

Digitalisation of Food Manufacturing

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Motivation

In a value chain driven by producers, ample availability, convenience, and low-priced foods (Food 3.0) are no longer enough for consumers. The shift from empirical to physics-based modelling offers the opportunity to move from the mass production-type of approach to target consumer groups with unique requirements, by responding to the main challenges of food manufacturing.

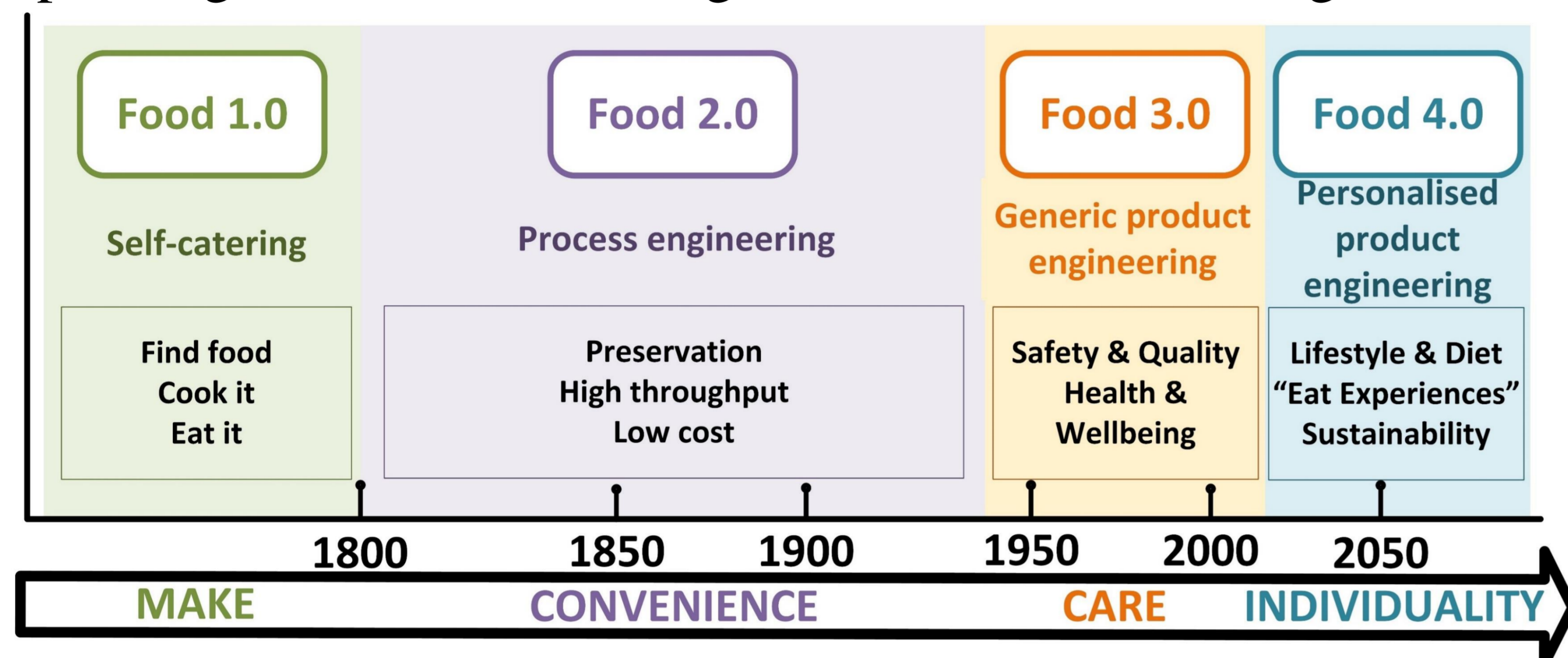


Figure 1: Evolution of food manufacturing

Challenges

Modelling for food engineering is challenging due to the multiscale nature of the phenomena and processes (Fig.2), the natural variability of food properties, and the difficulty for performing experimentation.

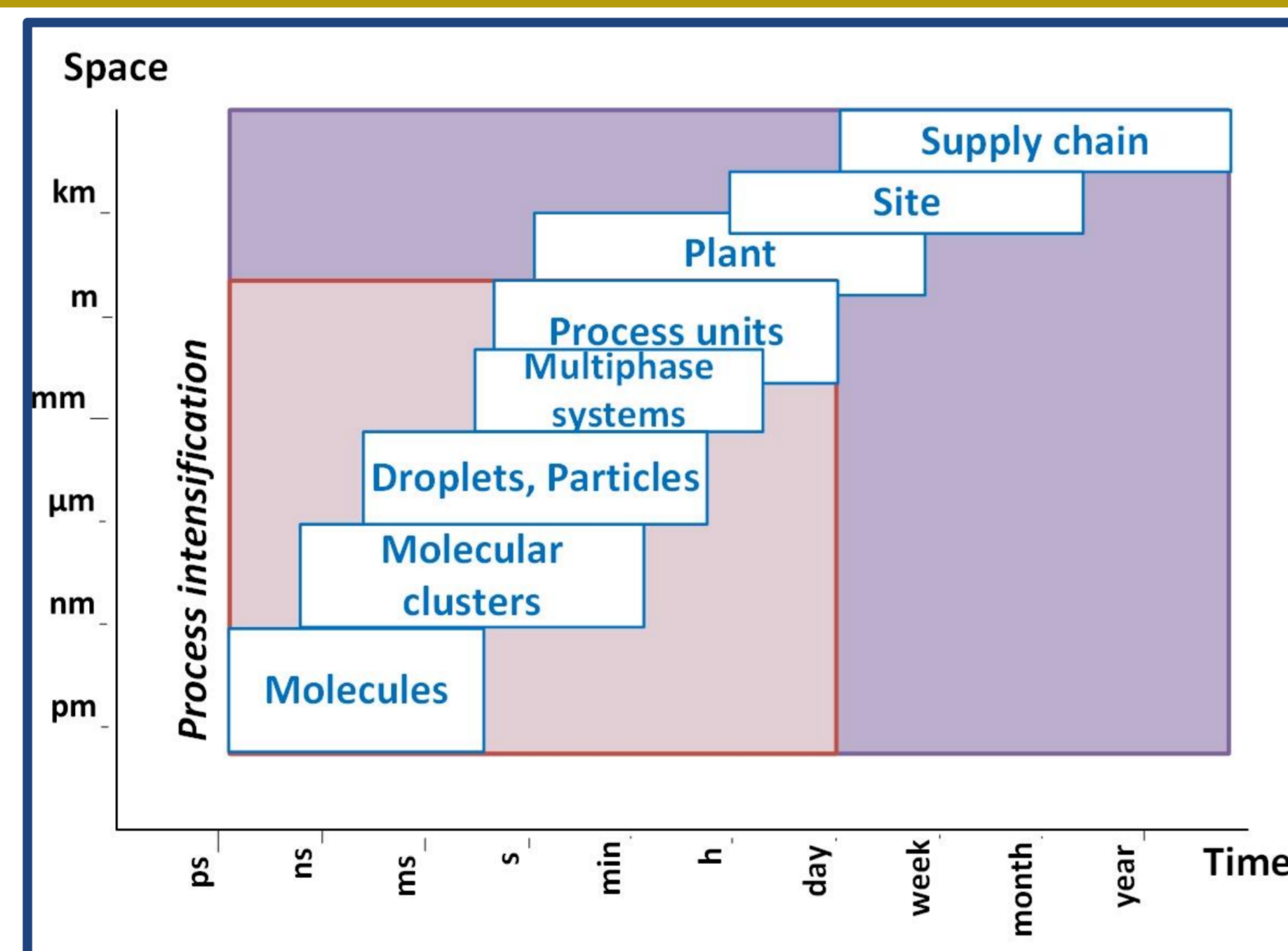


Figure 2: Multiscale aspects of food manufacturing

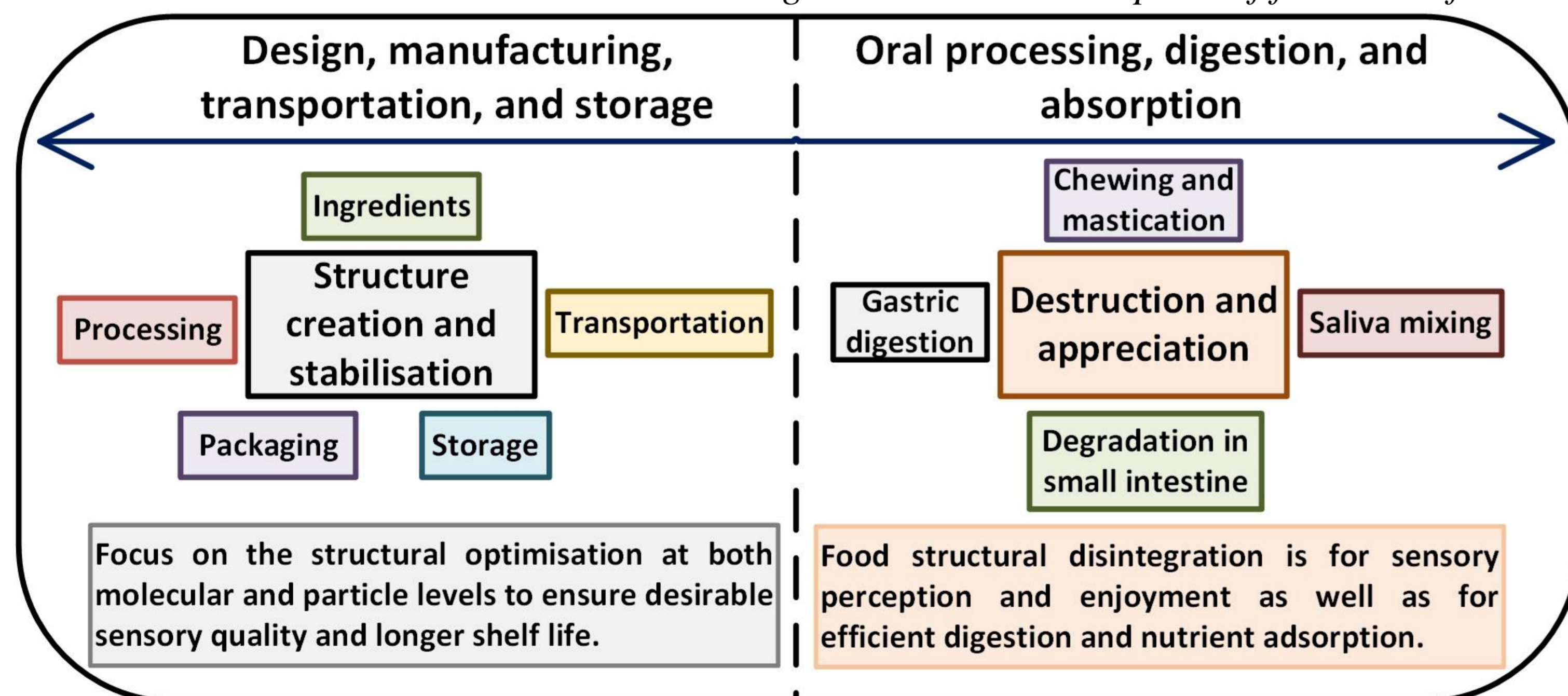


Figure 3: Structuring and destruction of food products

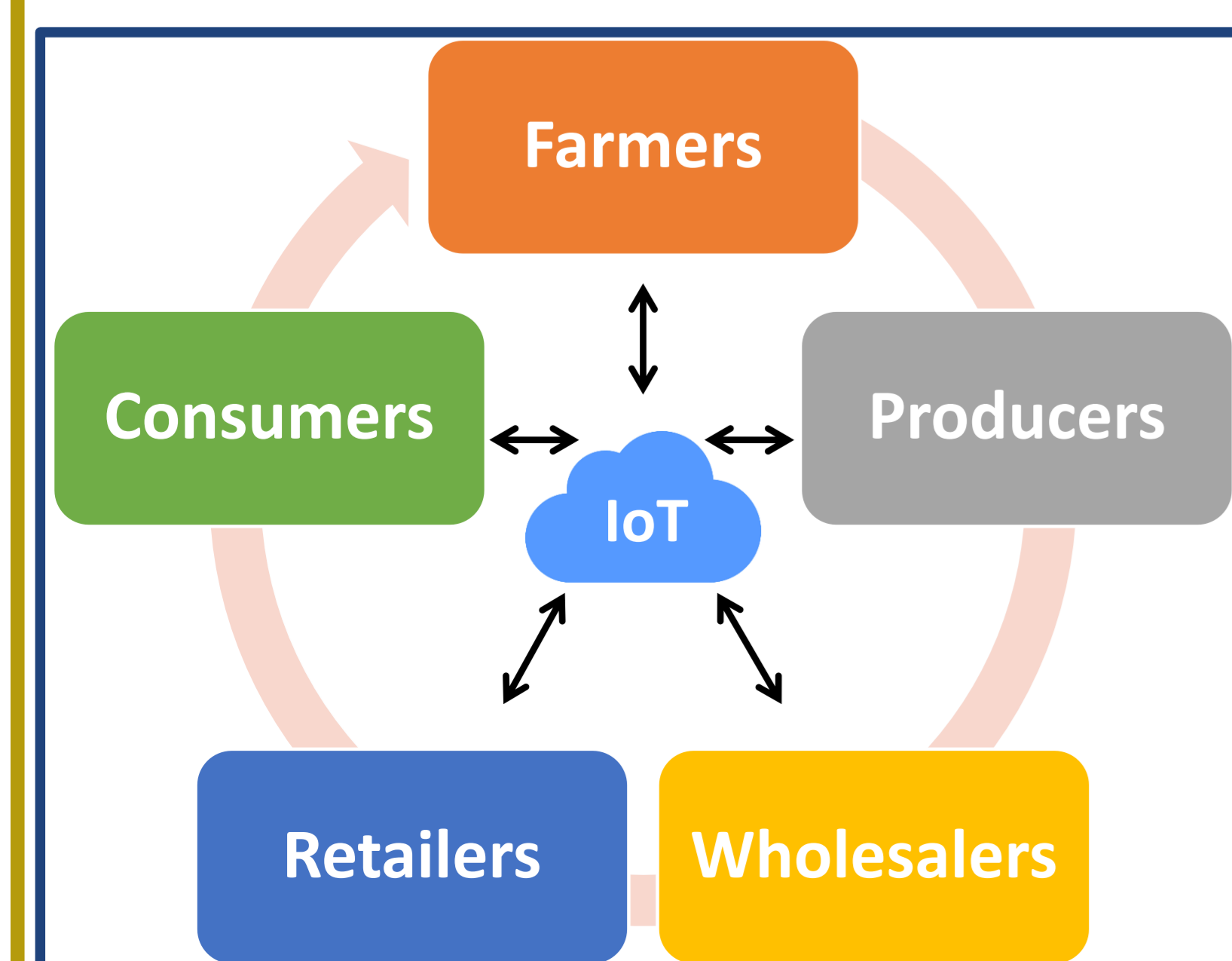


Figure 4: Flows in the food value chain

The physics of foods, processes, and human biology are not fully standardised for typical food products (Fig. 3). The food value chain is a complex network where the information does not move only from producers to consumers, but also from consumers to producers and other actors in the chain (Fig.4).

Aim

Develop a **novel approach** on exploiting the theoretical and technological progress in areas such as food science, food product and process engineering, food safety and security, human biological sciences, human behaviour, supply chain management, Internet of Things, big data analytics and artificial intelligence to obtain **digital models** of food manufacturing and food value chain related processes.

Approach

Virtualization of food processes into generic units that can be coupled in a modular manner (**Digital Production**) to obtain controlled product formulations (**Digital Products**) for targeted delivery of functional ingredients, which go through the digital twin of the human body and behaviour (**Digital Consumer**) for performance analysis (Fig. 5).

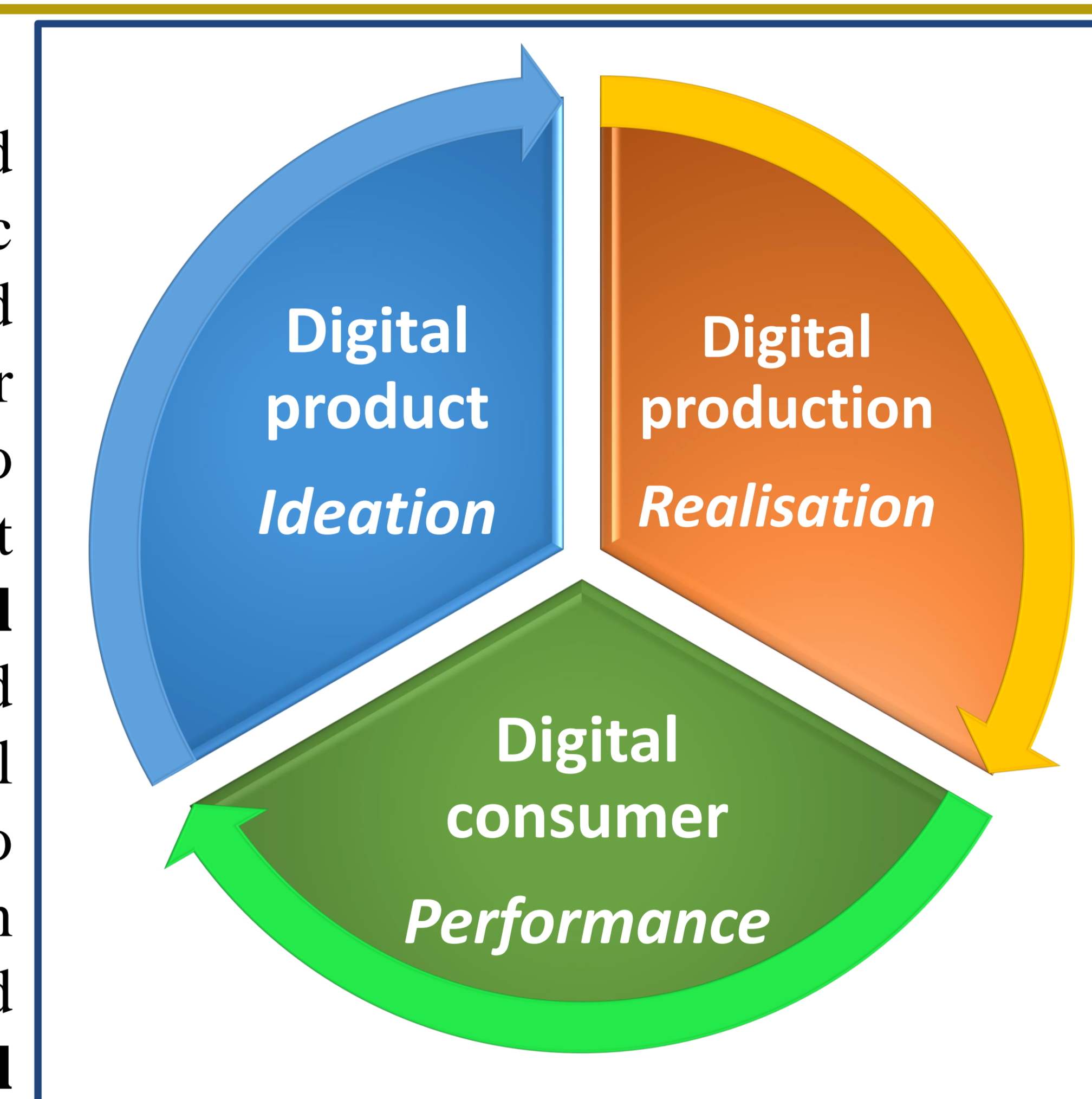


Figure 5: Digital food manufacturing

Deliverables

This will result in the development of an integrated solution of an adaptive **Digital Ecosystem Product – Process – Consumer** (Fig.6), that can be used to virtually simulate manufacturing of new products, predict crucial maintenance needs and adapt to consumer's requirements.

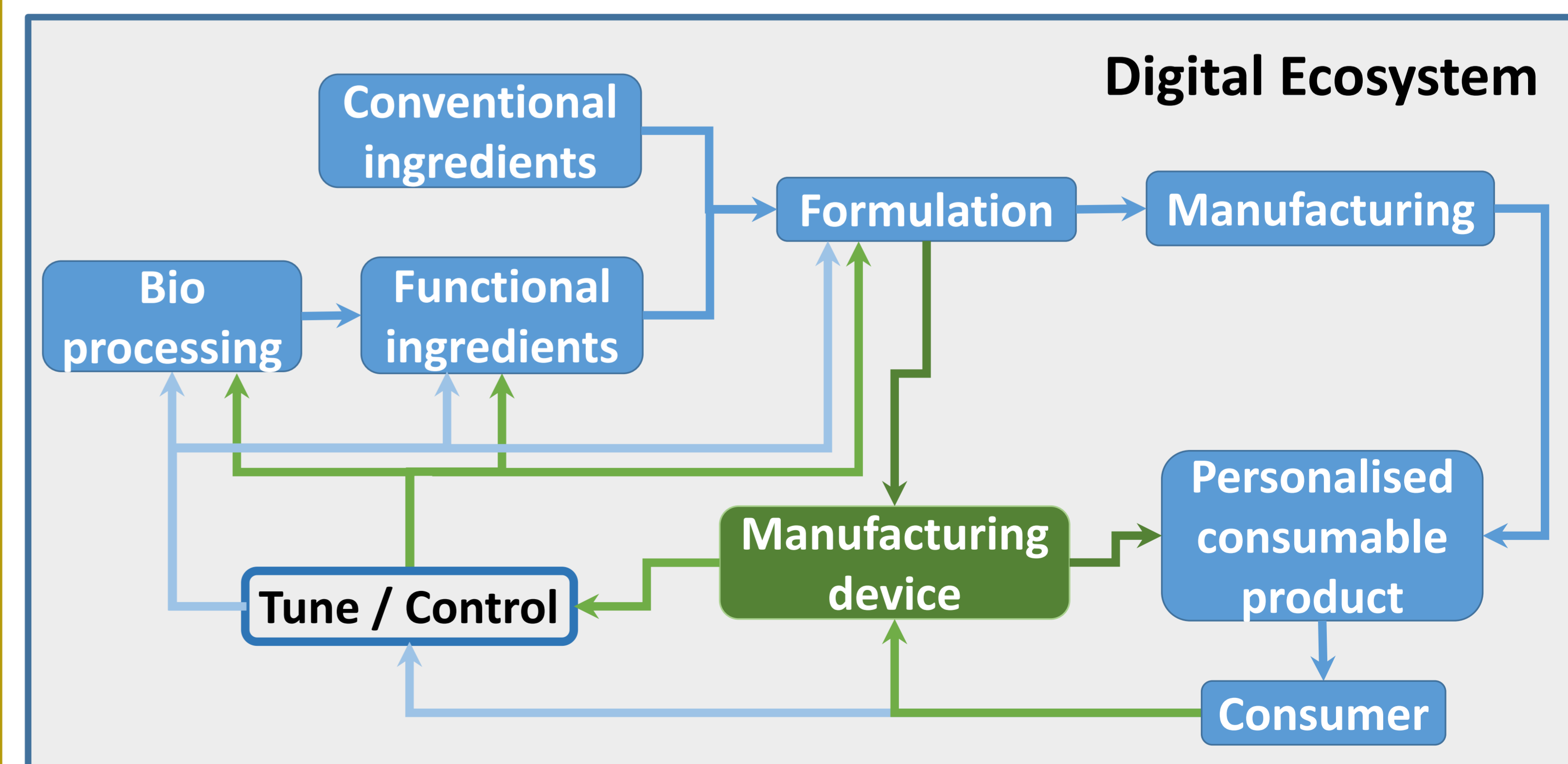


Figure 6: The Product – Process – Consumer Ecosystem

It will promote to a **complete rethink** of food manufacturing using *digital manufacturing technologies, intensification and integration using telescoping, agile supply chain methodologies* to respond rapidly, economically, accurately and flexibly to consumer needs.