

# **Supply Chain Social and Environmental Impacts: Measurement, Reduction and Disclosure**

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Firms are beginning to measure the social and environmental impacts associated with their products and (in a few cases) report those impacts to investors and consumers. Measurement is difficult and costly because many social and environmental impacts occur upstream in the supply chain. However, measurement enables a firm to reduce those impacts. Investors assign a higher valuation to a firm with relatively low expected social and environmental impacts, because future policy or negative publicity may cause the firm to bear costs associated with those impacts.

Supply chain strategy and structure (e.g., commitment to a supplier vs. flexibility to choose among many candidate suppliers; sharing a common supplier with another buyer) influence a firm's costs and benefits from impact measurement, reduction and disclosure.

Policy makers are debating whether or not to require firms to disclose what they learn about their products' social and environmental impacts.

Our research addresses the following questions:

- Under what conditions should a firm invest in learning about its supply chain social and environmental impacts? To what extent should the firm reduce those impacts, and how? In particular, should the firm search for a low-impact supplier or commit to help an existing supplier with impact reduction?
- How do those decisions change under a government mandate that the firm disclose whatever it learns about social and environmental impacts? Thus, how does the mandate affect impacts, firm expected profit, and the firm's valuation by investors?
- How do those decisions change because a manager is concerned with increasing the firm's market valuation in the short term, as opposed to maximizing the firm's expected profit? What are the implications for impacts, firm expected profit, and policy?
- How do consumers respond to information about the social and environmental impacts of a product? In particular, does *voluntary* disclosure of impacts increase

consumers' trust in the firm, and hence consumers' willingness-to-buy? Does consumers' willingness-to-buy increase when the consumers also learn about how the firm is helping suppliers to reduce their impacts? What are the implications of the consumer response for managers and policy makers?

In our model, the manager of a firm has uncertainty regarding the magnitude of the supply chain social and environmental impacts, and also has uncertainty about the cost of reducing those impacts. The manager may choose to incur a "learning cost" to resolve that uncertainty. The learning cost is lower if the manager *commits* the firm to help a supplier learn about and reduce its impacts. In comparison, the learning cost is higher under a "*supplier switching*" strategy (naturally, a supplier may attempt to hide its impacts, lest the firm switch to a lower-impact supplier). The learning cost is known to the manager, but not to its customers or investors. Investors have a prior distribution for the learning cost, magnitude of impacts, and impact reduction cost.

The manager of the firm seeks to maximize a weighted average of the long-term expected profit and short-term valuation of the firm by investors. Investors update that valuation in a Bayesian fashion, based on whether or not and what the firm discloses regarding impacts. In the base case with voluntary disclosure, a firm decides whether or not to disclose what it learned about the magnitude of social or environmental impact. Under mandatory disclosure, the firm must do so.

## **Analytic Results**

Analytic results address the questions in the first three bullet points, above. Let us highlight a few of the insights.

If the firm has flexibility to switch suppliers, a government mandate for disclosure is irrelevant. The rationale is that if the firm learns, the firm selects a supplier with low impact, and therefore voluntarily discloses the impact (to increase investor's valuation of the firm).

In contrast, under specified conditions that motivate commitment to a supplier (as opposed to switching), a mandate for disclosure deters a manager from learning. Specifically, the manager incurs the cost to learn if and only if the cost is below a threshold; the mandate reduces that threshold. The rationale is that disclosing a high

impact reduces investors' valuation of the firm. Without the mandate for disclosure, the manager can choose not to disclose impacts after learning that the impacts (and cost of reducing those impacts) are high, and this favors learning.

Thus, a mandate for disclosure can result in strictly higher impacts. We characterize parametric conditions under it does so.

The manager is always (at least weakly) better off with a government mandate for disclosure. With a supplier-switching strategy, the manager is indifferent. Otherwise, the mandate strictly increases investors' valuation of a firm that does not disclose supply chain impact information, because investors can infer that the firm did not learn (whereas without the mandate, the firm might have learned and not disclosed a high impact). The mandate motivates the manager to spend less on learning, which also makes the manager better off. Thus, a disclosure-mandate expands the parameter region in which a manager optimally commits to a supplier, rather than pursue a supplier-switching strategy.

Finally, suppose that two firms have a supplier in common. Under mandatory disclosure, this causes each firm to invest less in learning about and reducing the supplier's impacts (a free-riding problem). In contrast, with voluntary disclosure, sharing a supplier can increase learning. The rationale is that if both firms do not disclose impact information, investors interpret this a stronger signal that impacts are high, and lower the valuation of each firm (to greater extent than if each firm had a separate supply chain). This provides greater motivation for managers to learn, reduce, and disclose impacts.

### **Experiments to Evaluate Consumer Response**

To address the questions in the last bullet point above, we are conducting experiments in which people respond to a hypothetical purchasing scenario. The experiments are ongoing, but significant initial results suggest intriguing implications for managers and policy makers. The experiments will be completed before the MSOM conference.