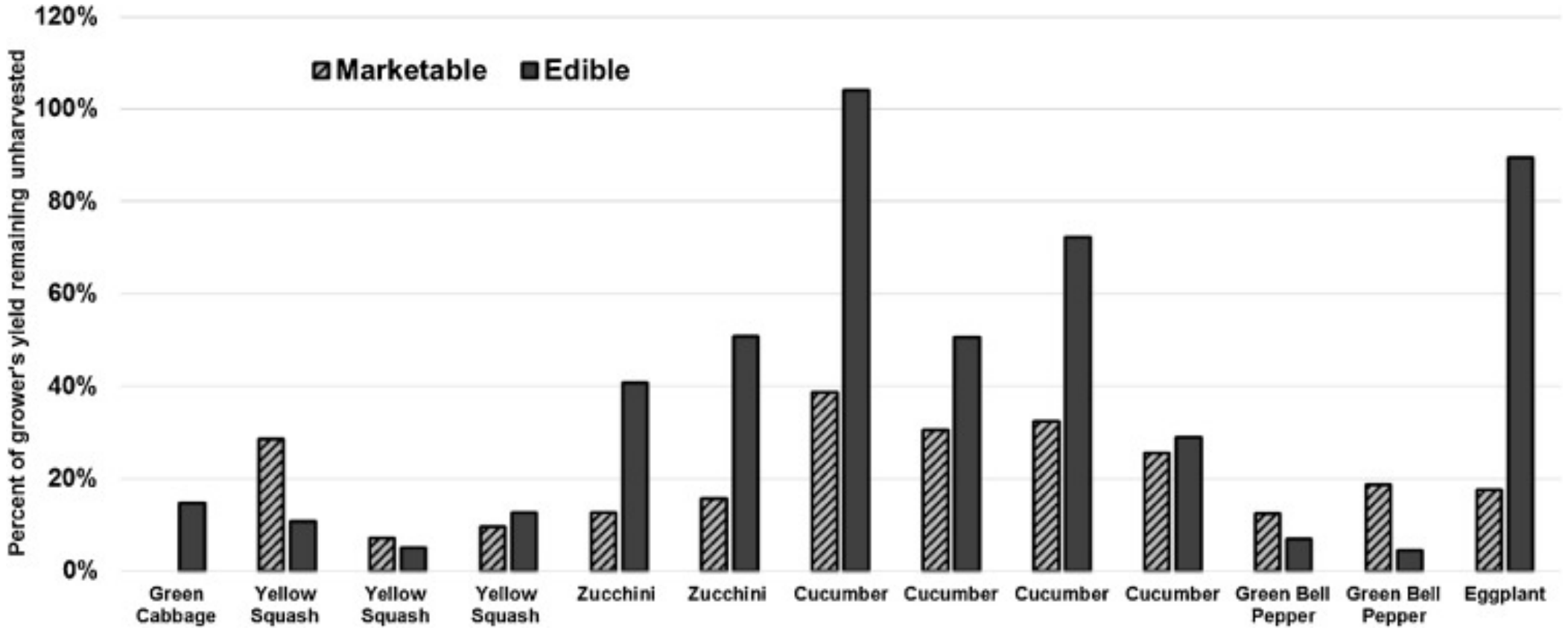
Innovations to Mitigate Food Loss and Waste: From the Farmer to the Consumer

Norbert Wilson

Tufts University

Food Loss and Waste (FLW)

- Estimated FLW is between 30-50% of food produced (Buzby, Wells, Hynman, 2014, Gunders et al. 2012, Minor et al. 2019, Muth et al. 2019, inter alia).
- This amount is in the range of 39-79 million metric tons (Muth et al. 2019, and multiple sources).
- Product specifications leads to $277 mill of diverted produce (ReFED 2016).
- FLW occurs along the entire supply chain.



Johnson, et al. 2018

Table 5
Loss Estimates for Walk-by Fields, Harvested Fields, and Total Plantings.

Crop	Walk-By Field Losses (% of Planted Area)	Full-season Loss for Harvested Fields (% of marketed yield)[a]	Total Crop Losses Including Walk-by and Harvested Fields (% of marketed yield)
Artichokes, annual	0.0	8.5	8.5
Artichokes, perennial	0.0	4.7	4.7
Broccoli	3.0	15.9	18.9
Brussels sprouts	0.0	13.2	13.2
Bunch spinach	2.6	20.9	23.5
Cabbage	4.0	51.6	55.6
Cantaloupe, LSL	1.0	9.7	10.7
Cantaloupe, WS	0.0	14.2	14.2
Cauliflower	2.0	34.1	36.1
Celery	1.8	30.3	32.1
Green beans	12.5	21.4	33.9
Green leaf lettuce	3.5	43.3	46.8
Iceberg lettuce	2.0	22.6	24.6
Kale	0.0	38.6	38.6
Napa cabbage	3.3	42.0	45.3
Romaine hearts	2.9	113.6	116.5
Romaine lettuce	3.1	39.5	42.6
Roma tomatoes	1.3	8.2	9.5
Round tomatoes	1.3	6.4	7.7
Strawberries	0.0	43.8	43.8
Sweet corn	4.0	4.5	8.5
Watermelon	1.0	56.7	57.7
Surveyed crops (Mean)	2.4	31.3	33.7

[a] Loss as a percentage of marketed yield was calculated by dividing the average kg/ha remaining by the reported marketed yields per hectare from county crop reports (except for green beans for which grower estimates were used). To calculate the mean crop losses (walk-by, full-season, and total), the mean loss percents for the two variety types for artichokes and cantaloupes were used.

Baker, et al 2019

U.S. Food Supply Chain

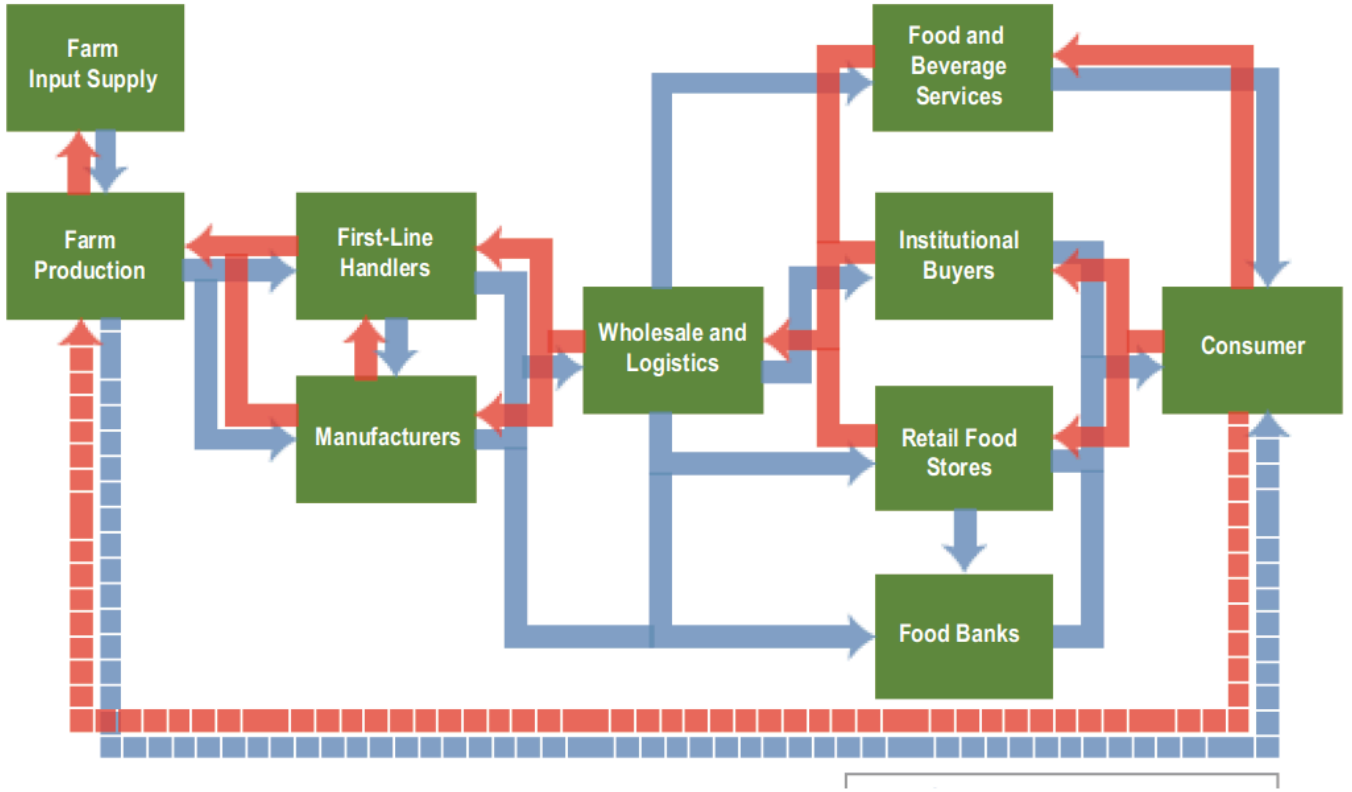
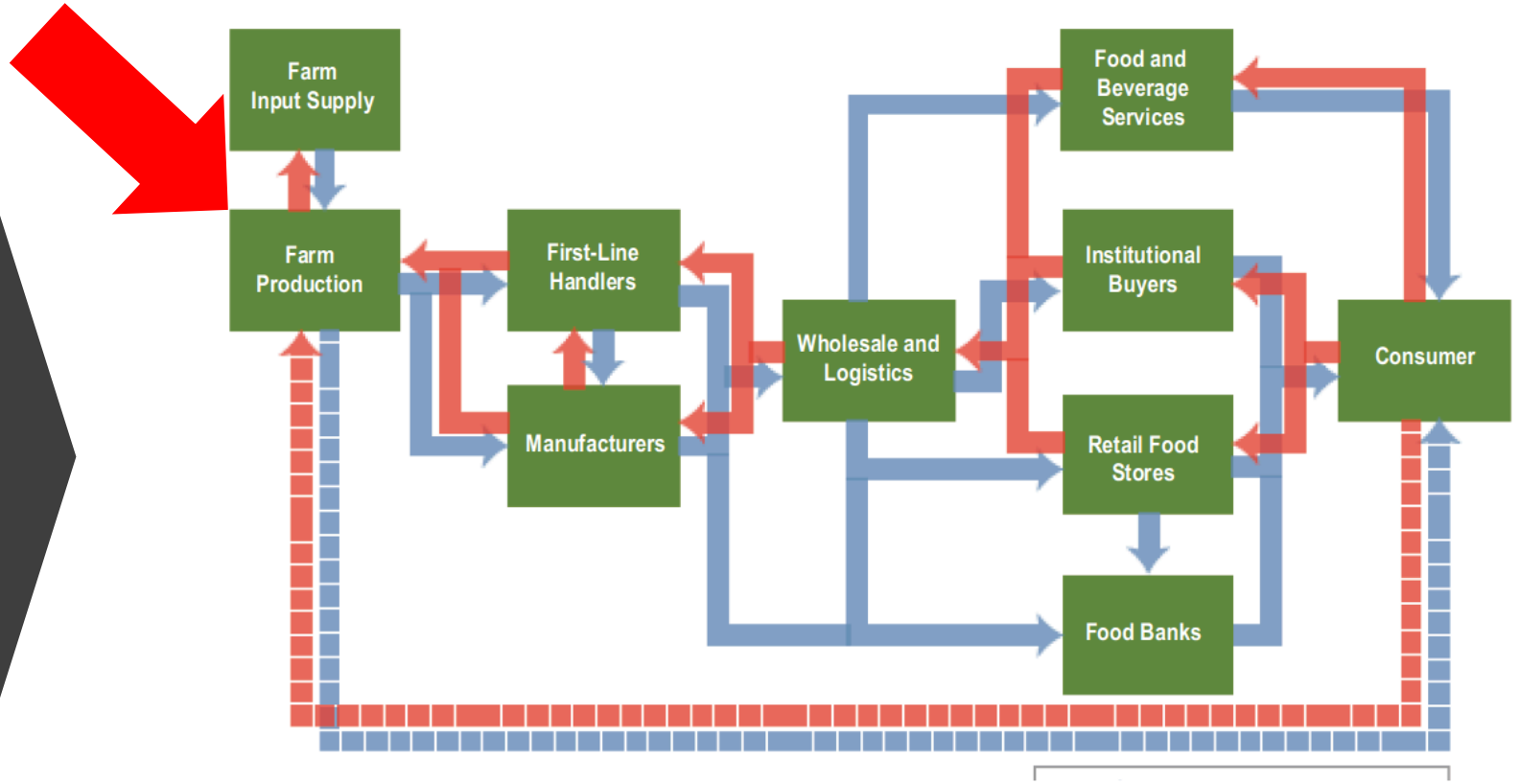


FIGURE S-1 Conceptual model of a food supply chain. Elements or actors in this supply chain in one area (e.g., region or country) also have interactions (e.g., international trade) with actors in other areas.

IOM (Institute of Medicine) and NRC (National Research Council) (2015)

Farm Production



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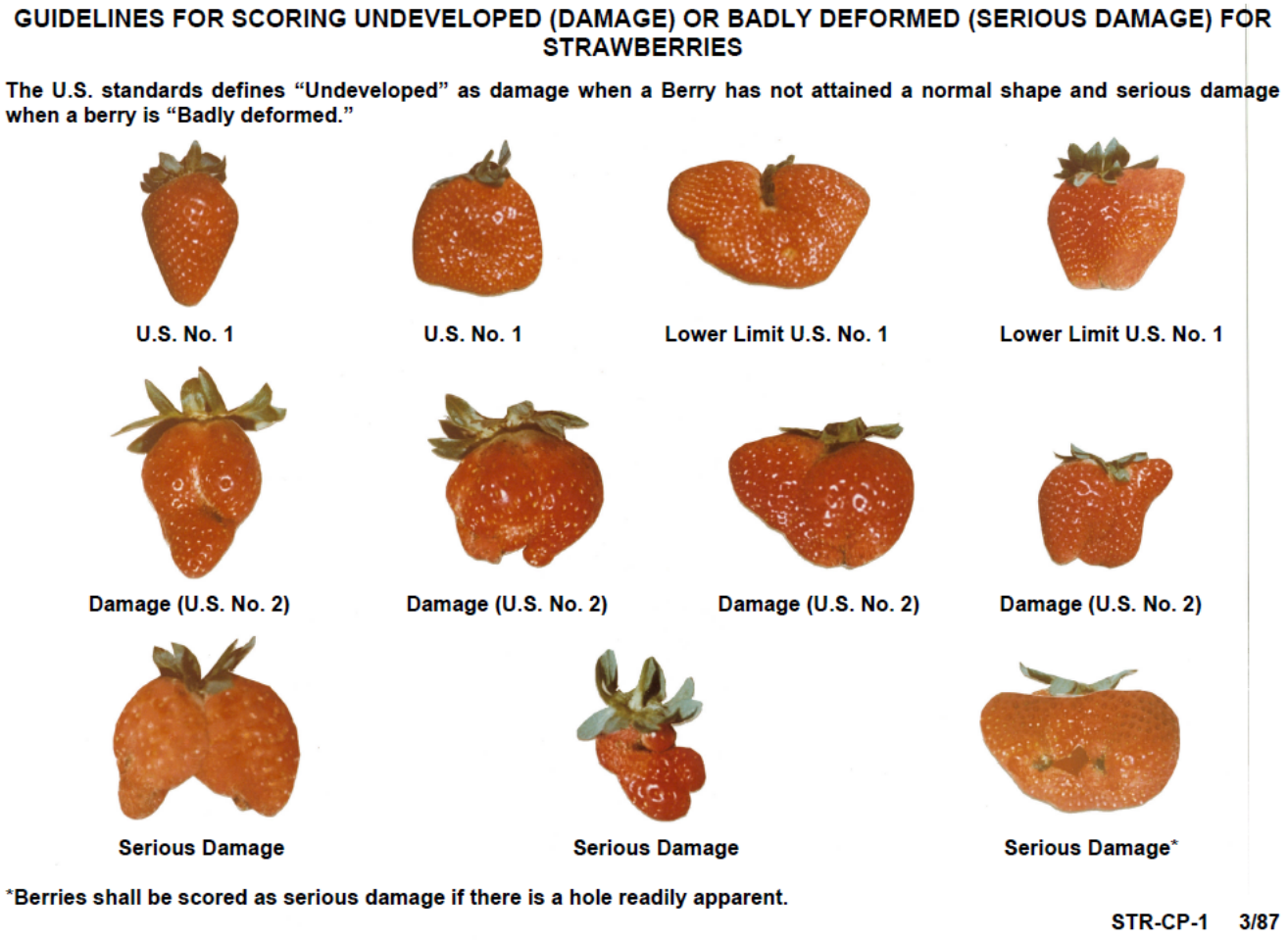
Market Conditions



GUIDELINES FOR SCORING UNDEVELOPED (DAMAGE) OR BADLY DEFORMED (SERIOUS DAMAGE) FOR STRAWBERRIES

The U.S. standards defines "Undeveloped" as damage when a Berry has not attained a normal shape and serious damage when a berry is "Badly deformed."

***Berries shall be scored as serious damage if there is a hole readily apparent.**

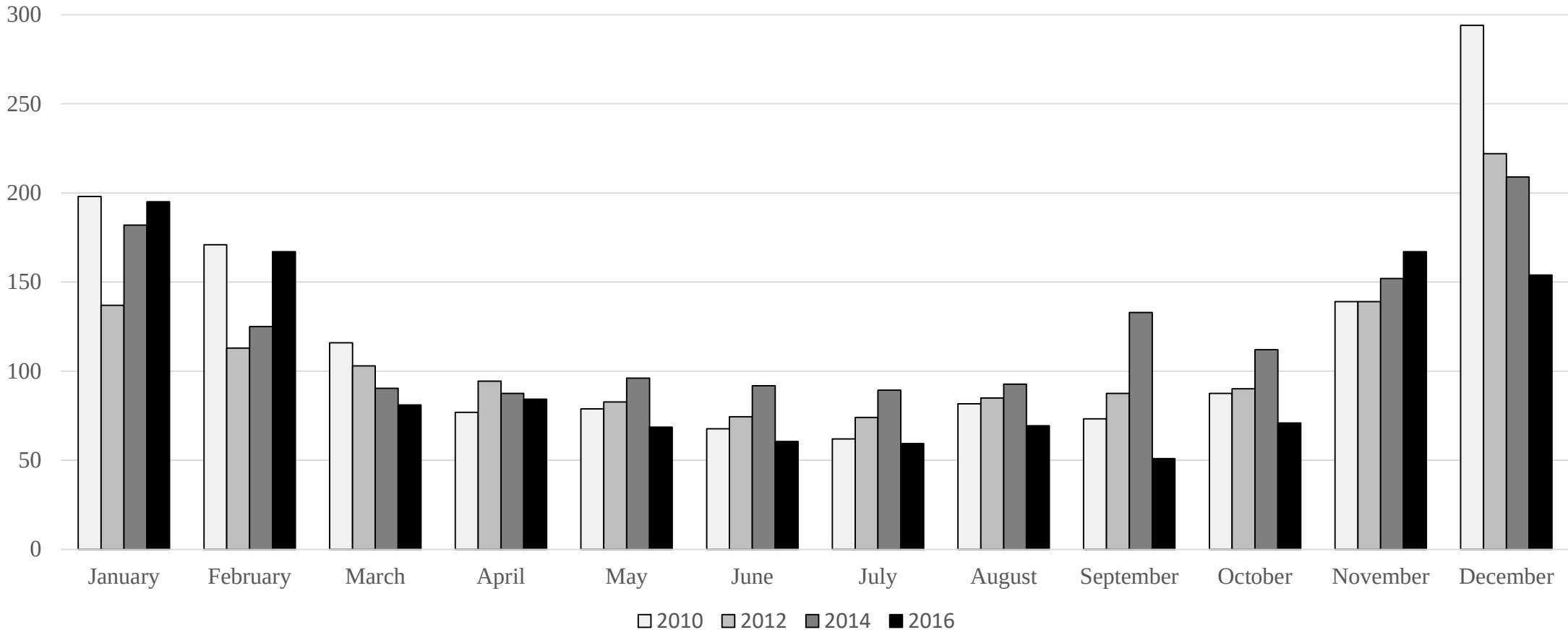
STR-CP-1 3/87

USDA Agricultural Marketing Service (2017)

Strawberry Case Study

- Strawberries are grown throughout the U.S.
- California produced >91% of total production in U.S.
- Upon maturity, growers make repeated decisions to harvest based on
  - Fruit maturity,
  - Quality,
  - Price, and
  - Labor availability (Hsu-Flanders, Gallagher, and Wilson, Forthcoming)

Monthly Prices Received by Growers of Fresh Strawberries for Selected Years



Hsu-Flanders, Gallagher, and Wilson (Forthcoming) and California Strawberry Commission, n.d.

Improved Varieties

- Hardier varieties
- Facilitate shipping
- Better timing (Ellison et al. Forthcoming)

Controlled Environments

- Examples
  - Low and high tunnels
  - Hydroponics and vertical farming.
- Can manage growing conditions and pests (Ellison et al. Forthcoming).
- Are small for strawberries $1million(2014) out of $3.5 billion (2017) (USDA NASS 2015).

Gleaning

- Gleaning is “an ancient tradition, a key part of the agricultural poor laws of the Bible” (Vitello et al 2015).
- The National Gleaning Project lists 282 groups in 45 states.
- Society of St. Andrew recovered 28.5 million lb. from 916 produce providers (St. St. Andrew Impact Report 2017).

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Food waste in the sharing economy

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ABSTRACT

Wasting food is one of the rare problems that affects our ability to achieve economic goals in terms of food security, environmental sustainability, and farm-financial security. Most of the ideas proposed to this point involve either behavioral nudges or administrative regulations that are either too paternalistic or piecemeal to represent viable solutions. In this study, we investigate the potential for commercial peer-to-peer mutualization systems (CPMSs), or sharing-economy firms, to emerge as market platforms for the exchange of surplus food. If a system of CPMSs is able to develop in a self-sustaining way, then the market prices they create will generate sufficient incentives for all actors to manage surplus food more efficiently. We develop an empirical model of a

HEALTH

The Murky Ethics of the Ugly-Produce Business

America's wonkiest fruits and vegetables have ignited a food war.

AMANDA MULL JAN 25, 2019

The middle strawberry is probably just as sweet. (JENNIFER A. SMITH / GETTY)

Do you know what baby carrots actually are?

For me, the baby-carrot jig was up a couple years ago. I'm not sure what I'd

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Logistics

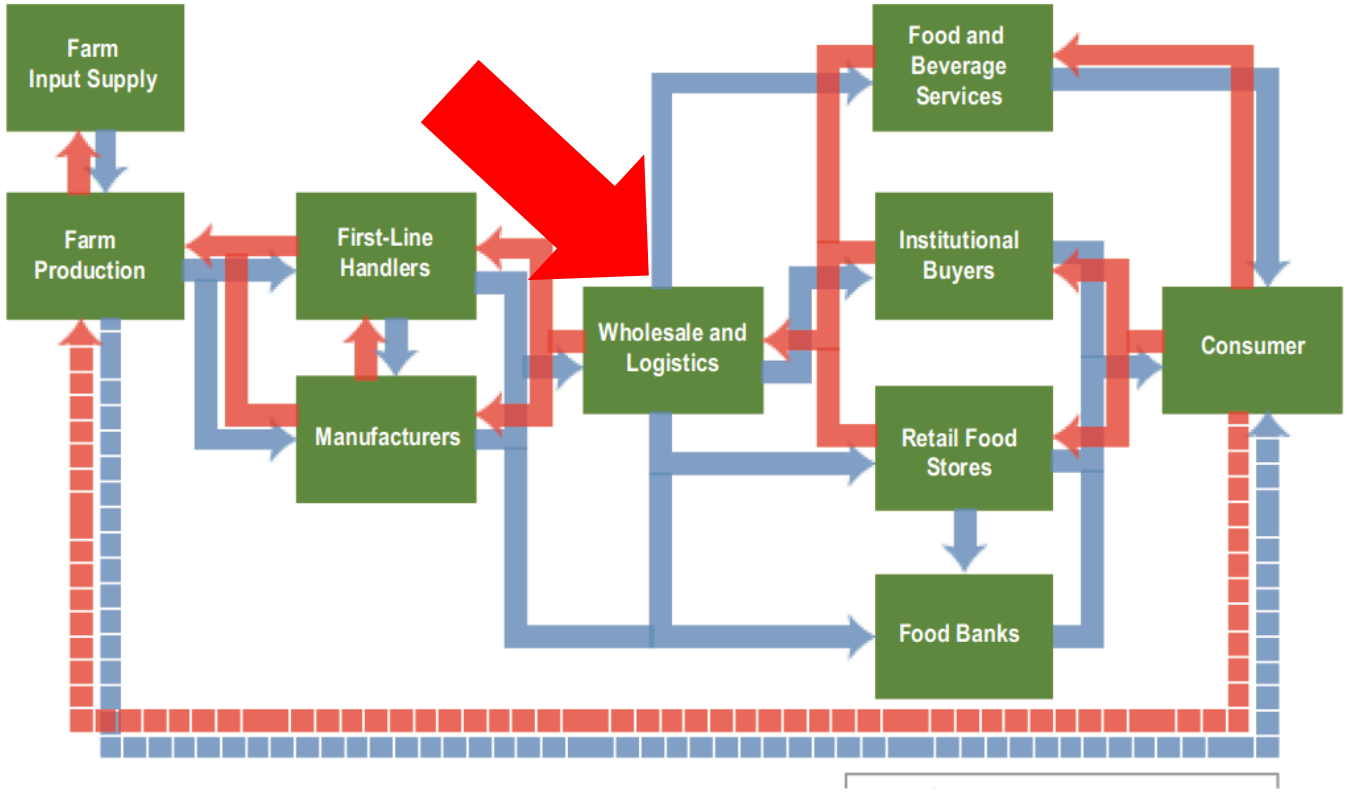


FIGURE S-1 Conceptual model of a food supply chain. Elements or actors in this supply chain in one area (e.g., region or country) also have interactions (e.g., international trade) with actors in other areas.

IOM (Institute of Medicine) and NRC (National Research Council) (2015)

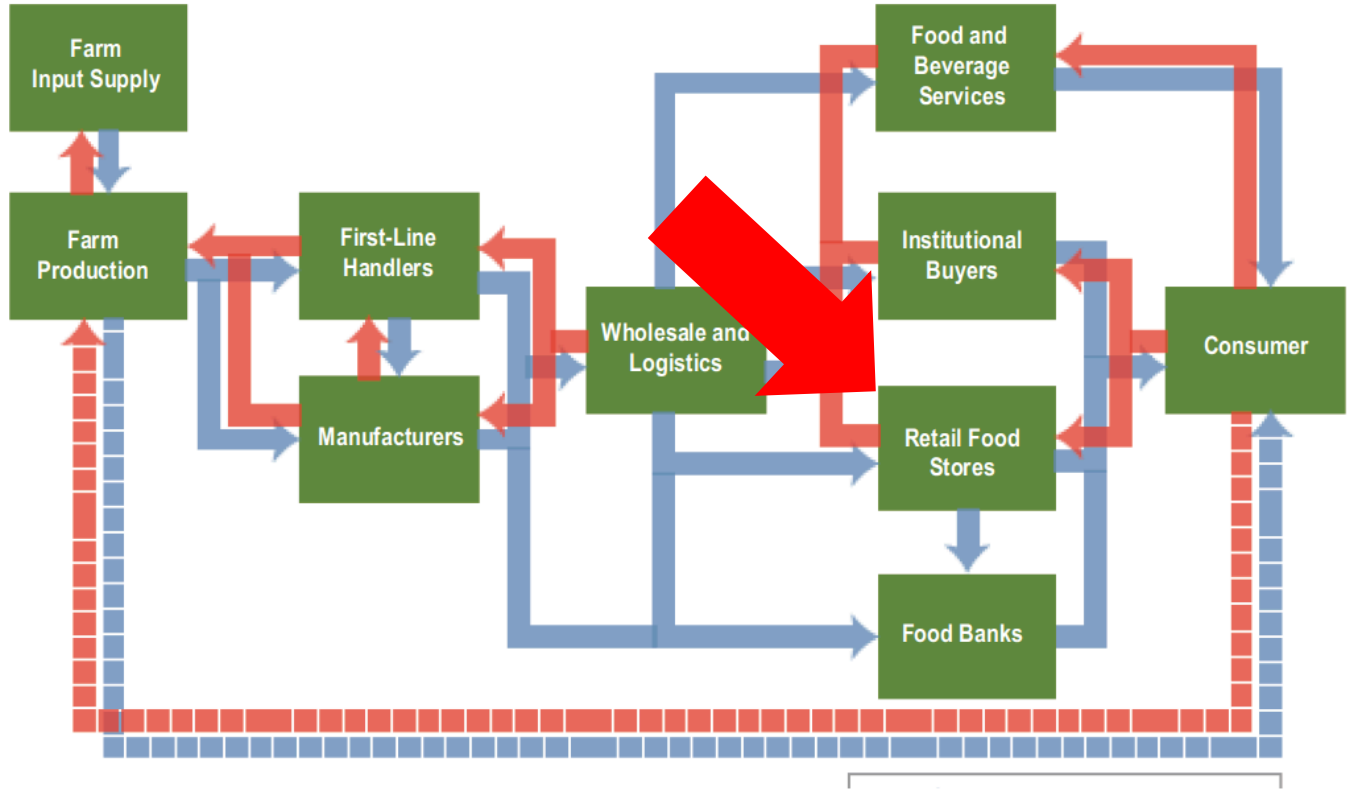
Cold Chain and Tech

- Failures can lead to shorter shelf-life, lower quality, and food safety issues (Ellis et al 2019, references (Aung and Chang 2014; Badia-Melis et al. 2018; Chonhenchob, Singh and Singh, 2017; Mercier et al. 2017; Ndraha et al. 2018))
- 12% of food waste is from poor refrigeration (Ellis et al. 2019 reference (Gunders 2012;)
- In strawberries, temperature fluctuations and delayed cooling can affect fruit color.

Cold Chains and Sensor Technology

- In strawberries, growers use cooling mechanisms liked forced air tunnels and cold walls. (Talbot and Chau 1998).
- Clam shells and their arrangement on pallets can help support cold chains (Ferrua and Singh 2009).
- Management strategies like first-expired-first-out vs. first-in-first-out can mitigate waste (Hsu-Flanders, Gallagher, and Wilson, Forthcoming).
- Radio Frequency Identification (RFID) tabs and wireless sensor networks can monitor temperatures (Ellis et al. 2019, Badia-Melis et al. 2018, Ndrah et al. 2018).

Retail



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Ugly Produce

- Hannaford in 2017 had “Misfits.”
- Kroger was to begin “Pickuliar Picks.”
- Walmart had “Spuglies” in 2016 in 400 stores in Texas and “I’m Perfect” apples in 300 Florida stores in 2016.
- Several grocers have dropped programs (Gallagher, Hsu-Flanders, and Wilson (Forthcoming) and Choi and McFetridge, 2019).

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Consumer

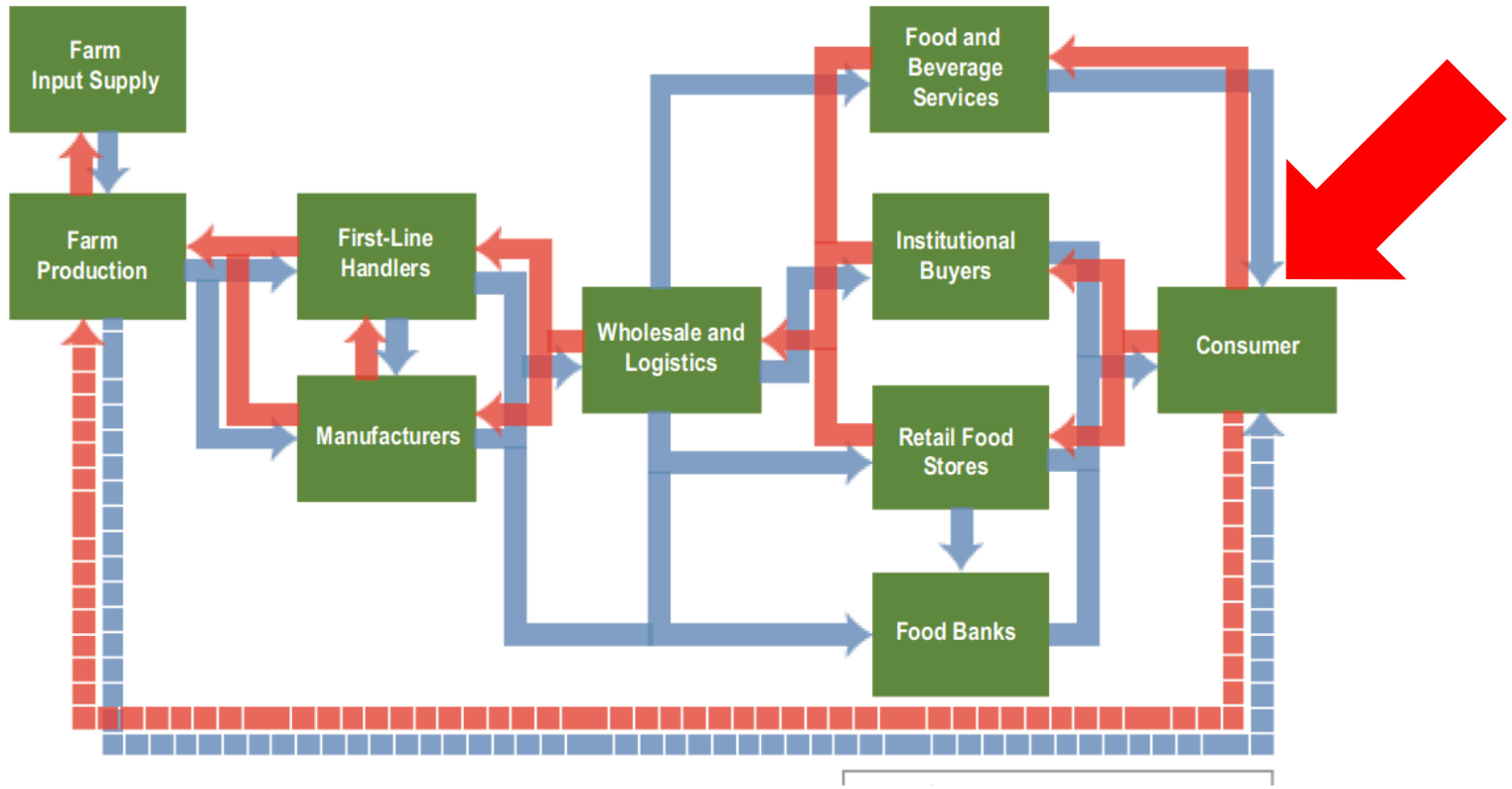

FIGURE S-1 Conceptual model of a food supply chain. Elements or actors in this supply chain in one area (e.g., region or country) also have interactions (e.g., international trade) with actors in other areas.

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Packaging & Labeling

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Food waste: The role of date labels, package size, and product category

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ABSTRACT

The presence of food waste, and ways to reduce it, has generated significant debate among industry stakeholders, policy makers, and consumer groups around the world. Many have argued that the variety of date labels used by food manufacturers leads to confusion about food quality and food safety among consumers. Here, we develop a between-subject, laboratory experiment with different date labels (Best by, Fresh by, Sell by, and Use by) for products (ready-to-eat cereal, salad greens, and yogurt) of different sizes and dates to evaluate how date labels influence the value of premeditated food waste of subjects, or

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Seeing Is Not Believing: Perceptions of Date Labels over Food and Attributes

Norbert L. W. Wilson, Ruiqing Miao & Carter Weis

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News Room

87% of Products Are Now Using Two Date Labels, Creating Needed Clarity

12/17/2018

FOR IMMEDIATE RELEASE

Katie McBreen (844) GMA-PRESS

press@gmaonline.org

87% of Products Are Now Using Two Date Labels, Creating Needed Clarity

New survey data says less confusion will help Americans waste less, save more

WASHINGTON, December 18, 2018 — The Grocery Manufacturers Association today shared the results of its date labeling initiative that narrowed the array of product labels to two options: "BEST If Used By" and "USE By." Since launching in 2017, 87 percent of products now carry the streamlined labels, according to the latest data from consumer packaged goods companies that was released in GMA's new report, *Best If Clearly Labeled*.

"Our industry is committed to empowering consumers to make informed decisions about the products they bring into

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Cancelled: 2019 Fall Food Labeling Workshop: Complying with Regulatory Requirements for the Labeling of Packaged Foods

Differential Response Date Labels

Conclusion

- Participants predicted waste of food that suggests a behavioral bias.
- Individuals who are loss averse and overweight small probabilities, wasting food avoids adverse events, at least for deli meat.
  - Their behavior reflects the myopic loss averse who excessively spend on the purchase of extended warranties for household goods (Rabin and Thaler 2001).

Assessment

- Food loss and waste
  - occur along the food supply chain and
  - is highly variable by products.
- Solutions include
  - New marketing structures,
  - Charitable institutions, and
  - Technology may help mitigate waste,
    - ***but* they may have unintended consequences.**

Assessment

- Solutions include
  - changing date labels, as they matter in consumer food waste,
  - ***but* solutions may lead to differential effects.**
- **Each of these solutions has little consideration of system dynamics.**

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  - Ruiqing Miao, Auburn University
  - Adriel Flanders-Hsu, Indigo
  - Laura Gallagher, USDA
  - Carter Weis, Cornell University
- Funding
  - NIFA AFRI Foundation Program 2016-67023-24817.
  - USDA/ERS Cooperative Agreement

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