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QUANTIFYING THE VALUE OF RFID AND THE EPCGLOBAL ARCHITECTURE FRAMEWORK IN LOGISTICS – A TECHNOLOGY-BASED APPROACH TO EVALUATE AND BILL PRODUCT-RELATED INFORMATION IN AN INTERNET OF THINGS

First reviewer:	Prof. Dr.-Ing. Bernd Scholz-Reiter University of Bremen, Germany
Second reviewer:	Prof. Ph.D. Bill C. Hardgrave Auburn University, USA

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The following adjustments have been made: the German abstract has been deleted, copyright statements have been added where appropriate and Springer formatting rules have been applied.

"If we could measure the value of information itself, we could use that to determine the value of conducting measurements. If we did compute this value, we would probably choose to measure completely different things. We would probably spend more effort and money measuring things we never measured before, and we would probably ignore some things we routinely measured in the past."

Douglas Hubbard, *How to Measure Anything: Finding the Value of "Intangibles" in Business* (2010, p. 99) – introduction to the chapter *Measuring the value of information*

Abstract

RFID and the Internet of Things have influenced researchers as well as companies throughout the last decade. The "EPCglobal Architecture Framework" is currently the most accepted technical approach to the Internet of Things and provides a solid foundation for building Business-to-Business information networks based on unique identifications of 'things'. Lately, the vision of the Internet of Things has been extended to a more holistic approach that integrates sensors as well as actuators and includes non-business stakeholders.

Research institutes have forecasted substantial growth rates for RFID especially in supply chain networks. However, these estimations continuously had to be reduced over the last years. This dissertation shows that one reason for this is that successful implementation of RFID in supply networks most often requires participation of multiple stakeholders, but costs and benefits are not evenly distributed and some companies may currently not find a business case at all. Mandating has failed in most industries as a means to push information suppliers into using RFID and the EPCglobal Architecture. Alternative Cost Benefit Sharing approaches are limited in their scalability and fail to quantify the value of RFID and the EPCglobal Architecture in logistics, as there are many intangible benefits that are difficult to measure. A detailed look at the current state of the art in research concerning cost and benefit estimations is provided and the limits of Cost Benefit Sharing for RFID-based IT-infrastructures are explained.

There is an alternative approach to quantify the value of IT-investments apart from cost- or benefit-based value estimations that has not yet been researched in detail, though. In this dissertation, a market driven value calculation that uses the sales value of information as a definite financial measure is chosen. Considering the low individual value of product information, such as a 'best before date', there have to be simple technical means to measure and aggregate these micro values to a billable amount. The necessary requirements for a corresponding electronic billing infrastructure are defined and a matching e-billing solution for a prototype evaluation scenario is selected to connect information queries and information prices, thus providing a technical infrastructure to evaluate and bill product-related information in a future Internet of Things based on an extended EPCglobal Architecture.

The model of a billing-enabled EPCglobal Architecture is verified through a lab-based scenario for the beverage industry. Further opportunities and threats of the provided solution are discussed to provide an overview of its future potential. If the willingness to pay for information increases, the suggested solution provides improved measurability, quantification and optimisation of information value, thus enabling new business models based on product- and supply network-related information sales in the Internet of Things. As a result it will contribute to the sustainable success of the Internet of Things itself.

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