Business process support using RFID-based information services in the distribution of fresh fruits and vegetables

Robert Reiche, Richard J. Lehmann, Melanie Fritz, Gerhard Schiefer

Professur für Unternehmensführung, Organisation und Informationsmanagement
Rheinische Friedrich-Wilhelms-Universität Bonn
Meckenheimer Allee 174
53115 Bonn
robert.reiche@uni-bonn.de

Abstract: The efficient distribution of fresh produce poses many challenges to enterprises in the fruit and vegetable sector. The exchange of product- and process-related information between actors in this network is crucial for improvement of process efficiency. In this paper we discuss a conceptual organization scheme for RFID-based business information services for improving food safety and increasing efficiency in the distribution process along the supply chain. The discussed business information service organization is of generic nature and can be adapted to other food supply networks as well.

1 Introduction

Food safety, traceability and consumer perception on quality, variety and convenience of fresh produce as well as their distribution and trade-processes are of paramount importance for the market success of enterprises in the agrifood sector [Ha08]. However, meeting those demands poses new, continuously changing challenges to the enterprises. Such challenges arise from mistrust and the resulting between the production/trade and retail companies in the sector. The adaptation of information and communication technology (ICT) for information exchange is an important key factor for increasing the competitiveness of the agrifood sector, by increasing inter-enterprise coordination and therefore reduction of transaction costs [BD09]. The development of information and communication services requires the adaption of new information technology and restructuring of the current information organization. Missing or incomplete information on a product, such as product laboratory results or certification information, can have a negative effect on distribution even if the product is in an uncritical condition [Sc08]. In this paper we discuss a conceptual organization scheme for improving the communication and the business process support in the distribution of fresh fruit and vegetables.

2 Conceptual Organization of RFID-based information services

RFID-based information services focusing on fruit and vegetable chains are poorly developed. The benefits of RFID-tags are rated perceptively lower than the costs of available tags by various actors in the chain. An impulse to change this assessment could be the development of chain-focused information services for increasing collaboration

and competitiveness. Insights from the European CERP-cluster project CuteLoop showed that this kind of information services can contribute to a number of current problems from a sectoral level down to enterprise level, by developing static and dynamic information services and networked enabled intelligence [CL09].

Actors in the agrifood sector are challenged by documentation of product information including quality information as well as tracking and tracing information. In the last decade the need for documentation increased due to the introduction of the European food law. While enterprises developed and still develop solutions coping with these issues, a high number of different systems are available and product information collected and stored with high efforts. While the fruit and vegetable chain is represented by a straightforward linkage of a few stages in production and trade, the needs for the delivery of trustworthy quality guarantees, quality preservation and organizational efficiency are of paramount importance. Fruits and vegetables are perishable products where quality is the focus of public and private regulations based primarily on food safety concerns that require an appropriate control of a variety of parameters in production and logistics.

Inter-enterprise information exchange enables the increase of efficiency in the distribution of fresh produce. Critical success factors in efficiency considerations are related to the very early and later stages of the chain. They concern the timely delivery of packaging materials and the timely delivery of products to retail. For the delivery of fresh fruits and vegetables, the time of delivery to retail according to agreements is crucial as products cannot be stored or, if delays occur, sold at other times for which other orders have already been placed. Apart from information on harvest times, the monitoring of inner- and cross-country product movements through the chain and especially of the transport situation in the final stages, including delays due to traffic conditions, is of high relevance. The development of static and dynamic product- and process-related information services supporting decision makers in the distribution process requires a change in the information organization of the enterprises in the supply chain of fresh produce.

Organization of information for enabling information services

The organization of product information is in most cases batch-centric because of the large amounts of one product managed by the trading organizations [Ha08]. A product batch is characterized by its cultivar, origin, harvest date and other product related information like laboratory results from pre- and post-harvest laboratory analyses. For enabling the organization of product information on a crate base, this batch-centric information scheme has to be extended by adding unique crate identification numbers. These ID numbers are often directly attached to the crates by the service providing companies such as Euro Pool System or IFCO. The collection of crate IDs can be realized by RFID or traditional barcode scanners. On the one hand bulk scanning with RFID-scanners is more costly, but more efficient and on the other hand single crate barcode scanning can be directly used, because of its availability. Based on that requirement RFID-based information services can be established by providing the unique crate ID to the product supplier and requested information can be provided for a collection of crates in a specific delivery.

Technological development and the application of mobile networked devices

The development of RFID-based information services is not only depending on the re-organization of information but also on the implementation of mobile networked devices, which enable the information provision to the place in the workflow where and when information is needed as well as in a form, that can be easily anticipated by the user. Mobile networked devices are devices, which are able to connect to different internal and external communication networks from different locations within the enterprise without a fixed cable connection. The implementation of RFID- and/or barcode scanning abilities is crucial for implementation into the distribution workflow and connection to the RFID-based information services.

Organization of a RFID-based information and communication service structure

The distribution of fresh produce is time critical due to post-harvest quality degeneration of the products. If a delay in the transportation occurs, distribution centres are often forced to re-organize and to procure replacements to fulfill their orders and keep their distribution schedule. Information services can be a contribution to reduce complexities by requesting required information and the rule-based evaluation (NDEI) of received information responses. Fig. 1 presents a generic organization diagram for the business information service setup.
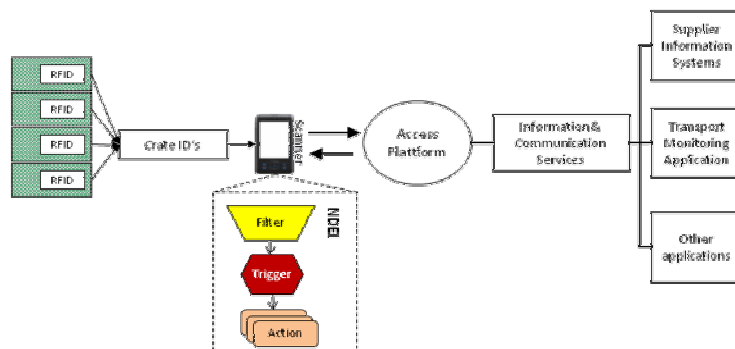

Fig. 1 Generic organization diagram for RFID-based information services

The workflow depicted in Fig. 1 is based on crate IDs, which are received from the RFID-tags at the product reception. These IDs are used to formulate a request for information at an access plattform. The structure of the access plattform allows requesting information from multiple linked applications based on the crate ID. The response from the access plattform is received by the scanner (mobile networked device). The evaluation is carried out by pre-defined the rule-based filter and trigger functionalities and an appropriate action is presented to the user. To provide an example, these actions can include the triggering of a task in the distribution process or other related actions, such as the elimination of a product from the distribution process due to in the laboratory results.

The provision of trustworthy quality guarantees, the monitoring and control of changes in quality during the product flow between trade and retail, and the monitoring of

transport situations build on applications that collect and process the necessary information and on the availability of appropriate network based and flexible communication services that serve the information needs of actors within and beyond the chain and provide the link between production, trade, retail and third party service providers.

3 Discussion

Willingness to share information between actors in the chain is not well established, because of mistrust between the production and the retail level of the chain. To overcome this issue, chain actors have to settle agreements, which information is of value for which actor and can be provided. However, the exchange of information with a competitive impact was mostly rejected in the past from the producers. Examples for information service content can be found in literature (e.g. [LH10]). The adoption of RFID and RFID-based applications and services is still in the initial phase [GW08]. Currently, RFID-tags are presented as an alternative in the identification of transport units to commonly used barcode based identification tags. Barcodes still the state of the art identification mechanism. Another aspect, which requires further research, is the ability to adopt needed the ICT infrastructure as well as an RFID-based product tracking and tracing within the enterprises in the chain. The previous discussed reorganization of information as well as the needs expert knowledge, which is seldom available in small and medium agrifood enterprises. The business process support can increase by the provision of needed information for decision making. Because of large amounts of available and provided information, a pre-evaluation of received information is crucial to disburden actors from separating required from not required information according to their needs. Rule-based decision support by networked device enabled filter and trigger components can support this decision support.

References

[BD09]   Bunte, F.;Dagevos, H. (2009) „Part 5 – Conclusions -Anticipating the future of the food economy" In: „The Food economy global issues and challenges" Bunte, F., Dagevos, H. (2009) eds., Wageningen Academic Publishers.

[CL09]   "The CuteLoop Concept" (2009), CuteLoop project report, available at: http://www.cuteloop.eu.

[Ha08]   Hannus, T. (2008) Informationsmanagement im betrieblichen Qualitätswesen - Umsetzung in der Agrar- und Ernährungsindustrie.

[LH10]   Lehmann, R. J., Hermansen, J. E. (2010). Information Deficiencies in European Pork Chains. Report A-10/1. In: Schiefer, G. (ed.): Informationsmanagement in der Agrar- und Ernährungswirtschaft, Universität Bonn-ILB Press.

[GW08]   Gampl, B., Wolfram, G. (2008) „Conclusion" In: Wolfram G., Gampl, B., Gabriel, P. (eds.) „The RFID Roadmap: The next steps for Europe", Springer Verlag.

[Sc08]   Schröder, A.B. (2008) „Produktinformationen und Informationsverarbeitung beim Import von Lebensmitteln - Eine empirische Untersuchung -„ , Culliver.