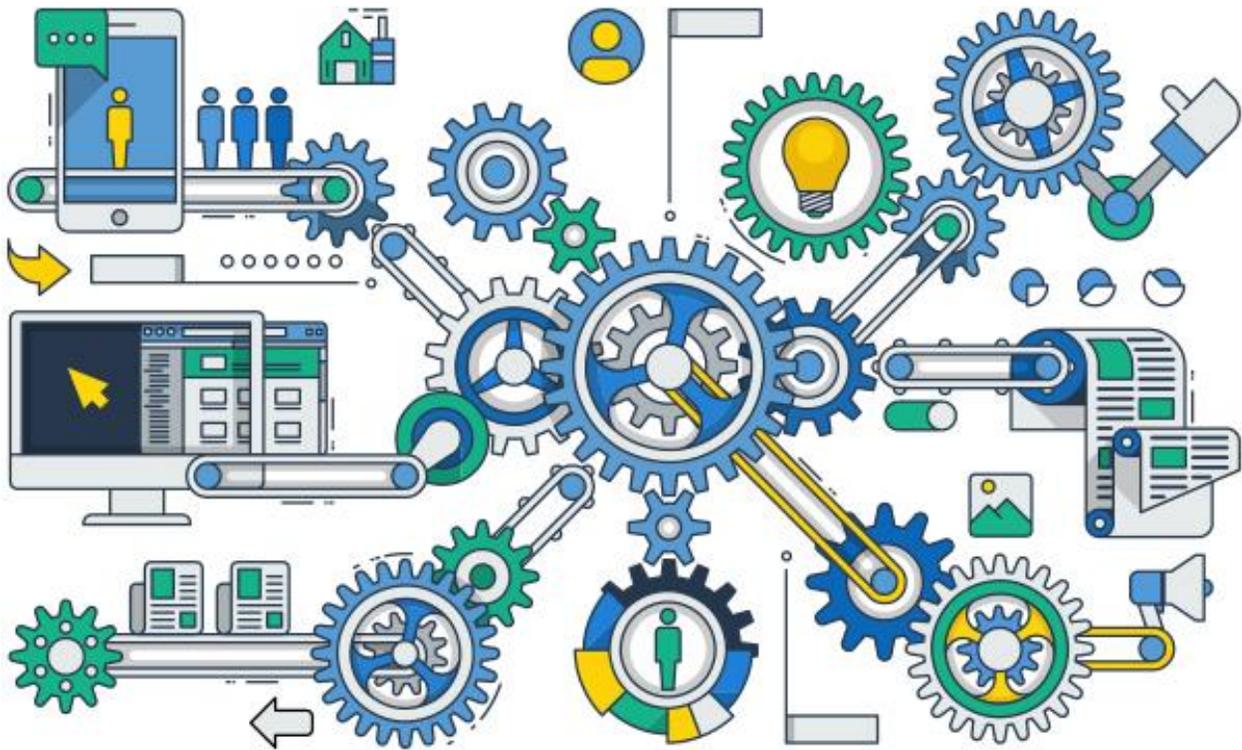


# AUTOMATION



## The Adaptive Machines

Dedicated machine designs are giving way to base machine modules that are configured to production requirements, reconfigured as needed and support 'batch of one' operations. The result is a new category of machinery, the adaptive machine. This paper discusses attributes of adaptive machines and the enabling technologies behind the movement. Today, automation technologies are being commercialized that put smart factory functionalities in the realm of real-world production and packaging applications. This new generation of machinery is required to cost effectively meet the expectations of consumers increasingly used to getting precisely what they want, quickly, online. While additive manufacturing is a promising approach in many applications, it is not applicable to the majority of food, beverage, pharmaceutical and household goods production processes.

Therefore, it will not be a subject of this paper. While production lots, literally of one product, also don't fit every product category, the same technologies apply to automation of rainbow packing, mass customization, short production runs with frequent changeovers and producing limited time offers. Batch size one is the ultimate invocation of these marketplace trends. Switching from glass bottles to plastic, or from rigid to flexible containers, requires completely new filling and packaging machinery. Consumer product and package lifecycles keep shrinking, while SKUs continue to expand. It is impossible to anticipate all changes -- especially disruptive ones -- that are likely to occur over the 15 to 20+ year service life of industrial machinery. An adaptive machine is one that has the capacity to change over on the fly, and moreover, to reconfigure with different production modules on the same base machine platform. It will readily be adaptable to constant size and format changes. But it will also be adaptable to radical and unforeseen requirements through corresponding equipment changes, such as replacing a carton erector module with a pouch forming module. Adaptive machinery will compare favorably in all aspects of productivity measurement – OEE, ROI, TCO – as lot sizes shrink and throughput (leadtime and volume) requirements remain critical.

## Innovations Abound

It is the combination of many seemingly small innovations such as these that combine to enable the adaptive machine: One recent example is HTML5 based human-machine interfaces that run on any web-enabled device regardless of operating system. This makes it much simpler to fulfill the popular concept of deploying remote visualization on any phone, tablet or computer screen-- without needing to support versions for Android, iOS, Windows,

Linux or any other operating systems for that matter. The user experience also improves, because the HMI can now have the familiar feel and navigation of web pages, benefiting from the latest HTML 5, JavaScript and Cascading Style Sheet web design standards.

Another is networked safety, which replaces hardwired safety. Networked safety has spawned both new diagnostic capabilities and safe motion, in which the machinery continues to operate in a safe mode rather than shutting down. Simplifying production of small batch sizes, software modules to program network integrated light curtains now make it possible for objects of different sizes and shapes to pass through without triggering a safety response – perfect for batch size one products of different sizes and shapes. Safe robotic control will also be key to the expanded use of collaborative robots.

Combined with condition monitoring to enable predictive maintenance and energy monitoring to optimize efficiency, these software innovations and others, available today, are making the adaptive machine a practical reality.

Machine applications can now Tweet, sending information via text message or email to communicate alerts instantly. Automated text messaging allows a machine application to send text messages and emails triggered by specific events and can easily be connected to other software components, such as alarms, to automatically notify a maintenance technician when immediate action is required.