

National Academy of Science: Labor & Automation Workshop Notes:

Manoj Karkee (Fruit/veg tech development)

- Issues with current fruit/veg mechanization include:
 - Speed/accuracy/robustness
 - Plant damage
 - Cost of adoption
- Currently working on cherry and apple harvesting tech.
- Recent developments include:
 - Targeted shake and catch systems that are tiered and only permit fruit to fall 12 inches max.
 - Machines/robotic arms that target specific branches on a tree.
 - AI vision systems that identify where fruit is located on tree/branch.
 - Co-robots that work alongside harvest workers.
- Making lots of progress and tech is close to being brought to market.
- Issues with tech include:
 - Workers want year-round work, so replacing them during harvest time creates labor force challenges in terms of retaining employees.
 - Current tech only harvests about 65% of available fruit.
 - Unacceptable damage to fruit.

Marcos Marcondes (Dairy tech development)

- There are high employee turnover rates in dairy industry.
- Farmers complain that they need a solution to the labor availability issue.
- Dairy workers have to wake up at 3 or 4 am, this work is hard to do, and the workforce is aging.
- Farmers have increased wages, but can only increase so much: they have tight profit margins.
- Dairy farms are going out of business and are relocating.
- Automated systems include milking robots and health monitor systems (think large farms):
 - Body Condition Score sensing can help boost productivity by identifying cows that are overweight and need to be culled or otherwise treated.
 - Machine Vision Systems can identify health conditions.
- Cost of robotic milking machines is about \$150,000 and can service about 60 cows per day. With large farms (1000+ cows), this becomes very expensive to start.
- What happens to displaced laborers? Can they be trained to do other tasks?

Leland Glenna (Sociologist)

- Talked about survey he did on farmers.
- Labor scarcity can lead to tech adoption – trying to understand how farmers feel about adoption and figure out factors that are linked to adoption.
- Survey is about robotic pruning systems adoption in vineyards.
- Small and large farmers reported being less interested in it.

- Growers with high seasonal labor demands were more interested.
- One farmer reported that he had no interest in it because he needs to keep his workers employed year-round, so they would either need a system that fully automates all aspects of production, or he wouldn't be interested in it because he would not be able to retain the workers he needs.
- There are social issues in terms of making sure workers have enough work to feed their families.
- Mid-sized growers were most interested because they faced increased competition with labor demand from large employers.
- Large employers could afford to pay more for labor, so they had less need for mechanization.

Diane Charlton

- Labor is scarce, the supply of farmworkers is declining.
- Workers have opportunities in other industries.
- Technology could help mitigate this problem.
- Moving forward, technology will become increasingly important.
- We need to think about skill development for the future farm workforce.

Discussant Panel

- We need to understand the cost/benefit of technology adoption and how many hours of labor a particular technology will save the farmer.
- Technologies need to be very reliable...who will fix them in the middle of harvest time if they break down?
- We should also consider how technology impact the rest of the supply chain. If technology does not harvest all the crop or damages a lot of it, will that cause food supply issues?
- How do we deal with displaced workers?
- There is a disconnect in communication between different agricultural employees, and improving communication could help improve data-driven solutions to ag problems.
- Data analyst jobs are very attractive to the youth. They want to make a difference in the world and address issues of sustainability. Traditional management roles are not that attractive anymore.
- We should recruit ag employees from rural areas since that is where the food is being grown
- Need to train students to think about agriculture in a technologically advanced world
- When the labor force ages and is not replaced by the next generation, we lose industry expertise. Need a way to fill that gap.