

A Frost & Sullivan Whitepaper

The Future of Motion Control for CPG Manufacturing, Materials Handling and Assembly

**Leveraging Lexium MC12 Multi Carrier
System with EcoStruxure Machine Expert
Twin**





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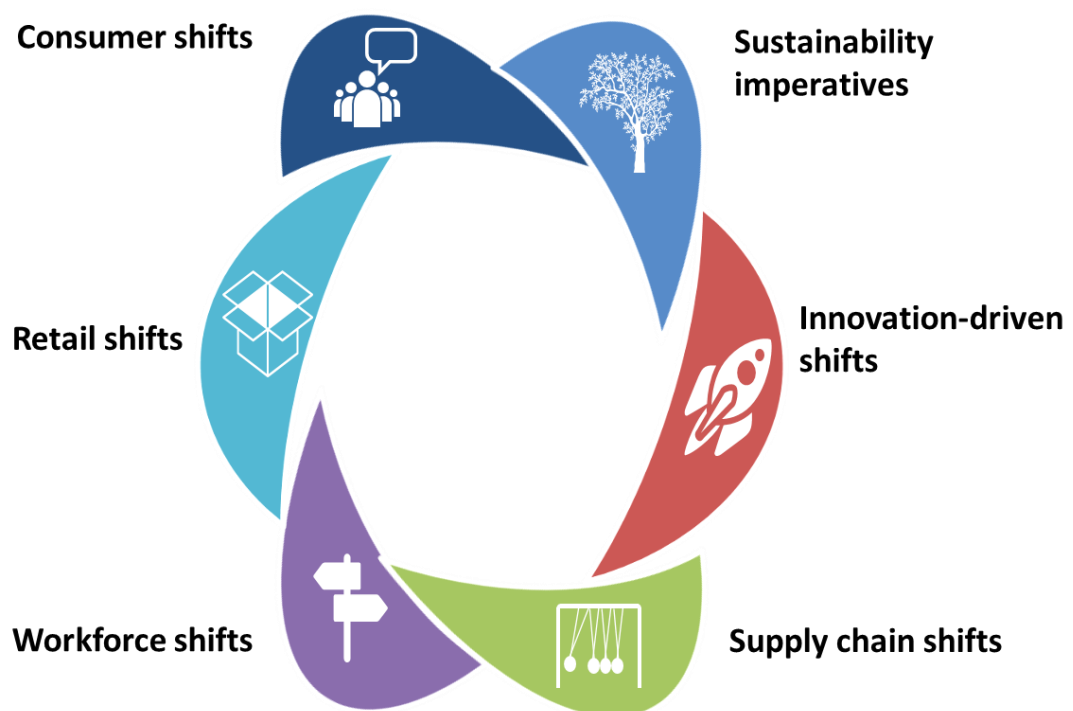
The Paper was completed in June 2022.

The Future of Motion Control for CPG Manufacturing, Materials Handling and Assembly

Key Shifts Impacting CPG Manufacturing, Materials Handling and Assembly

Frost & Sullivan identifies six **shifts** that are expected to play a critical role in redefining success for **Consumer Packaged Goods (CPG) manufacturing, materials handling and assembly** moving forward.


Figure 1: Key Shifts Impacting the Future of CPG Manufacturing, Materials Handling and Assembly



Source: Frost & Sullivan

Consumer shifts

One of the mega trends impacting consumer demand is that of **personalisation**. This can take the form of increased diversity in core product attributes (for example, CPG products customised according to health conditions such as allergies, dietary lifestyles, and personal preferences and habits), sensory factors (such as taste, mouthfeel, flavour and fragrance), as well as packaging attributes (such as pack sizes, shapes, colours, and convenience features).



In the food & beverage industry, for instance, an increasing number of new products launched are customised based on gender, age, health condition and dietary need/preference (such as a diabetic plan, gluten-free plan, nut-free, dairy-free, fat-free, keto, paleo, etc.), stage of life (such as menopause), health goals, DNA and metabolic rates.¹

This – along with **intensified competition** – translates into increased new product development activity and shorter product lifecycles. While COVID-19-driven supply chain disruptions forced some manufacturers to consolidate or rationalise SKUs² over the short term, long term trends suggest a return to developing new products to drive growth.

As a result, there is increased demand for more flexible equipment that can support **multiple materials and product formats**. It also translates into the need for **shorter changeover times** from one batch to another and **shorter time windows for servicing** of machines.

Additionally, as manufacturing shifts from mass commoditisation toward mass personalisation, the concept of **microfactories** is emerging to adapt to real-time production changes and deliver customised products. Unlike traditional manufacturing, products in microfactories are produced only after an order has been placed, which helps companies generate ‘market pull’ for their products and also allows complete customisation to customers’ tastes and preferences.

Retail shifts

Globally, **online retail sales** have grown from 10% of total retail sales in 2019 to an estimated 17% in 2022.³

This surge in online retail is forcing co-packers, contract manufacturers and leading CPG brands to **revise their production plans** to be more fully geared to new purchasing habits and online retail logistics. In fact, the demand for greater agility is prompting a shift from monthly planning cycles to weekly or even **continuous planning**.

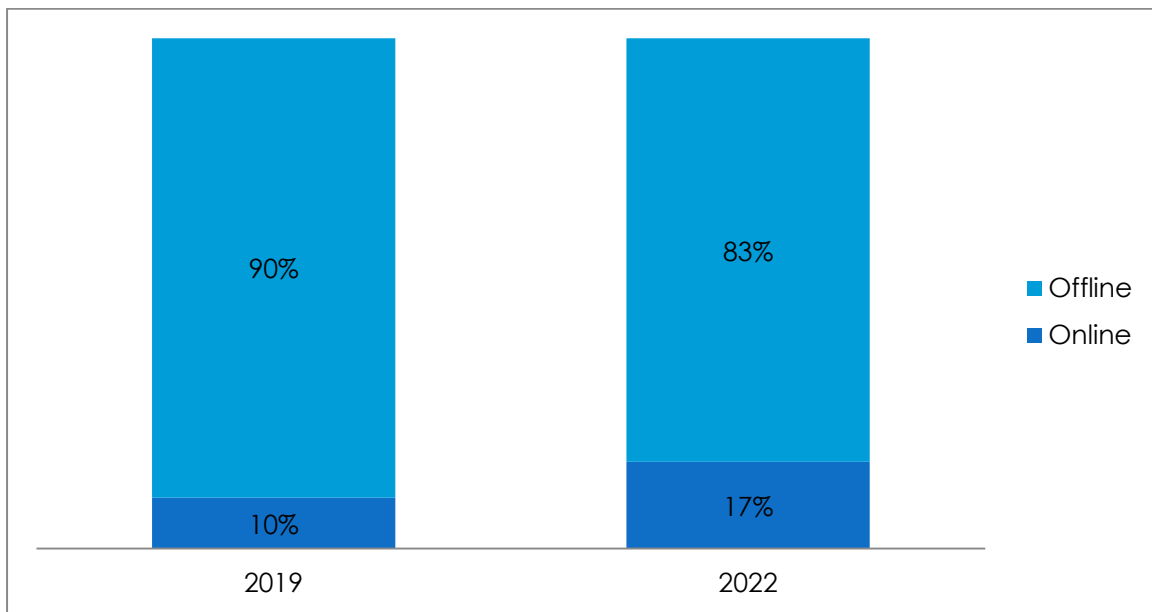
It is also spurring demand for **more robust and more varied packaging, with reduced time-to-market**. Additionally, demand for **smart labels and codes on packaging** is growing to help drive consumer engagement with the product/supplier.

¹ Radical Transparency will Alter the Global Packaged Food and Beverage Industry, Outlook 2021, Frost & Sullivan, April 2021

² Stock-keeping units

³ Consumer goods and retail in 2022, The Economist Intelligence Unit Limited

Figure 2: Global Online vs Offline Retail Sales, 2019 and Estimated 2022



Source: Edge by Ascential; EIU

Workforce shifts

A 2021 industry survey found that the most mentioned operational priority for CPG companies and processing and packaging equipment OEMs was the workforce.⁴

A major concern for the sector today is the scarcity of expertise amongst line workers. There are many types of machines and brands, which are constantly evolving or being exchanged for or upgraded to newer models, which makes specialisation difficult for a large number of workers. Even when talent exists, industries find it difficult to train and capture operational knowledge for future use. The issue of capturing expertise and distributing that knowledge to solve problems faced within industrial infrastructure is difficult to resolve. A majority of the problems occur in tasks such as process planning, diagnosis of machinery, scheduling, and engineering design.⁵

At equipment OEM companies, this **shortage of expertise and qualified staff** makes it more difficult to increase responsiveness (in design, delivery and maintenance of the fleet of installed machines).

Supply chain shifts

The COVID-19 pandemic created **extreme supply volatility, steep price increases, and high levels of uncertainty**. This has triggered significant transformation of production and distribution approaches. Also, in the ongoing shift toward global protectionism, companies seeking to 'reshore' manufacturing capabilities from low-cost regions can leverage

⁴ Key Challenges for Packaging and Processing Operations, Top to Top Summit Survey, PMMI, September 2021

⁵ IoT Start-up Tracker: Digital Manufacturing, Frost & Sullivan, September 2021

microfactories to build products within close proximity to their customers, as well as reduce transportation costs by up to 40% of product cost.⁶

This shift toward a more decentralised structure and automated manufacturing processes will drive the demand for microfactories that require a **smaller workforce and require less space, energy and materials**.

Innovation-driven shifts

The CPG industry is witnessing a surge in **packaging driven innovation** to solve significant distribution challenges, whilst meeting new requirements for product consumption/use. For example, in the pharmaceuticals sector, Pfizer has developed reusable GPS-enabled temperature-controlled thermal shippers to maintain ultra-low temperatures. Moderna offers multiple types of packaging to ease transport and distribution, including multi-dose vials, pre-conditioned -20°C shippers, full cases, and full or partial pallets that can be deployed in any healthcare setting. Smart packaging for pharmaceuticals can also address the problem of drug counterfeiting (a market that exceeds US\$200 billion) and medication adherence⁷ (a problem that holds the potential to save US\$100-300 billion per year).⁸

In addition, business model innovation that goes beyond product innovation often results in new ways of working. For example, the **trend of outsourcing** is on the rise, and it includes contract packaging and labelling, warehouse management, and production scheduling that must align with the supply chain.

Sustainability imperatives

Moving forward, **environmental, social and governance (ESG) imperatives** will take centre stage, especially because the younger generation takes into account all aspects of business when making a purchase decision for CPG products, including ingredient sources, business practices, and packaging materials. For example, recent studies show strong growth for locally sourced food, which might drive the trend of local food manufacturing. Consumer preference and willingness to pay a premium for local food is higher than willingness to pay a premium for other food attributes such as organic, fair trade and product origin. This will

In March 2022, 175 nations endorsed a historic resolution at the UN Environment Assembly (UNEA-5) to complete a draft global legally binding agreement on plastic pollution by the end of 2024 (to promote sustainable production and consumption of plastics, including, product design and environmentally sound waste management, through resource efficiency and circular economy approaches).

A shift to a circular economy can reduce the volume of plastics entering oceans by over 80% by 2040; reduce virgin plastic production by 55%; save governments US\$70 billion by 2040; reduce greenhouse gas emissions by 25%; and create 700,000 additional jobs.

- **UN Environment Programme**

⁶ Transformative Mega Trends Enabling Lights Out Manufacturing, Frost & Sullivan, May 2021

⁷ The WHO defines adherence to long-term therapy as "the extent to which a person's behaviour—taking medication, following a diet, and/or executing lifestyle changes—corresponds with agreed recommendations from a health care provider."

⁸ Global Pharmaceutical Packaging Growth Opportunities, Frost & Sullivan, November 2021

drive demand for smaller batch runs in closer proximity to sale and consumption.

ESG imperatives are also translating into 'innovating to zero' manufacturing processes, targeting **zero defects, zero waste, zero emissions and zero-accidents. Manufacturing-to-zero**, by its very definition, directly impacts outcomes. The goal is to eliminate manufacturing defects, manufacturing waste, manufacturing greenhouse emissions, and manufacturing-related injuries. This is translating into CPG companies increasing their expectations of processing and materials handling/assembly OEMs in terms of the commitments they make to such targets.

Implications for Processing and Materials Handling/Assembly Equipment OEMs

These shifts are prompting processing and materials handling/assembly equipment OEMs to rethink the value they deliver. **Machinery performance to ensure throughput** remains the continuing priority (a 2021 industry survey found that amongst CPG companies, over 80% mentioned 'throughput' in their top-3 drivers of investment in machinery).⁹

Apart from addressing this priority for throughput, in order to achieve mass customisation, address the needs of online retail, optimise workforce, increase supply chain resilience, facilitate innovation-driven competitive advantage and address sustainability imperatives, companies must shift toward **dynamic and agile manufacturing**. This means the creation of '**smart factories**' that interact with the connected environment using sensors and actuators, as well as provide interoperability between software and hardware components to create a flexible manufacturing architecture. Without this, machine flexibility to handle more diverse materials, sizes, and shapes becomes extremely difficult.

While smart manufacturing processes today offer plug-and-play services and a connected Internet of things (IoT) network, the cognitive capabilities of advanced manufacturing will also allow **adjustments to be made to accommodate different part variances for resilience, and self-optimisation for production efficiency**.

In all of these efforts, digital technologies will prove to be the critical enabler. For example, technologies that enable smart packaging features include sensors, radio-frequency identification (RFID), programmable alerts, quick response (QR) codes, near-field communication (NFC), and integrated transmitters. Significantly, while the extent of impact and transformation of these digital tools is self-evident, CPG manufacturers and materials handling/assembly end-users need help with ensuring easy and effective implementation.

In this **shift from traditional manufacturing to software-defined, flexible and intelligent manufacturing**, one critical area of focus is that of **motion control** that moves objects through the machine.

⁹ Packaging & Processing - Coming Through COVID-19, CPG Survey, PMMI, June 2021

The Future of Motion Control

The use of automated industrial motion control in manufacturing, materials handling and assembly environments has been driven by the ability to automate mundane and repetitive tasks, reduce cycle time, and thereby increase the throughput that gives companies a competitive edge. It has helped companies expand capacity beyond traditional shift hours and take on additional work orders to respond to burgeoning demand. Significantly, it has helped improve precision when performing complex tasks.

Whilst labour costs and shortages were the initial catalysts for industries globally looking to adopt automated industrial motion control, the further benefits of reduced error, higher consistency and quality of product, as well as reduced risk of safety hazards have improved the overall return on investment (ROI).

To help support **the move beyond traditional belts, gears and chains**, towards greater manufacturing flexibility in discrete processing, Schneider Electric offers the **Lexium MC12 Multi Carrier System with EcoStruxure Machine Expert Twin**.

Figure 3: Lexium MC12 Multi Carrier System



Source: Schneider Electric

The Lexium MC12 Multi Carrier System is an innovative transport system for **transporting, grouping, and positioning products** in CPG manufacturing, materials handling and assembly operations.

This solution delivers a range of unique benefits for equipment OEMs and end-users, including the following:

- Machine design quality is greatly improved because of **simplified engineering and a modular design**. Simplified mechanics allow ease of mounting (and replacing) of segments (by direct mounting from the top onto baseplates). This eliminates complicated assembly or disassembly



that is often required in the case of some multi carrier systems. Simplified engineering also eliminates complicated wiring (through the use of interconnection elements).

- Machine **installation and commissioning** is quicker and less onerous since the Lexium MC12 is simple to mount from the top and does not require extra tools for installation.
- Standard conveyor systems move product in one direction only, and with limited flexibility in terms of speeds. This means more stations to be installed in conventional settings to conduct distinct tasks (e.g. capping versus filling). However, with the Lexium MC12, carriers move independently of each other on track systems, and with individual velocity. This flexibility to run different tasks at different speeds and in different directions **reduces the need for multiple dedicated stations and supports optimal throughput.**
- The compact, curvilinear design makes it simple to build ovals where process components can be arranged on two sides instead of only one side. This reduces the overall **footprint of equipment.**
- Leveraging **EcoStruxure Machine Expert Twin** (Schneider Electric's digital twin¹⁰ solution), OEMs and end-users can model the machine digitally, connect the model to the Programmable Logic Controller (PLC) and test immediately. They can develop applications in parallel; testing and optimising the system before the actual start of operations. This ensures that OEMs can get their equipment to market quickly. Most importantly, the **digital twin simulation** helps identify the optimal number of carriers required, potential bottlenecks and waiting times, so that the optimal design is in place without the risk of expensive and disruptive reconfiguration or process changes thereafter. On an ongoing basis as well, the digital twin solution can support remote condition monitoring.
- **Tight integration** of the Lexium MC12 into the system results in reduced time and effort spent in the training of maintenance staff.
- **A cycle time of 1 millisecond** for carrier control allows modifying movement in real time, e.g. performing processes in synchronisation with the motion of other machine parts.

“Using EcoStruxure Machine from Schneider Electric, including the next - generation Lexium MC12 multi carrier system, will mean our operations are much more easily integrated. Our machines will be faster, more modular, and have a smaller footprint that saves us 30–40% in costs and gives us a 50% faster changeover time. We can also better service our leading multinational customers in the food industry with easier maintenance provided by a high performance digital solution.”

Federico Scornaienchi, Export Manager, Livetech
(machine systems for packaging, palletising, and chocolate moulding)

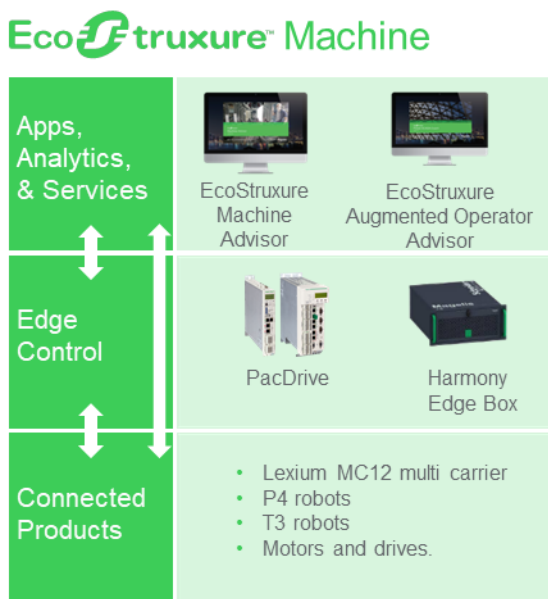
¹⁰ A digital twin is a digital model or replica of a physical asset, product, process, or system that allows users to have a digital footprint of an asset's or product's life, from the design and development phases through deployment and the end of the asset's or product's lifecycle. The connected digital twin (powered by modelling solutions, sensors, actuators, analytical tools, the internet of things (IoT), cloud computing, and artificial intelligence) enables businesses to proactively monitor equipment or processes, streamline operations and inform predictive maintenance

- Schneider Electric’s extensive **set of libraries** allows the use of pre-defined stations (e.g. for filling tasks or clamping tasks); making process configuration and modification faster and more efficient.
- Being **part of the open, interoperable, IoT-enabled system architecture and platform** from Schneider Electric (EcoStruxure Machine) allows users to leverage Lexium MC12 to add products on the fly or add assembly tasks on the fly without compromise to overall operational energy management, productivity, safety or cybersecurity goals. It also enables effective remote monitoring and predictive maintenance.

Reported enhancements from first customers of Lexium MC12 include:

- Up to 50% increase in machine performance and flexibility
- Up to 30% reduction of design and time-to-market
- Up to 50% faster machine installation and commissioning
- Up to 40% savings on investment costs
- Up to 20% savings on footprint¹¹

Figure 4: EcoStruxure Machine Solution including the Lexium MC12 Multi Carrier System



Source: Schneider Electric

Overall, the flexibility of product movement, grouping, positioning, stacking, and pick-and-place, as well as the enhanced diagnostics to minimise any downtime helps increase the **overall equipment effectiveness (OEE)**¹² of machines. In short, Lexium MC12 with EcoStruxure Machine Expert Twin provides flexibility without impacting throughput.

¹¹ Schneider Electric

¹² OEE is a key measurement of efficiency in manufacturing processes (at machine, manufacturing cell or assembly line levels), and is the cumulative impact of three factors – availability, performance and quality.

Conclusion

The CPG and discrete manufacturing industries are looking to OEMs for support on **deriving the maximum value from their equipment**. The response from OEMs has a significant bearing on end-user agility and the success they have in addressing consumer, channel, competitor and compliance-driven shifts.

For OEMs and end-users dealing with machines to handle discrete objects, **optimising in machine object transport is a critical success factor**. However, it is not merely a matter of replacing a conveyor line with a multi carrier system. It calls for **rethinking the machine** and moving from classical design to an **all-in-one, smart and flexible multi carrier system design**. This calls for long-term vision and an innovative, digital-first approach.

It also means working with a **trusted technology provider** with the high-performance system that can deliver decisive competitive advantage to end-users through **faster installation, reduced footprint, improved OEE and easier serviceability**. The leverage of digital twin technology will also help bring in **analytics-based decision making**, from installation through to trouble shooting and problem resolution during operations, so CPG companies can address the realities of today's market in an agile, profitable and sustainable manner.



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