

Embracing Innovations in Food Quality Technologies

Step-by-Step guide on
Digitising Food Quality for the 21st century



A LEMON IS A LEMON. *or IS IT?*

For a consumer, a lemon is a lemon. For quality control teams, who deal with different suppliers, varieties and defects, one lemon is as different from another as a potato is from an apple.

In this e-book, we touch upon the hurdles quality inspectors, managers and heads face because of this diversity. Then we move on to technologies that help iron over these wrinkles and improve your quality.



INTRODUCTION

Fresh produce is a tough and turbulent market for many reasons. One of them is quality. It has never been easy to sort, grade and maintain quality standards.

Fruits and vegetables are perishable. They are fragile. Suppliers are fragmented. Consumer expectations are high. And that's the tip of the iceberg. The majority of problems are below the water's surface and arise from the traditional quality control method - manual inspection.





The prevalent method of inspecting fresh produce trusts the senses. The eyes, the hands, and the nose are used to see how the item looks, feels, or smells and then judged worthy or not. In theory, it appears simple; but in real life, it is laborious and time-eating.

THE TRADITIONAL METHOD IS A BROKEN SYSTEM.

While human vision can perform quality control tasks effortlessly, productivity and efficiency suffer from inexperience, fatigue and inconsistency.

1.1

CRITICAL CHALLENGES OF MANUAL QUALITY INSPECTIONS

- **Each fruit and vegetable has its own clues to freshness and quality.**

Watermelons require an assessment of water content and color. Tomatoes need to be checked for seven criteria including their color and visual defects. Lemons need to be checked for color, girth, length and peel thickness.

There are multitude of quality criteria, which only increase with each new addition of fruit or vegetable in the supply chain. As a result, it can take a quality inspector up to 2 years to learn the trade.

Class of attribute	Quality attribute	Measurement of quality attribute
External	Appearance (sight)	Visual evaluation of size, shape, gloss and color May be accompanied by visual guides and colorimeters
	Feel (touch)	Manual evaluation of firmness and texture. May be accompanied by mechanical texture analysis
	Defects	Visual evaluation of absence of defects or deterioration of color. May be accompanied by mechanical methods (e.g. ultrasound)
Internal	Odor	Mostly qualitative and subjective evaluation by smelling. May be accompanied by technical methods (gas chromatography)
	Taste	Oral tasting (sweetness, bitterness, sourness and saltiness) Technical quantification of taste compounds (e.g. chromatography)
	Texture	Includes tenderness, firmness, crispness, crunchiness, chewiness, fibrousness which are measured by applying force to the produce; additionally, textural characteristics are evaluated as “mouthfeel”

- **Grading of fresh produce is not limited to ‘accepted’ and ‘rejected.’ There are varying quality grades.**

Food businesses often deal with different labels – a private label with better quality and homegrown label with less stringent criteria. Sorting a single lot of potatoes requires a laser-sharp memory that remembers different specs for different labels.



- **Quality requirements also change with season and locations.**

For instance, table grapes packed in the early season must have a minimum Brix of 14%. Later in the season, it changes to 16%. Fruits and vegetables exported to India have some leeway in quality. Those exported to the US have tighter standards with no defects.

- **Food compliance and safety need to be paramount.**

Overworked inspectors, interrupted audits, strained resources, lack of documentation and tracking snafus make inspecting, and maintaining fresh produce quality challenging. It lets safety standards slip through the cracks leading to recalls.

1.1.1

BESIDES TROUBLES DIRECTLY CONNECTED TO INSPECTION, THERE ARE OFFSHOOT ISSUES.

- **Ask any quality team to explain how they sort, grade, and track their fresh produce and they'll point to a pen and paper.**

By and large, there is no compiled and helpful information, with teams swimming in unstructured and useless data. In an era where Big Data has transformed businesses for the better, this lack of data is distressing.

- **In very rare cases, a few quality teams will point to an excel spreadsheet.**

But this necessitates an additional burden of converting the data from hard to soft copy. Most businesses pile it on an already overburdened quality inspector.

An international freight forwarder with one quality inspector per port estimates it takes 8 hours a week just to transfer data from paper to excel.

- **The businesses who can afford it hire a data encoder.**

The person is responsible for typing in the information the quality inspector records on paper into an excel spreadsheet.

The excel sheet is checked by the quality supervisor. A farm-fresh banana and pineapple grower, supplier, and exporter from the Philippines estimates it takes up to 4 days a year for the supervisor to track errors and mis-entries made by a data encoder.

The exporter readily accepted that manually tracking quality suffers from a legion of problems:

- *It's labor-intensive and error-prone.*
- *There is no real standardization of quality specs.*
- *It takes a long time to train a quality inspector, and the turnover is high. The constant hiring and training of workers become a daunting task.*

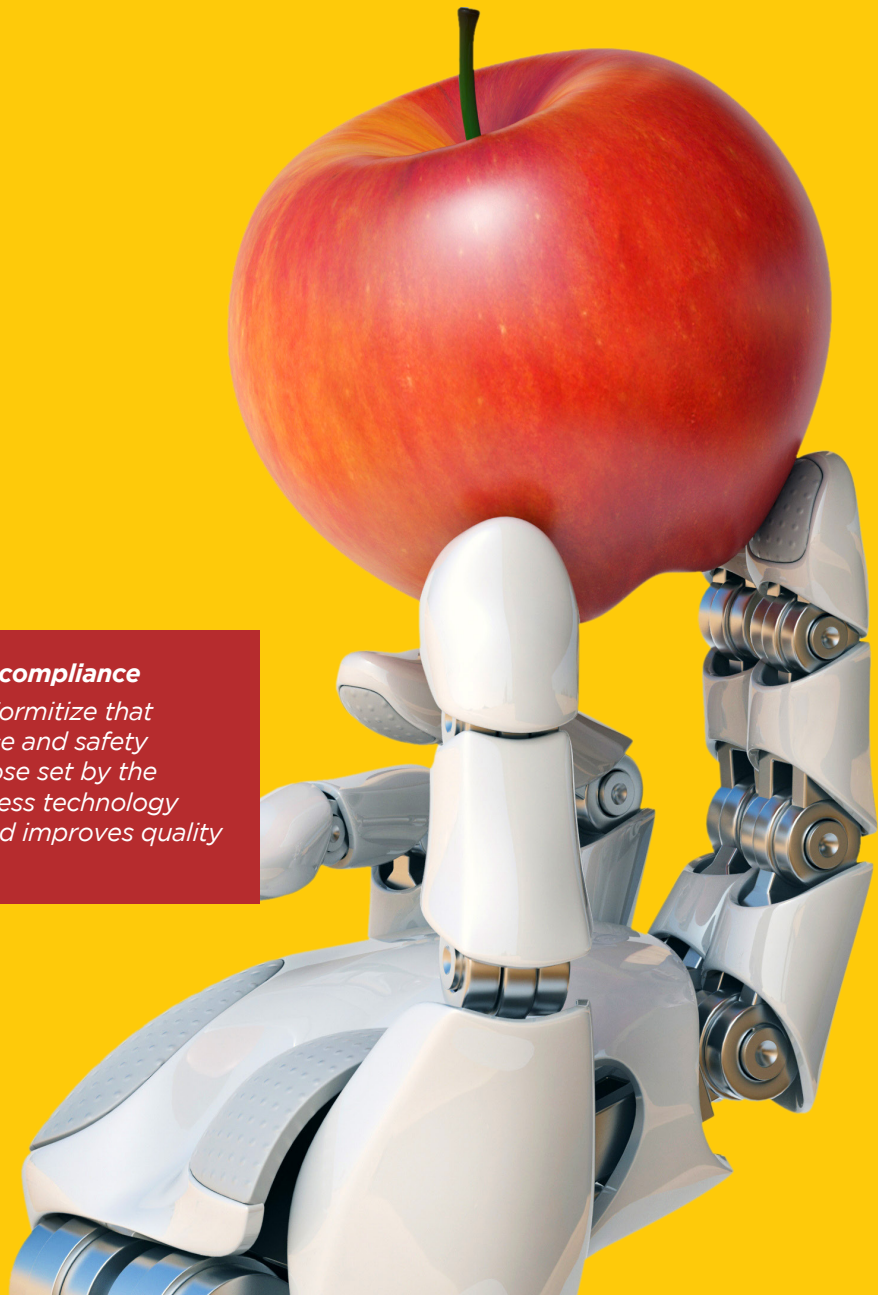
UPGRADING FRESH PRODUCE QUALITY PROCESSES TO THE 21ST CENTURY WITH TECHNOLOGY.

There is assorted technology that addresses problems in fresh produce quality processes. The majority of them tackle one of the four issues - speed, accuracy, safety and consistency. We touch upon a handful of them before diving deep into the benefits of computer vision and ML-based technology, both of which are making great strides in the field.

2

Going paperless for compliance

There are apps like Formitize that help meet compliance and safety requirements like those set by the U.S. FDA. The paperless technology prevents citations and improves quality efficiency



2.1

MATERIAL DISCRIMINATION X-RAY FOR CONTAMINANT DETECTION

- **MDX technology, like that by Eagle Product Inspection, enables a quality inspector to pick out organic material from inorganic.**

The tech measures the ratio of two different sets of X-ray energies passing through a product. With it, a quality officer can find a piece of plastic in a bag of corn. Essentially, the tech allows for unprecedented contaminant detection capabilities.

2.2

PROTECTIVE COATING FOR FRESHER PRODUCE

- **Businesses such as Apeel and Mori are building naturally derived materials that help extend shelf life of produce by maintaining quality.**

The tasteless, odorless layer seals moisture and prevents oxygen from penetrating. Made out of peels, seeds, pulp or sometimes derived silk proteins, the coating is added protection, keeping fresh produce from spoiling further as it moves down the supply chain.

Hazel has a clamshell liner that releases an organic anti-fungal vapor that prevents mold and decay. It neutralizes the effects of ethylene and extends shelf life.

2.3

NIR SPECTROSCOPY FOR NON-DESTRUCTIVE SAMPLING

- **Compact near-infrared spectrometers, like those made by Ocean Sight.**

Deliver a non-destructive technique to sample fruit pulp beneath the peel. Quality teams can use them for critical parameters such as fat, moisture and protein content. The sensors can even assess sugar and starch levels accurately without harming the produce.

2.4

ARTIFICIAL OLFACTION FOR DECAY DETECTION

- **Artificial noses, like that by Stratuscent, can catch fruit before it rots due to perishability and improper storage.**

The tech mimics the sense of smell by analyzing the chemical composition using a cloud-based AI engine and a digital sensor. Thus, tracking lead indicators of spoilage by monitoring the change in fruit odor.

HANDY APPS FOR OBJECTIVE, STANDARDIZED INSPECTIONS

- **AI-powered tools, like Intello Track, automate fresh produce quality to ensure only the best fruits and vegetables make it out the door.**

The application can assess abnormalities the human eye would miss, minimizing errors during the inspection.



Customize to your needs

Configure the app and track the parameters that matter to you



Trace back to source

Track quality of lots across the supply chain – from Growers to Consumers



Monitor real-time

Leverage dashboards to analyze trends on quality and loss

It also requires little effort on the part of the quality officer. Once they complete their role of clicking a photo, the technology completes all the subsequent steps. Using machine learning algorithms the mobile-based app detects variance in color, shape, size, and other visual defects. It then sends a phone alert to the quality officer to take corrective action.

3

THE THREE STARTING STEPS TO DIGITIZING QUALITY

- **The first and the simplest step to digitizing quality is by digitizing the data stored in quality reports.**

Switch from PDFs and Excls to one common platform/application that automates quality reports.



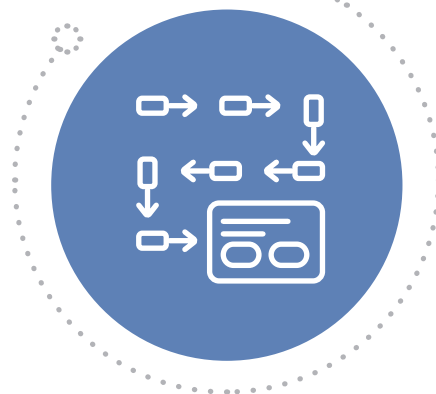
- **The second step in digitizing quality is analyzing structured data for trends.**

With the information accessible to everyone through a single source of truth, accurately identifying suppliers contributing to quality changes becomes effortless. Further, teams can make data-driven mission-critical decisions before a drop in quality turns into a pervasive problem.



- **The third step in the digitization of quality is automating work-flows.**

For instance, a modification in the quality parameters of tomatoes by the supervisor immediately reflects the entire team or making it possible to share reports with any stakeholder with a single click.



THE CLEAR ADVANTAGES OF DIGITIZING QUALITY PROCESSES

From classifying fruits and vegetables in predefined quality grades to reducing shrink, most advantages of AI-powered tools are self-evident.

Some benefits are imperceptible but equally effective, such as cost of experience.

Hiring experienced inspectors across the supply chain of a food business comes at a high price point. Tools that digitize quality act as assistants to novice quality officers, curtailing the need for economically prohibitive inspectors. Thus, lessening the cost to the company.

Let's pick up the example of table grapes from earlier once again. When grading is manual, quality teams rely on an email to inform on-site inspectors that it is time to modify the Brix threshold. The supervisor hopes the quality inspectors will read the email and follow the instructions.

With automated quality inspection applications, there is no such ambiguity. Once the quality manager changes the parameter, the algorithm automatically updates and inspects fresh produce accordingly.

4.1

AN ASSISTANT TO THE QUALITY INSPECTOR

- It saves them time by reducing manual parts of the inspection like filling in reports and incorporating photos.
- It's a constant source of reference when inspecting a new fruit or vegetable.
- The tech only offers a suggestion; the final call remains in the hands of the officer.

Profit:

- Drastically reduced labor costs
- Lessen spoilage by 50%

Consistency:

- Objective assessment for better and predictable quality control

Efficiency:

- Improved and faster quality control processes

Satisfaction:

- Better client satisfaction due to enhanced and consistent quality

Besides grading fresh produce, technologies that digitize quality can be used to:

- Train new quality officers
- Reduce food loss and waste

- Achieve food compliance and safety
- Eliminate the hassles of pen, paper, and excel sheets
- Gain insight on suppliers through real-time data on recorded quality

4.2

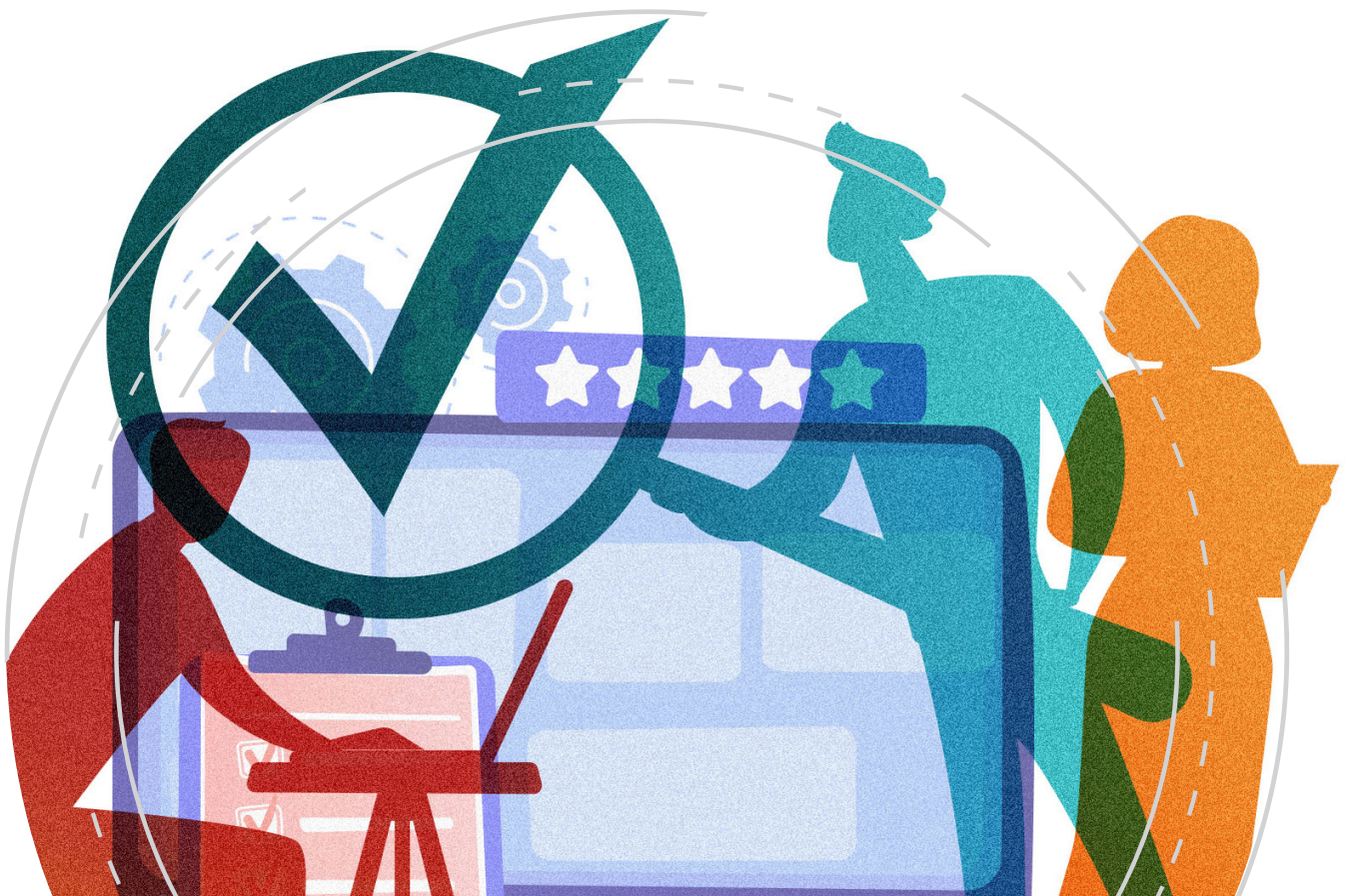
A TRAINING TOOL FOR THE QUALITY MANAGER

- It is a faster training tool for all new personnel as compared to shadowing.
- It standardizes quality criteria ensuring that every distribution center of food business, irrespective of the location, supplies the same quality produce to clients.
- It's exceptionally convenient for quality managers who have traded more than one label. Remembering the quality specs for each label is challenging, AI tools eradicate this need. The manager simply chooses a filter – premium, in-house, or another – and the app inspects the fresh produce for the respective criteria.

4.3

AN INSIGHT REPORTER TO THE QUALITY HEAD

- Digitizing quality improves supply chain visibility. With real-time data, quality heads can know with confidence which supplier has the freshest produce with the best quality.
- It helps measure supplier performance, which can be leveraged to improve business decisions and profit margins.
- It offers traceability. A living record of the lot can be obtained either using the Lot ID or by scanning the barcode. This is valuable for provenance and accountability and ties into food safety.
- It can help create brand new specifications and unlock more monetization avenues.





The current system quality teams utilize is broken. Think of it like driving a hatchback all your life without realizing that you can afford a faster and better car.

That's why even after spending so much effort on transporting and handling fresh produce, much of it ends up in the dumpster. Technology and automation can play a big part in fixing this.

Working as colleagues to technology, quality teams can optimize processes to deliver high-quality fresh produce and attain healthier efficiency and consistency. If you're curious about how the power of AI can transform quality for the better, please visit our website or get in touch directly with one of our experts.

Intello Labs is an award-winning agritech company. We revolutionize quality and transparency in the global food value chain by marrying tech to fresh produce. We design, build and deliver AI-based sorting, tracking and reporting technology for food businesses across the supply chain. Through smart, scalable solutions, Intello is creating the de-facto standards for fresh produce quality assurance.

5

TECH AND QUALITY TEAMS GO HAND IN HAND



CONCLUSION

Subjective quality processes lead to fresh produce that's, at best, sub-par. For food businesses, sub-optimal quality equates to thinner profit margins. The need of the hour is exceptional quality, delivered persistently.

The first step to achieving exceptional quality is following standardized quality criteria and specifications. They assist in grading fresh produce more effectively, and consistently.

The second step is automating the entire quality process to eliminate the vagaries of manual sorting and inspection. Take measures to attain objective and error-free quality. Invest in the power of computer-based vision, and machine learning with Intello Labs.



An award-winning agritech company focused on revolutionizing quality assurance and transparency in the global food value chain using the power of technology and AI.

For more information on Intello Labs' suite of products, please get in touch at:
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