Chapter 13
Integrated Production and Information Process Modeling for Decision Support in Quality Management

R.J. Lehmann
University of Bonn, Germany

R. Reiche
University of Bonn, Germany

M. Fritz
University of Bonn, Germany

G. Schiefer
University of Bonn, Germany

ABSTRACT
Enterprises in the agri-food sector are challenged by an increasing number of public and private requirements regarding traceability, food safety, food quality and other aspects of sustainability, which has lead to a growing number of information system development and process (re-)design activities. Decision makers need to identify sector and enterprise requirements, transfer them into interrelated production and information process models, develop decision alternatives and evaluate the achievement for the given objectives considering different possible future scenarios. An integrated modelling approach for quality management is presented, which supports decision makers to come to a well-founded decision by integrating functional, behavioural and informational supply network models using the Unified Modeling Language (UML) and discrete-event simulation.

INTRODUCTION
Enterprises in the agri-food sector are more and more confronted with requirements regarding the provision of product information and product guarantees on traceability, food safety, food quality and other aspects of sustainability, coming from legislation, customers at various stages along a supply chain or network, and consumers as the final customers. As a consequence, quality management
is challenged to improve information logistics, which has lead to an ever growing number of information system development initiatives and process (re-)design activities. To be able to cope with new challenges and to eliminate inefficiencies in existing production and information processes, enterprises need support at identifying, analysing and documenting relevant requirements and related processes to provide a basis for developing decision alternatives with which a well-founded decision can be reached.

Most existing modelling approaches focus on intra-enterprise production and information processes and include other actors of a supply network only with secondary interest. The few approaches suitable for supply chains and networks show weaknesses as they only consider a description of production and information processes but do not support the decision maker in developing decision alternatives. As a consequence, existing modelling approaches have to be improved by integrating interrelated functional, behavioural and informational views of whole supply networks into one model and to take these models as a basis for developing and evaluating decision alternatives which consider different possible future scenarios. However, with regard to modelling interrelations between production and information processes, traditional system modelling approaches have limitations. Due to the fact that availability of information plays a decisive role for quality management in food production, it is indispensible to be aware of such interrelations to be able to understand and improve production and information processes. The complexity of food supply networks and the resulting multitude of interacting elements require models, which allow for analysing the different elements in separate but interrelated views with different levels of abstraction. The different modelling views as well as their interrelations are presented using a simplified food supply network consisting of the levels “production,” “processing,” and “retail.”

It is the objective of this book chapter to introduce an integrated supply network modelling framework, which supports decision makers at developing decision alternatives on basis of interrelated production and information process models. This includes the introduction of a requirement model as well as of static and dynamic production and information process models, which focus on the interrelations among these processes. The following section (section 2) presents requirements for food supply networks and current approaches to supply network modelling and simulation. In section 3 the static and dynamic modelling of processes and their interrelations are introduced. For the static modelling, representing the supply network at a fixed point in time, the Unified Modeling Language (UML) is used. The UML represents the de facto modelling standard for object oriented software design (Kobryn, 1999). In addition, it is widely accepted as standard for business process modelling (Kreische, 2004). For the dynamic part of the modelling discrete-event simulation is used, which allows decision makers to evaluate impacts of a decision over time, giving the possibility to develop decision alternatives in consideration of different possible future scenarios. Section 4 presents a framework, which integrates static and dynamic supply network models to support quality management at reaching well-founded decisions at the complex problems they are presently confronted with. Section 5 summarises the book chapter, concludes the discussion and gives suggestions for further research.

**REQUIREMENTS FOR FOOD SUPPLY NETWORK MODELLING AND AVAILABLE METHODS**

The global food sector is presently confronted with several important developments and trends such as a growing demand for bio-energy, limited availability of sweet water, diminishing production resources (Standing Committee on Agricultural Research, 2007) and the increasing consumption...

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