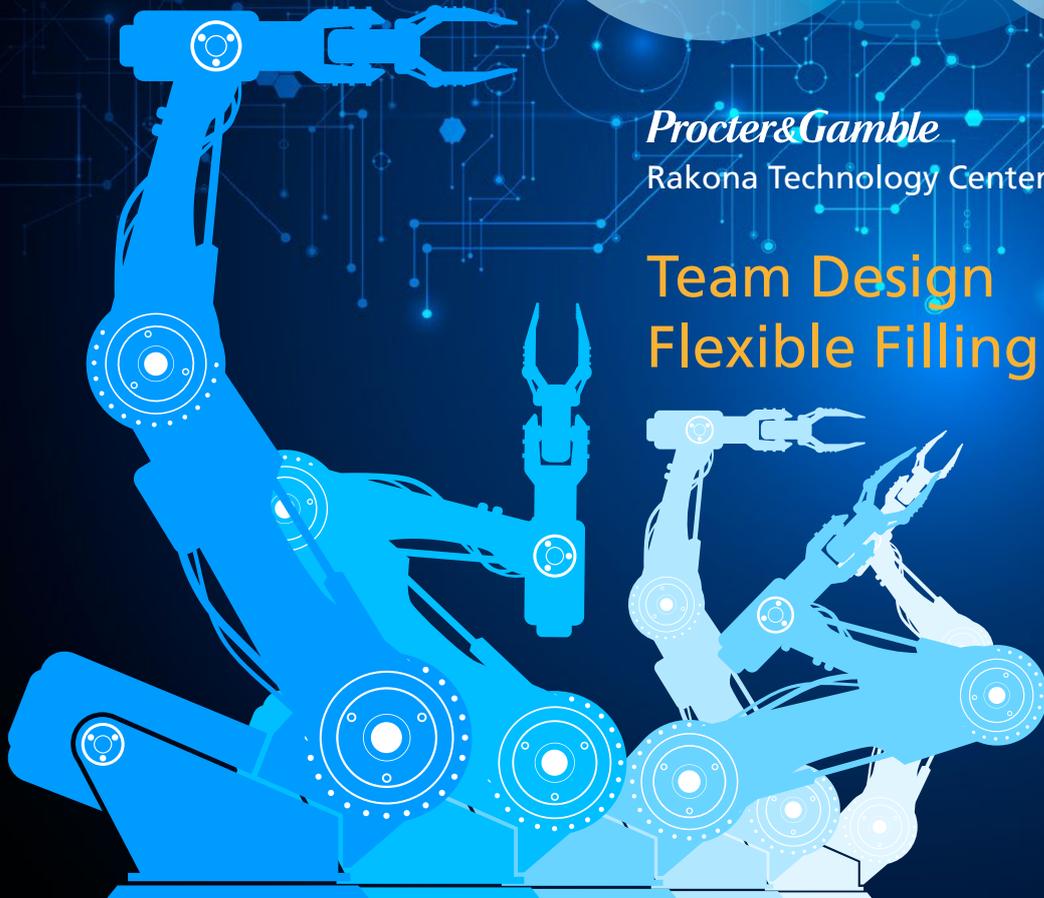
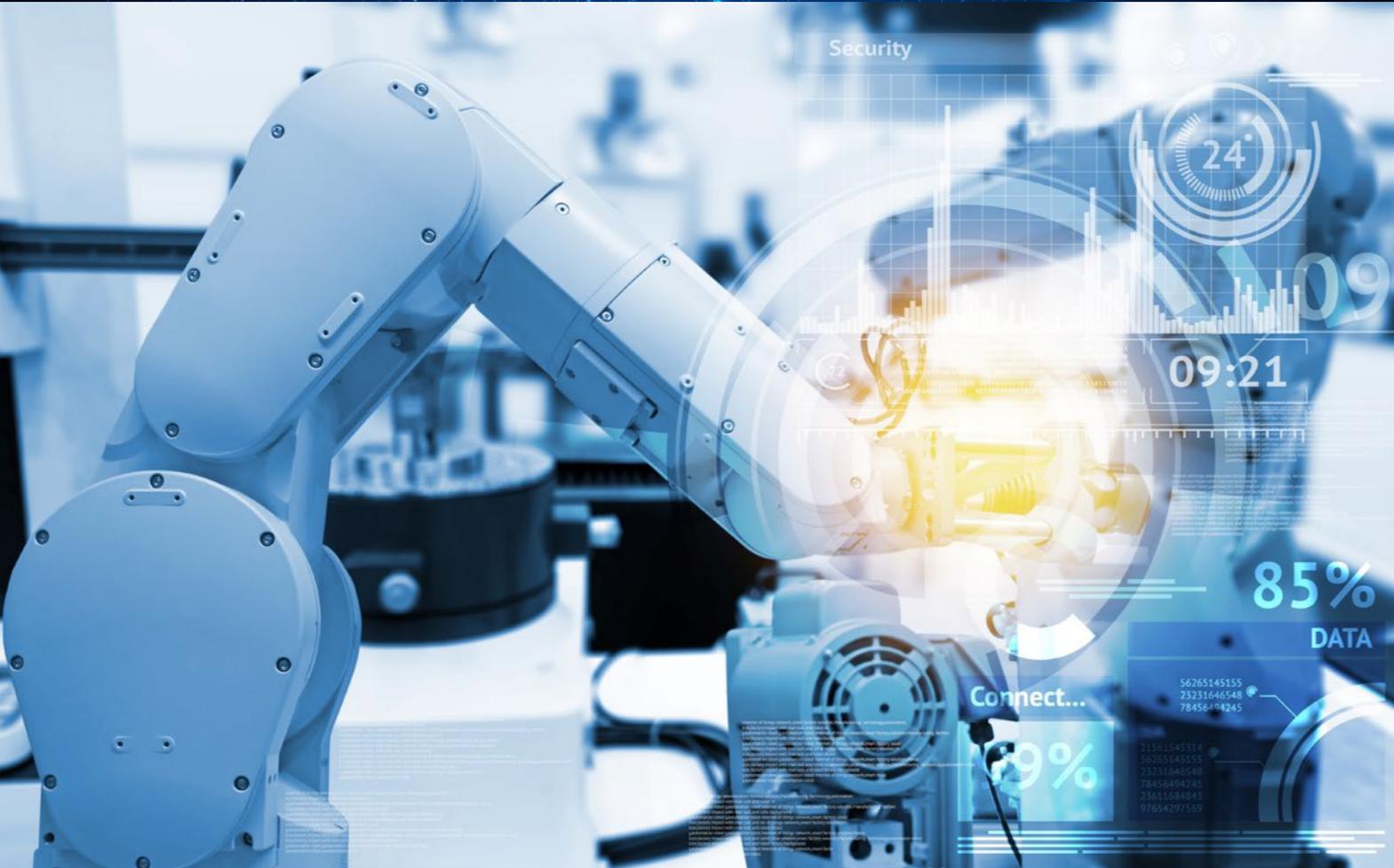




*Procter&Gamble*  
Rakona Technology Center

# Team Design Flexible Filling





## Problem Statement

The engineering team located in Czech Republic is asked to design and build a prototype of a bottle filling machine that combine a standard filling operation for different bottle sizes with an innovative feature of mix-in-bottle operation while meeting the target criteria of safety, quality, speed and reliability.

## Business Project Description

### Current Situation

Procter & Gamble typically has dozens of product variations that reflect the preferences of different customer groups. To maintain the business competitiveness, the in-house engineering teams need to design equipment that can be used to produce all the variations in the product portfolio.

The traditional approach for P&G operation is to install systems of

- (1) process units that produce the liquid
- (2) interconnected machinery that runs various operations related to packaging.

### Business Request

With the popularity growth of consumer products customizations according to customer preferences, P&G has established a new business plan in cooperation with a major online retailer that involves an online app that allows users to define and order a custom product according to their preferences (in terms of product flavor, performance level, size and color of the bottle...).

As each customer can select a unique product characteristics, this business request requires ultimate flexibility of the manufacturing lines. Since changing the operation from one product to another normally triggers actions in all the traditional production systems, a major redesign must be one to avoid productivity losses.

## Technical Problem Description

The request from your team is to design and build a prototype of a bottle filling machine that combine a standard filling operation for different bottle sizes with an innovative feature of mix-in-bottle operation (see picture below the scope of the process).

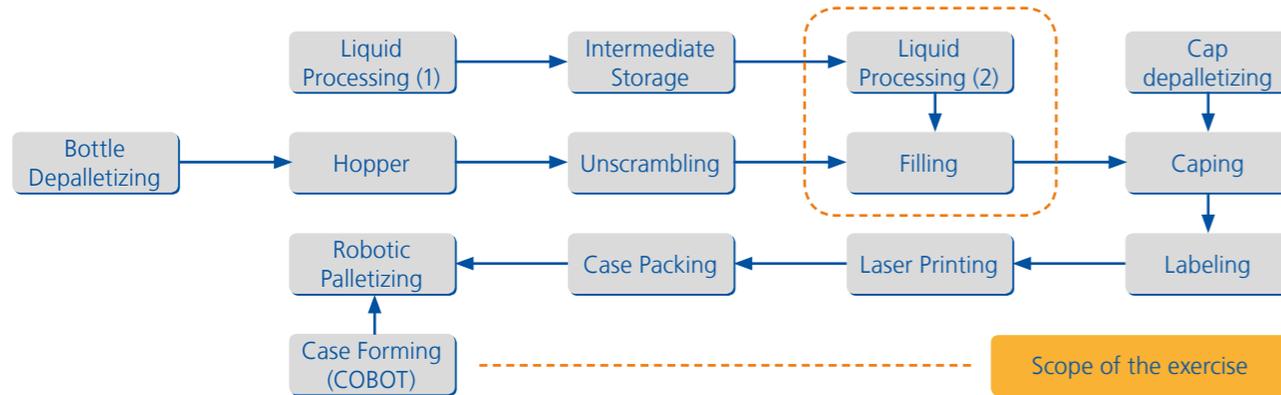


Figure 1 The Block diagram of existing lines highlighting the scope of the exercise

The innovation areas consist of:

- filling of different bottle sizes in a single production run
- avoiding complex change-over procedures at the liquid processing units by adding selected raw materials directly into the bottle during filling.

The scheme of the machine is visible below. Each team will be given:

- 2 bottles of different size (300 ml, 500 ml)
- Dye representing a set of raw materials
- Standard to show what the target products look like

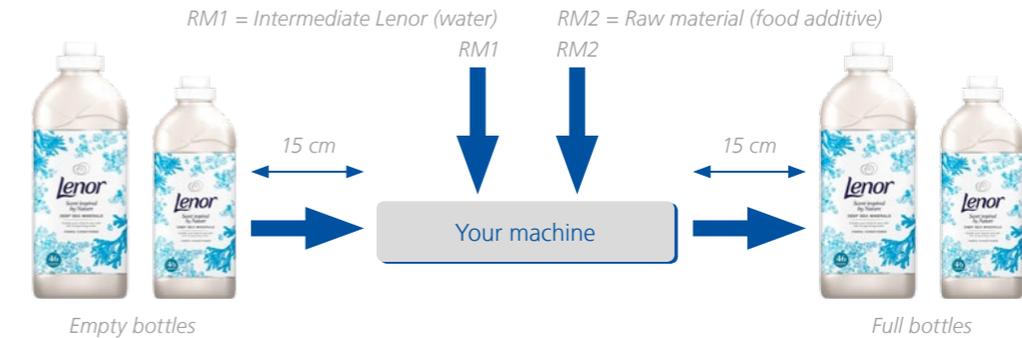
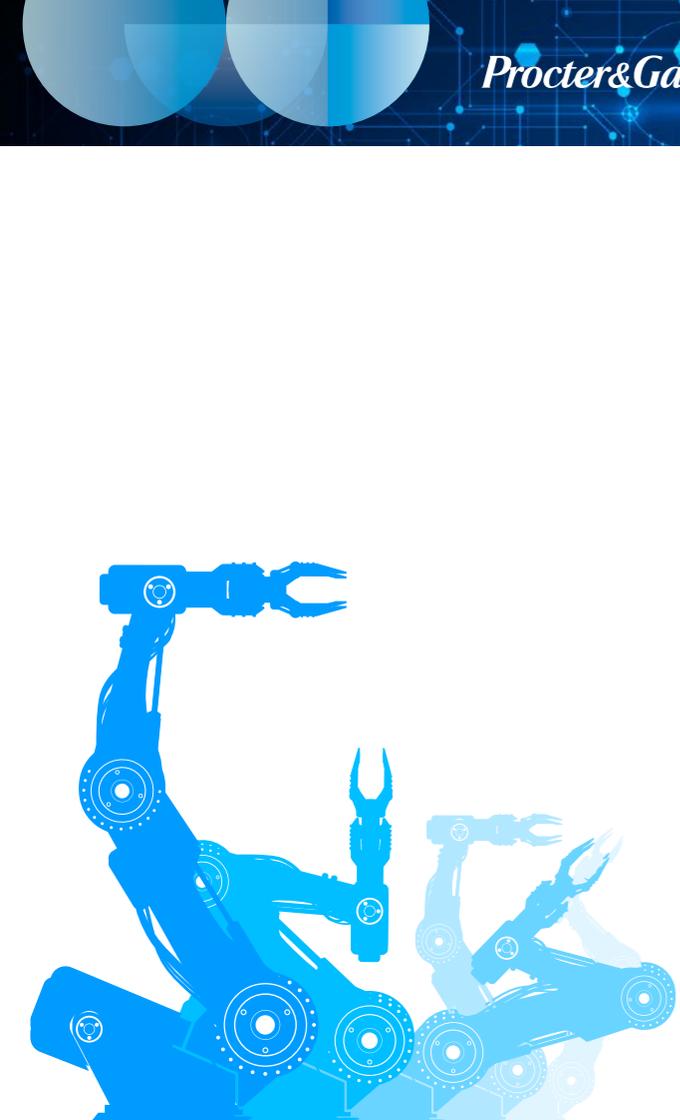
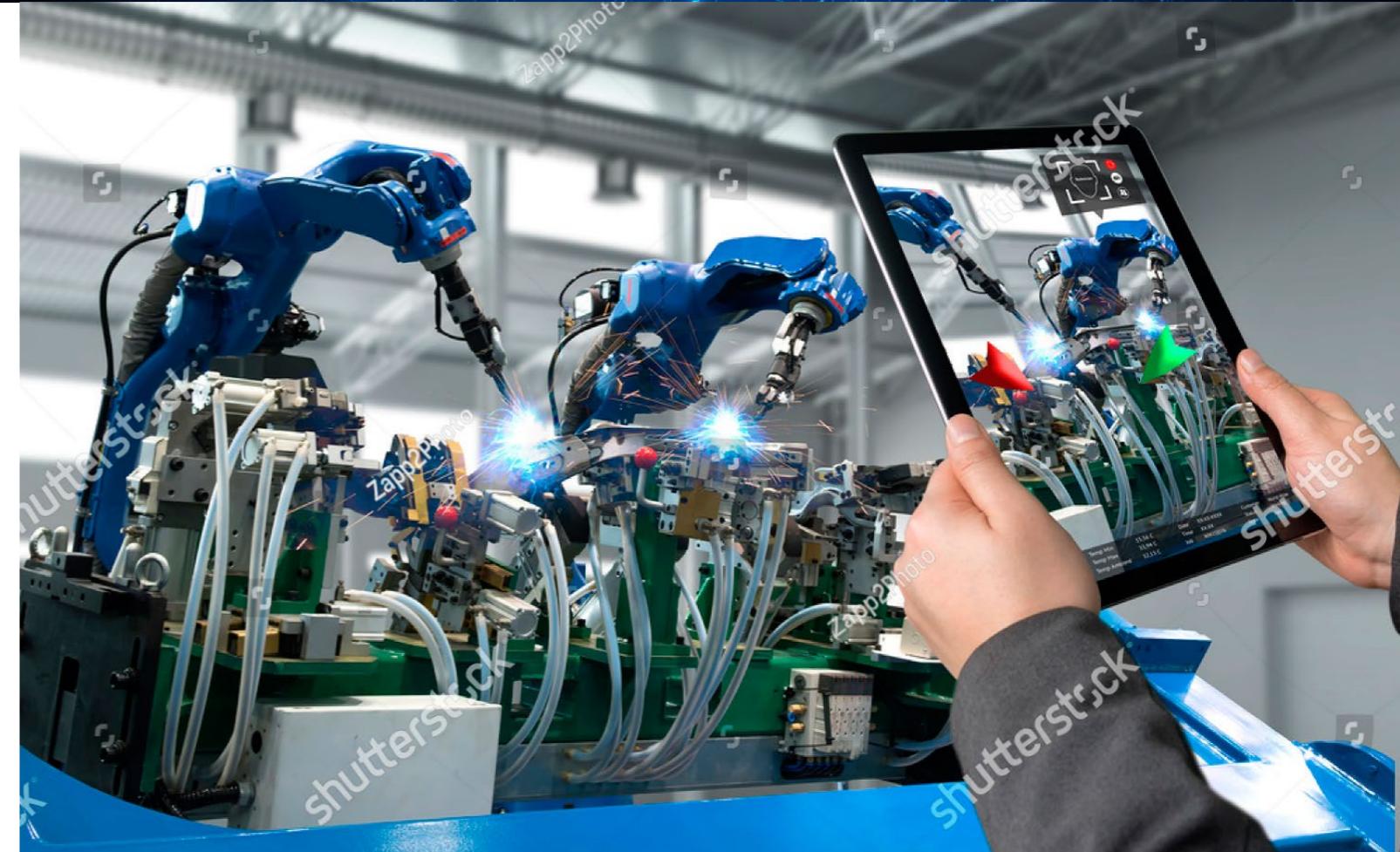


Figure 2 Scheme of your machine

The development teams work with “Fast Cycle Principle” and therefore a demonstration of a functional prototype needs to be presented by the end of the day. At the same time, P&G does not intend to spend large sums of money until the technical and business feasibility is confirmed, therefore some manual steps and inaccuracies are tolerated as long as the team can explain how to address them in a real-life machine.

During the demonstration, the empty bottle can be put in the machine manually to simulate the bottle infeed. However, due to safety reasons short (>150mm) conveyor will have to be in place to prevent injuries inside the filler. The bottle will then be transported into the filler, where it will be filled with water that simulates the main intermediate product and food dye additive that simulates minor raw materials. Similarly, to the bottle infeed, the bottle outfeed can be simulated by manual bottle extraction by operator, but the same 150 mm clearance must be kept.

The dye shall be provided and it can be added in any form as long as long the target color is achieved. The overall amount of liquid should be as close as possible to the target.



## Success Criteria

The machine must comply with the target criteria of safety, quality, speed and reliability. For the purposes of this competition, the judging panel will also evaluate the technical ingenuity & execution of the solution and overall cost of construction.

### Safety

Meeting P&G's high safety standards is a hard-point. In this simulation, we will check that no contestants were hurt during the demonstration. Additionally, the operator cannot touch the bottles while inside the machine.

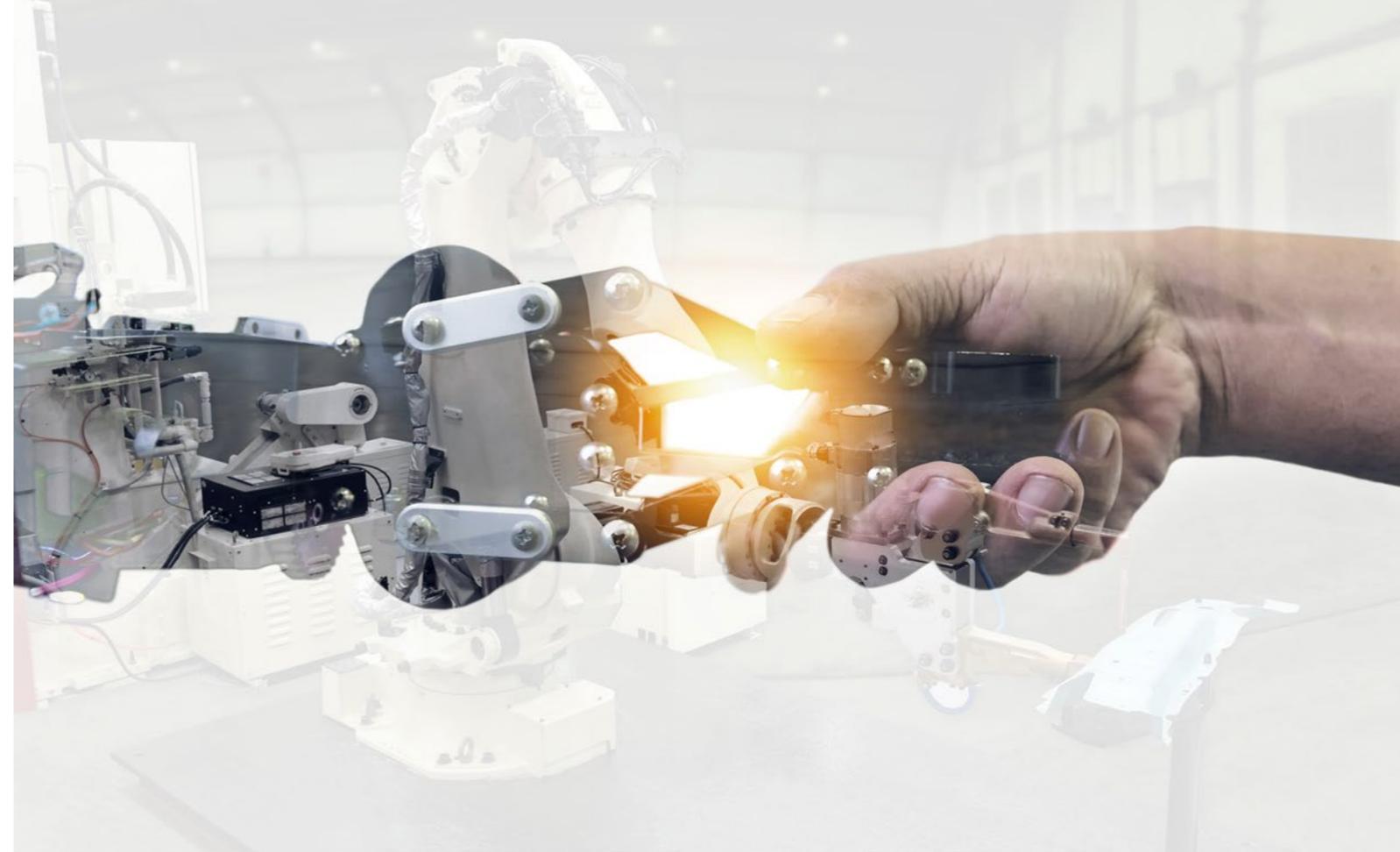
### Quality

Meeting P&G's high-quality standards is a hard-point. Even the slightest imperfection on the package that does not even impact the product performance may, in the eyes of the customers, undermine the confidence in the overall brand. We will look for spills on a bottle, color of the products vs. standard, damage to the bottle and other differences vs. our standard.

Additionally, the mass of the liquid in the bottle will be checked vs. the target. Underfilling is unacceptable due to legal reasons. Overfilling leads to losses for P&G.

### Speed

Our benchmark speeds in traditional machines reach up to 24000 bottles / hour. In case of in-bottle mixing, the speed can be reduced due to technical limitations. However, speed remains an important performance indicator as it directly impacts cost per capacity. We will measure the time to fill the bottles.





### Reliability

Overall capacity and manufacturing productivity is enabled with reliable equipment. We will look for the number of breakdowns, machine stops and general smoothness of operation.

### Technical Ingenuity & Execution

The judge panel will evaluate the combination of technical ingenuity and execution. Example of a good solution can be level of automation, blindness to bottle size and shape or scale-up potential.

### Construction Cost

The basic materials for construction will be received "for free", but more sophisticated parts must be purchased from the BEST shop. Lower cost will be evaluated with higher points. Note that lower cost at the expense of the other success may not be the best solution.

