Adaption of the Design Thinking Method for Production Planning in the Meat Industry Using Machine Learning Algorithms

Authors : Alica Höpken, Hergen Pargmann

Abstract : The resource-efficient planning of the complex production planning processes in the meat industry and the reduction of food waste is a permanent challenge. The complexity of the production planning process occurs in every part of the supply chain, from agriculture to the end consumer. It arises from long and uncertain planning phases. Uncertainties such as stochastic yields, fluctuations in demand, and resource variability are part of this process. In the meat industry, waste mainly relates to incorrect storage, technical causes in production, or overproduction. The high amount of food waste along the complex supply chain in the meat industry could not be reduced by simple solutions until now. Therefore, resource-efficient production planning by conventional methods is currently only partially feasible. The realization of intelligent, automated production planning is basically possible through the application of machine learning algorithms, such as those of reinforcement learning. By applying the adapted design thinking method, machine learning methods (especially reinforcement learning algorithms) are used for the complex production planning process in the meat industry. This method represents a concretization to the application area. A resource-efficient production planning process is made available by adapting the design thinking method. In addition, the complex processes can be planned efficiently by using this method, since this standardized approach offers new possibilities in order to challenge the complexity and the high time consumption. It represents a tool to support the efficient production planning in the meat industry. This paper shows an elegant adaption of the design thinking method to apply the reinforcement learning method for a resource-efficient production planning process in the meat industry. Following, the steps that are necessary to introduce machine learning algorithms into the production planning of the food industry are determined. This is achieved based on a case study which is part of the research project "REIF - Resource Efficient, Economic and Intelligent Food Chain" supported by the German Federal Ministry for Economic Affairs and Climate Action of Germany and the German Aerospace Center. Through this structured approach, significantly better planning results are achieved, which would be too complex or very time consuming using conventional methods.

Keywords : change management, design thinking method, machine learning, meat industry, reinforcement learning, resource-efficient production planning