundant and cheap and violations to human rights are a common practice. Jeans are stitched together in

"sweatshops" where, usually woman and children are forced to work sometimes 18-hour days, which can be stretched long into the night into the next morning if a big shipment is being made. Almost always the pay is below any minimum wage standard, clearly a case of exploitation of few for the consumption of many. Livelihoods from this line of work are definitely not economically sustainable nor does it seem like the workers' health and wellbeing would be considered sustainable.

(4) Transportation

As with any globally marketed product, there are inherent environmental impacts as a direct result of transportation. In the LCA report by LS&Co., the transportation is laid out for a pair of their 501 brand jeans (see *Figure 1* in Appendix). The transportation of any consumer good has its relative carbon impacts on the environment and so it was necessary to at least have it be addressed briefly as worldwide, the GHG emissions from the transportation sector is substantial. Environmental and social impacts from the other steps involved in the lifecycle of a pair of jeans may be more apparent, however the impacts from this part of the jeans lifecycle should not be overlooked when addressing their overall sustainability.

(5) Consumer Use

According to the LCA report by LS&Co., their researched showed that the largest energy use and largest affect on global climate change occurred during the consumer phase of their jeans. While the overall water consumption in a jeans lifecycle is largely accounted for in the cotton growing stage at around 49%, the consumer phase comes in a close second at 43% (percentages based on the cumulative water usage for each stage in the jeans lifecycle). Based on these statistics, it would seem that the consumer phase could have the greatest impact on the environment than any other phase. In their report, the overall impact on climate change reported in a pie-chart form was the highest by far in the consumer use phase compromising 58% of its total calculated impact. This is followed by the fabric production phase, which was 21% of the pie, and thirdly the cutting/sewing/finishing phase at a small 9%.

It would seem that most of the consumer use impact as reported in their assessment came from the energy and water consumption based on an average lifespan of two years with one washing per week totaling 104 washings. By decreasing the number of times you wash your jeans to a per monthly basis, you can significantly reduce the consumer impact.

(6) Recycling and (7) Landfill Waste

Not surprisingly, there exists great potential for recycling in the jean industry. Crane & Co. is a company that has incorporated scrap denim remnants into its recipe for paper money in the US. This company makes paper from cotton not wood, the type of paper used for the dollar bill. Denim constitutes 20-30% of each American bill. The synthetic indigo dyes are outsourced to an Ohio company and then they are ready to be used for making paper. In the early 1990's LS&Co. sent its scrap denim to Crane & Co. to be made into paper, which was then sold back to LS&Co. as stationary.

LS&Co. also supported a plant in Thailand where the manager spearheaded a recycling program for the unused denim. For every 5 new pairs of jeans, roughly 1 lb of scrap denim is created, supporting the notion that this "waste" can be made into something useful (Motavalli, 1999). The manager's recycling program was able to take the unused scraps and made them into card stock paper.

Another recycling initiative is from a non-profit organization called "Cotton. From Blue to Green." This organization was first created in 2006 as a grassroots student campaign to collect old jeans and unused denim to be transformed into building insulation. In 2006, they transported 1,000 lb bales to JBM Fibers, which was preprocessed and then sent to Banded Logic, Inc. where it was manufactured into *Ultratouch* denim insulation. In the spring of 2007, this insulation was used in 12 homes out of the 30 created by Habitat for Humanity for the victims of hurricane Katrina. By May 2008, it had been used in 75 homes for Habitat for Humanity projects and by 2009, *Ultratouch* denim was used in 540 homes in all areas across the country affected by natural disasters preventing 200 tons of denim from being thrown away in landfills (Cotton. From Blue to Green, 2010). This insulation contains no formaldehyde or chemical irritants and performs better than traditional fiber insulations.

In a study done by Dennis Wambuguh in 2008, he found their existed a simple method of recycling indigo dye waste from effluent though absorption with palygorskite clay and subsequent conversion into "maya blue," an inorganic-organic hybrid pigment used in the paint and coating industry (Wambuguh, 2008). He determined that roughly 1/5 of indigo dye does not fix on the fabric and is sent into the effluent stream. By filtering effluent through this specific clay, native to Mesoamerica and used by the Mayans in conjunction with indigo for painting onto their pottery, he found that it could be an effective means of recycling the dye.

Unfortunately, many times the denim scraps from factories in developing worlds end up going to nearby municipal landfills. Many times these landfills present serious environmental

hazards, with respect to the chemicals that end up getting dumped in landfills, like sodium hydroxide, or the carcinogens released from incinerating the waste. However there are also significant social impacts from the typically unregulated disposal of textile scraps. One case in particular that received widespread media attention back in August of 2009 revolved around the people residing in the city of Lesotho in Southern Africa. In this city, there is a factory producing jeans and t-shirts for GAP. The Taiwanese suppliers Nie Hsing and Formosa Textile had been dumping tons of their garment refuse in a dump by a nearby community. It was common practice for the workers dumping the garbage to set fire to it, plaguing the lungs of the locals with many cases of respiratory and eye problems. The chemicals they were dumping their included sodium hydroxide, which can cause serious chemical burns and rashes.

These impacts have a direct effect on the environment, but they also directly impact social structure and political aspects. Levi Strauss & Co. has taken steps regulate their product to better the environment and socio-political aspects.

Levi Strauss & Co. markets their products in over 110 countries and produces in over 50. This bears the company with a large responsibility of abiding by many trade regulations, governments and cultures of different countries. Levi Strauss & Co. have a history of exercising their corporate power to promote better regulations for trade, fairer conditions for workers, more environmentally sustainable practices in the company's operations, as well as promoting the awareness of HIV/AIDS. Levi Strauss & Co. focuses their practices of corporate social responsibility (CSR) on the four dimensions of trade, workers rights, environment, and HIV/AIDS ("Public policy," 2010). If Levi Strauss & Co. wishes to be considered a sustainable business, they must live up to a high standard due to their globally dominating business size. The hope of Levi Strauss & Co. being considered a sustainable business partly lies in their ability to engage in practices of CSR that have goals consistent with the aims of sustainability.

Hilary Krane, the company's former Senior Vice President, gave insight to the company's CSR practices by saying:

> Any successful corporate social responsibility (CSR) campaign has to be embedded in the business throughout the organization. For CSR to be most effective, an organization should take its CSR objectives and fundamentally build them into strategic planning so that everyone considers business decisions through the lens of corporate social responsibility. (Krane, n.d.)

An example illustrating the company's dedication to be socially responsible would be in 1991 when Levis discontinued their annual funding of $40,000-80,000 to the Boy Scouts of

America for barring homosexuals from joining, a policy that was said by Levis to be against the company's core principles (Wulfson, 2001).

The tools used by the company for implementing CSR practices include setting performance objectives that involve citizenship objectives. Research is needed by whoever is qualified to effectively collect information on development in communities around the world. Reporting their goals and providing transparency on the company's CSR goals is a tool used by the company. Krane also noted that the hardest tool to implement CSR with is metrics because different measurements are taken from company to company and it is important to find common ground for businesses to come together and collaborate on (Krane, n.d.).

In terms of Levis public policy goals on trade, they claim to be "the first and only major multinational company to publicly advocate for linkage of trade and labor, incorporating key workplace standards and workers rights provisions with the context of trade agreements". Examples of Levis public policy activities in terms of trade include the founding of Europe's first branded apparel industry trade association, serving as a member on the U.S. governments international trade advisory committee, as well as asking the Asia-Pacific Economic Cooperation (APEC) to provide more transparency when governing trade program rules and regulations ("Public policy," 2010). David Love, the Senior Vice President and Chief Supply Chain Officer gave a testimony to the Committee of Ways and Means (tax-writing committee in the House of Representatives) during a hearing about the "operation, impact and future of the U.S. trade preference programs." Love said in his testimony:

> As a socially responsible company, upholding labor standards is a key aspect of these preference programs. We need to make sure that we provide trade preferences to those least developing countries that not only need a leg up but are committed to improving respect for workers rights. (Love, n.d.)

Love's testimony reflected the company's status as a socially responsible company, which is key to a business that seeks to engage in sustainable corporate practices.

Levis also advocates for the inclusion of workers rights provisions and enforcement measures in all trade agreements. Levis belongs to multiple international labor organizations and partnerships such as Multi-Fiber Arrangement Forum, Better Factories Cambodia, and Better Work. The company also conducts case studies on labor issues in order to resolve them. These case studies include addressing child labor in Bangladesh and supporting freedom of association for workers in Haiti whom tried to form a union ("Public policy," 2010). Levis has also pulled

their cotton sourcing business out of Uzbekistan until the country strengthened its child labor laws despite the fact that cotton is the company's core raw commodity (Tan, 2009).

Levis has a commitment to the environment to be active on company policies on climate change, water scarcity and availability, and renewable energy tax incentives. Levis engagement on climate change policy includes the companies campaign against the California ballot initiative to overturn California's Global Warming Solutions Act of 2006 and their joining with Oxfam America Sisters on the Planet to argue for U.S. government funding to build great resilience to the effects of climate change in developing nations ("Public policy," 2010). Hilary Krane delivered a testimony in October of 2009 that called on funding support for climate adaption. The testimony called on the Senate to ensure that comprehensive climate change legislation dedicate at least 3% of allowances to support community efforts to build resilience to climate change in developing nations. Krane pointed out that cotton, the company's core raw commodity, is affected by climate change as well as the 40 million worldwide cotton farmers. Krane also recognized the point that much of the company's manufacturing supply chain is located in developing countries that are affected by climate change, despite the fact the countries are not responsible for the bulk of climate change (Krane, 2009).

In 2007, Levis launched the UN Global Compact CEO Water Mandate to assist companies in the development, implementation and disclosure of water sustainability and practices. In 2008, Levis, among other California-based companies, advocated for the renewal of tax incentives for renewable energy through the World Resources Institutes Green Power Group. The tax incentives were passed by Congress and signed by the President in 2008 ("Public policy," 2010).

The fourth category that Levis focuses their corporate social responsibility is HIV/AIDS awareness. The company has worked with the U.S. government to build a stronger national policy on HIV/AIDS awareness and in 2006 they launched the Clinton Global Initiative commitment to revitalize and expand employees HIV/AIDS workplace policies, education and benefits ("Public policy," 2010).

In *Business Ethics Quarterly*, Levi Strauss & Co. is said to fall into the category of businesses that have engaged in "purely ethical" practices of corporate social responsibility. A "purely ethical" activity would involve one that has no direct or indirect economic of legal implications. In 1993, Levi Strauss & Co. along with Timberland pulled their businesses out of China in protest of human-rights abuses, despite the loss of potential profits (Schwartz, & Carroll, 2003).

Levi Strauss & Co. has received recognition for their stance on public policies and practices of corporate social responsibility. In 2009 the company received the San Francisco Business Times Green Business of the Year Award for a large company. In 2000, the Council on Economic Priorities corporate social responsibility survey ranked Levis first out of 320 companies and gave them an "A" grade in for charitable giving, disclosure, family benefits, minority advancement, women's advancement and workplace issues. The company has received other awards on their work in terms of workers rights, HIV/AIDS awareness, equality and CSR/Sustainability ("Public policy," 2010).

Levi Strauss & Co. is a pioneer in the apparel industry in terms of their CSR practices. After being on of the first in their industry to implement their CSR programs, the CEO and president of the company John Anderson noted that 90% of the industry now works with Levis on their CSR programs. John Anderson also noted that there are limitations to their practices of CSR. "We do it because it's the right thing to do but its also got to make business sense," claimed Anderson in 2009 at a conference in Singapore (Tan, 2009). Despite these limitations however Levis has maintained an admirable record in terms of their CSR practices. They are a leading example for sustainable business practices in their industry and as long as they continue to responsibly work with and give back to the communities they are involved in, they will continue to grow as a sustainable business.

In order for the jean to become an environmental sustainable product policies and laws need to be passed on a global scale. This will help ensure consumers that they have received the truly sustainable product they wanted to buy. Strict policy will also help regulate the issue of companies green washing consumers. The big question of policy making surrounding the production of denim is what, in the production process, is there actually to regulate and how should this regulation be put in place. In order to answer this properly and accurately a basic knowledge of the production cycle needs to be examined. Levi's even stated that in 2006 "making one pair of 501's required almost 920 gallons of water, 400 mega joules of energy and expelled 32 kilograms of carbon dioxide" (Levi Strauss & Co., 2009).

The life cycle of a common jean brand, like that of Levi, starts with the production and harvesting of cotton. Large-scale production presents a problem with sourcing of cotton. Farmers from all over the world produce cotton, some of which will be used by Levi's to make their jeans. Policies need to be put in place to regulate the outsourcing of cotton from non-organic producers to ensure denim companies a quality product that does not use pesticides in their production process. Problems like the issue presented in the revenue distribution from

global companies like Cotton Inc. become ever so important. Organic Cotton farmers are paying these $1.50 taxes per bale and then in term receiving no financial compensation from the company. Taxation without representation is the overriding issue within the United States, but on the global scale cotton farmers worldwide need the higher industrial power to shift benefit heavy conventional cotton, to benefit heavy organic cotton (Adelson, 1997).

After the harvesting process the cotton is then transferred to fabric mills where it is spun into massive sheets of denim. Factories pose several problems for regulation. Energy use and waste management at factories could be regulated in ways, which would help the environmental issues of jean production. Another important issue in the factories is the livelihoods of the workers producing the product. The LCA of LS&Co. not only provided evidence of material sourcing, but that of labor regulations. Proper wages and benefits are needed of a global scale to ensure that factory workers and support themselves and their families.

Most companies heavily dye the fabric in order make the classic blue jean denim sold. The dyes are mixed into vats of water and once that water is contaminated it is very hard to remove the dye from the water. This water is now essentially waste waster and cannot be reused. If taxes were put in place based on volume of wastewater production it would put stress on companies to find alternative sustainable methods of dying.

Going back to the harvesting process of cotton, companies should look into developing a genetically modified strand of cotton that has an artificially implanted blue color to the cotton (Ajootian, 2004). Since cotton has natural colors other than the most commonly know white color companies could even use a grey color as a base. Using grey as the base color would allow for less dying and possibly creating a new more ‘hip’ jean wash.

> Levi Strauss & Co. has been a leading partner to NRDC’s Responsible Sourcing Initiative in China and Bangladesh. By working together we will improve sustainability and energy efficiency throughout fabric mills and dye houses. (Linda Greer, Director of Environment & Health Programs, Natural Resources Defense Council)

According to Greer, Levi Strauss is already making efforts to reduce their environmental impact in countries where they have factories. Having memberships to BSR (Businesses for Social Responsibly) allow a company to develop business strategies incorporating the planet and earth as the center point, not just the place upon which the production is done. They strive to create, as their webpage says “tangible results for your business.”

As for consumers trying to shift towards a more sustainable denim product, they will have to look for alternatives. Companies like The Hempest in Burlington, Vermont sells products made of 100% organic hemp (The Hempest, 2010). Uninformed consumers have a common myth embedded in their minds that organic and all natural products are great for the environment, but the price tag is always more. This myth does not hold true in regards to the denim industry. It heavily relies on the branding that goes along with the product. Organic designer brands like that of Nudie offer $179 dollars jeans to their possible consumers, $100 dollars less than some offered by their traditional competitors like True Religion, Citizens of Humanity and Diesel. Another approach to ensure the consumer a quality product would be research. Laws need to be set in place to have large-scale denim companies to put their sustainability practices on their webpage. Sourcing all their factories, cotton farmers, dying houses and other plants involved in the production process would create a open door policy towards company practice. Green washing is a big issue that companies have to try to avoid while still trying to promote a greener product. Companies can use the theoretical wall of information containment to bring customers what they want to hear with green advertisements and marketing options, but then not change anything in their business practice. Providing a material source list will ensure consumers that a company who claims they are green and eco-friendly, because they have alternative energy powered factories, are actually telling the truth from first hand evidence.

The last issue and recommendations based of the preliminary sustainability assessment is jean care. Jean care is what the consumer does with the product after purchase, and how they dispose of the product once they feel that they no longer need the jean. A GE energy efficient front load washer uses about 60hz of power and around 40 gallons of water per load. Essentially washing your jeans, averaging 1 was per week for 1 calendar year will use 2080 gallons of water and 3120hz of power. The easiest thing to do when caring for your jeans is to wash them as little as possible. As far as end of cycle there are many options. If they just don't fit, give them to someone else or donate them to Goodwill. If they have a huge hole, patch it up. If they were a designer jean and they just don't fit right anyone, use them as a gardener's jean of housework jean. The last thing you want to do is throw them away. So much energy has been put into the production of the product, do you best to consume less and reuse more.

Appendix:

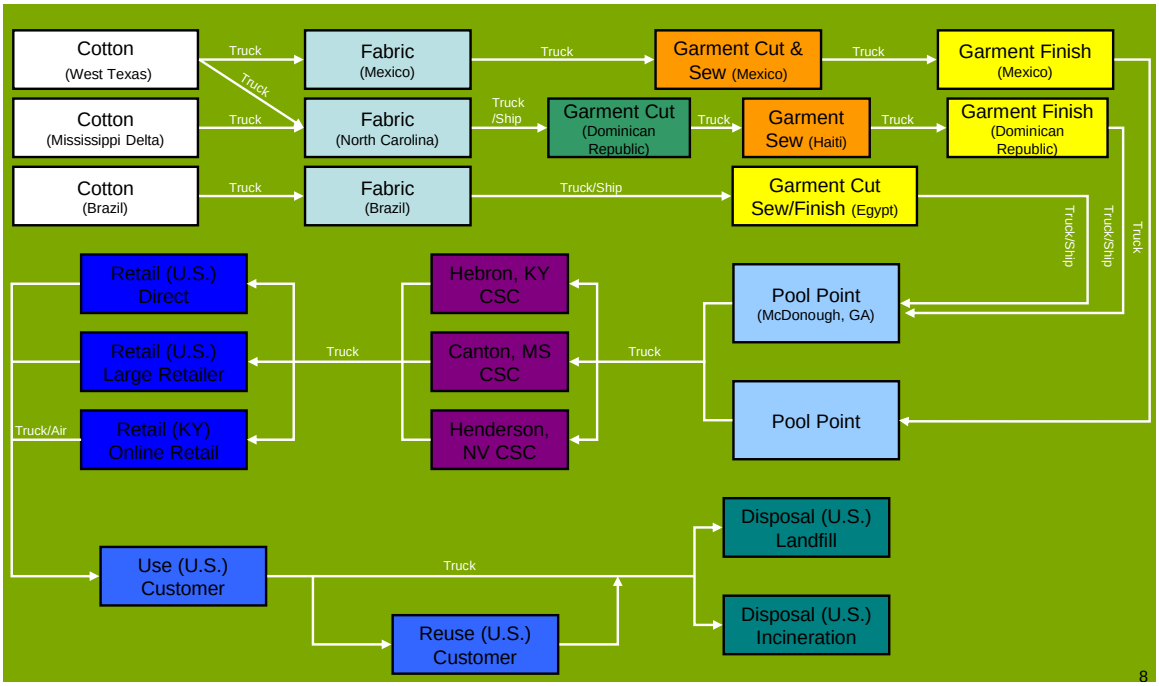

Figure 1: Transportation between individual steps in the lifecycle of Levi 501 medium stonewashed jeans. Taken from Levi Strauss and Co. Product Lifecycle Assessment portable document file from their website http://www.levistrauss.com/

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