Contribution of Agri-Food Supply Chain in Depleting Forest Covers

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Deforestation is one of the side-products of our success in technology. Deforestation refers to a permanent removal of forest covers to establish businesses of any kind, ranging from, agri-food business to automotive. Even establishment of growing civilizations were done by removing some of the forest cover. According to the United Nation's Food and Agriculture Organization (FAO, 2016) earth on an average is losing 18 million acres of forest each year (https://www.livescience.com/27692-deforestation.html) and more than 70% of the loss of forest cover is due to farm and commercial agriculture. This major depletion of forest cover each year will contribute to greenhouse gas (GHG) emissions. We as a civilization has used up lands since ages and now is the time when nature is on the verge of giving up on us if we don't intend to replenish it back.

We need to make our supply chain systems deforestation free, it may not sound practical for food business operators but is possible. Recently, Nestle' confirmed that it purchased 12 commodities from suppliers contributing towards deforestation but as of March 2019 these 12 commodity suppliers are verified as 77% deforestation free. Nestle' aims to achieve a target of 100% deforestation free by 2020. Such a verification is achieved by Nestle' through incorporating traceability in their supply chain network. Use of satellite monitoring system to track source of commodities is the strategy adopted by Nestle' in association with Air Bus.

Traceability is the ability to trace or track movement of a raw material/ingredient through a specified supply chain. The traceability objective fulfilled by this approach is supply chain sustainability and check on GHG emissions. Given below is the breakdown of how traceability can be used in detecting deforestation levels:

1. **Identify:** Use of traceability tools such as GIS (estimating the locational coordinates for latitude, longitude) to locate where actually the supply chain participant has established its plant.
2. **Assess:** Check the prior land data for any signs of previous forest cover in the last 20 years.
3. **Confirm:** Use "satellite monitoring systems" that uses imagery and algorithms to identify any previous deforestation events. The satellite monitoring systems are so built that it can also identify the causes of the deforestation.

According to the report by FAO, 2016 the major contributors to deforestation are increased demand for agricultural commodities such as palm oil, soy, beef cattle, wood products, cocoa, sugar, and rubber. The demand for these products is going to increase in times to come and we need to sustainably think of methods to feed these growing demands for these products. The supply chain in its entirety should work together towards protecting forest covers along with producing ample amounts of food to feed. We should tap into the rework or recycling market and devise ways to recover the "food gone bad" segment. Given below are the ways through which we can save our forest covers:

1. Reworking the waste products
2. Using lean six sigma to minimize waste in the food supply chain, given below is an example of minimizing waste in the grain supply chain using lean management principles:

Use of such a system fulfills both the objective of food safety, quality and waste management. It can identify the source of waste and prevent them from occurring.

3. Agricultural intensification, increasing yield per unit of inputs used. The inputs can be labor, land resources, fertilizer, seed, and cash inflow. For agricultural intensification pointers that need to be taken care are:

   a. Manage horse power i.e. evaluate total energy consumption and maximize the output.

   b. Use farming techniques such as crop rotation.

   c. Improve land drainage and grazing systems.

Supply chain participant	Farmer (harvests wheat grain)	Wheat elevator (stores and handles harvested wheat)	Flour mill (processes wheat kernel into flour)	Consumer(s) (Cookie dough industries, restaurants, house-holds)
1. Define objective/ value	To harvest clean and healthy grain	To preserve grain Meet quality standards such as protein content, moisture content, and pest free grain	Produce clean and safe flour Meet specific particle size for different consumers	Use of clean and safe flour Define desired particle size
2. Value stream	Harvesting	Storage and handling	Internal processing operations	Internal and external operations
3. Flow	Progressive movement of activities through which a raw material progresses to become final product.			
4. Pull	Ovoid over-production of flour. Products made ahead of time contributes to waste as the finished products take up inventory space, capital for investments, and unneeded labor costs from overproduction.			
5. Perfection		Document movement of grain, storage conditions, create unique identification for bins storing grains	Equipment maintenance and internal auditing to improve processes	Documentation of: All consumers All carrier units

The ways to control GHG emissions through bio-fuels is indirectly contributing to some extent to the GHG emissions as they also contribute in depletion of some forest covers. The approach is to follow a balance matrix which is sustainable ecologically, socially, and economically.

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