



MIT SCALE RESEARCH REPORT

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The Global SCALE Network allows faculty, researchers, students, and affiliated companies from all six centers around the world to pool their expertise and collaborate on projects that will create supply chain and logistics innovations with global applications.

This reprint is intended to communicate research results of innovative supply chain research completed by faculty, researchers, and students of the Global SCALE Network, thereby contributing to the greater public knowledge about supply chains.

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Elements, Feasibility and Coordination Mechanisms of IP Soybean Supply Chains

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Elements, Feasibility and Coordination Mechanisms of IP Soybean Supply Chains

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EXECUTIVE SUMMARY

As global incomes rise, consumers demand a wider variety of nutritious and tasty foods. Higher-fiber bread, lower fat cooking oils, and juicier tomatoes are just the tip of the iceberg. Genetic modification in agriculture has sped up the development of beneficial traits in staple crops, such as high oleic oil corn and herbicide resistant soybeans. These two forces increase the number of specialty crops produced each year.

Current agricultural supply chains are unfit to handle specialty crops because they lack segregated material channels. Traditionally, staple crops have been commodities, segregated into broad grades and aggregated down the supply chain in massive scale. If lumped in with commodity crops during handling, transportation or storage, specialty crops lose their market premium.

Clearly, the rising trend and the industry structure are at odds. The solutions are identity preservation systems that segregate specialty crops throughout the supply chain. To better understand the requirements and economics of identity preservation systems, this thesis explores the elements, economic feasibility and coordination mechanisms of non-genetically modified soybean supply chains as one example of an identity-preserved supply chain.

Identity-preserved, non-genetically modified soybean supply chains have many possible structures that represent different linkages between seed producers, farmers, grain elevators, soybean processors and food or feed manufacturers. Independent of structure, the main differences between identity-preserved and commodity soybean supply chains are in the material and information flows.

- **Separate but parallel material flows:** Although genetically modified and non-genetically modified soybeans are processed the same way, non-genetically modified soybeans require clean handling and separate storage and transportation to maintain their market premium. This implies added handling, logistics and capacity utilization costs.
- **More detailed information flows:** Fast, accurate information flows are critical in non-genetically modified soybean supply chains because each party in the supply chain requires identity reporting and verification at points of inbound and outbound logistics to maintain the market premium. This implies added testing costs.

A non-genetically modified soybean supply chain sourcing from the United States and selling to Japan is economically feasible. An economic analysis of the non-genetically modified soybean supply chain compares the market premium for non-genetically modified soybeans to the reported costs of identity preservation at various levels of a soybean supply chain. The value remaining in the supply chain after the costs are subtracted from the premium is \$6.29 per metric ton of whole, non-genetically modified soybeans. This premium is shared between seed producers, farmers and grain elevators such that each party is made better off by the introduction of the identity-preservation system and the coordinating party covers its contracting costs.

Appropriate coordination mechanisms of identity-preserved supply chains are highlighted by the case of Warburton's wheat. Warburton's wrote contracts with Canadian grain elevators to source stated volumes of premium wheat for a new line of premium bread. The grain elevators contracted farmers to source the wheat, but on Warburton's terms of seed quality, handling and reporting. After three years, channel volumes were increasing due to the success of the program. From this case, we see that identity-preserved supply chains are:

- **Coordinated with contracts:** Contracts reduce the risk of a holdup at each progressive stage of the supply chain and transmit requirements and expectations across party boundaries.
- **Managed by a single party:** A single coordinator reduces contracting costs and maintains supply chain cohesion.

This work lays the foundation for further research into the feasibility and implementation of an identity preserved soybean supply chain.

