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The available time span for food product and process innovation is steadily decreasing, and to increase the efficacy of the development cycles, systematic design procedures can be used to develop new and to redesign existing processes. The Conceptual Process Design (CPD) methodologies used in chemical industry might also be applied in the food industry to rethink their systems and to break down the complexity of problems into several hierarchical levels. The Delft design matrix, a combination of the iterative design procedure, hierarchical decomposition and task driven methods, is a promising tool which can cover the different objectives and criteria of food design. This article analyzes the potential applicability of Delft Design Matrix as a CPD methodology for food process design and illustrates its functionality with the design of a bakery production system.

Key Words: conceptual, process design, Delft design matrix, bakery

INTRODUCTION

Innovation in process development is an essential instrument for the food industry to stand out from competitors and to fulfill market expectations (Menrad, 2004). Hutcheson and Ball (1995) pointed out that an industry can only be successful if it can readily translate market opportunities into process and product development. Once an industry has defined a new product based on an identified market opportunity, it comes down to the process designer to translate the processing and production needs of this specific product quickly into a tailored and efficient solution. This is the concept of market driven design (*top-down approach*) where consumer preferences in terms of product quality are considered as the starting point of design. On the other hand, process design is often based on the opportunities created by new technologies or changes in existing lines, which are explored to create new products. This is known as technology driven design (*bottom-up approach*). Meanwhile, the time frame available for process innovation in food industries has steadily decreased over last decades. Boom et al. (2005) stated that to accomplish an innovation in a short time span, the development activities will increasingly rely on the use of current design methodologies. Next to new processes, it applies equally strong for the re-designing and rethinking of existing processes.

For design problems, a design framework is needed that helps: (i) to organize the information, (ii) to break down the problem (iii) and to aid the selection from different alternative solutions. Conceptual process design (CPD) is a methodology applicable in the early stage of (re-) design of production systems (Boom et al., 2005) and to organize process development based on specified external needs (Li and Kraslawski, 2004). It has been reported that streamlining the design according a CPD approach could result in total cost savings of about 20–60% (Harmsen, 2004). The idea of CPD was initially developed in the chemical engineering area from the basic design procedure which iterates over a synthesis and analysis phase to meet the specified criteria. Douglas (1988) introduced a way to decompose the overall layout of a process in a hierarchical organization, to find new configurations for series of unit operations. The classic iterative design cycle and decomposition methods are typically used in forward design fashion, driven by the experience with available technology. Siirola (1996) proposed a CPD- approach

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