The Impact of Trading Digital Products on Retail Information Systems

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Abstract

Current research activities in the area of trading intangible content usually focus on specific legal or technical problems, neglecting the underlying business models and their implications on retail information systems. There is a need for a framework to structure the diverse research efforts. In this paper trading of digital products is positioned within the wider field of electronic commerce. Then business models for procurement and distribution of digital products are established. The Retail-H-Model, a framework for retail information systems originally developed for traditional retailing, is introduced as a structural framework for dealing with digital product trading issues. Some of the underlying functional models are examined and adapted in order to fulfil the requirements for trading digital products. The paper concludes with an outlook on future research activities.

1 Motivation

The technical developments in information and communication technology as well as the growing commercialization of the Internet in the business-to-consumer area have given companies trading digital content a new distribution channel. Many of the business challenges resulting from the use of new business models have been neglected so far. The existing research focuses on selected legal (e. g. intellectual copyright) or technical (e. g. cryptography) subjects, disregarding the underlying business models and their implications for the design of retail information systems (RIS).

The design of information systems to support all aspects of trading digital commerce is a task, that so far lacks a guideline in the form of a reference model. In addition there is a need for a structural framework to order the existing research efforts and thereby structure the research in the area of trading intangible content, detecting areas neglected so far and finally creating a consistent research map. The Retail-H-Model [1] poses as a structural framework for RIS.

The first hypothesis to be proven within this paper is that the basic structure of the framework applies to the trade of digital products, as well as physical products. The second hypothesis states, that the underlying function-, data-, and process-models need to be adapted to be able to handle the specific requirements for trading digital products. By looking at a number of selected functional models the necessary adaptations will be exemplified, the data and process models need to be adapted accordingly. Having proven these two hypothesises the Retail-H-Model can then be used as a framework for developing RIS, and as a map, on which to position research related to the trade of digital products.

2 Introduction of Terms

2.1 Digital Commerce

The first step in any scientific discussion is to define the specific area of interest. WHINSTON et al. [13] define electronic commerce as "[...] the use of electronic means and technologies to conduct commerce, including within-business, business-to-business, and business-to-consumer interactions." Further limiting the scope is the introduction of the term fully digital commerce, which can be found if players, processes and products are in digital form, as presented in Fig. 1. Fully digital commerce will be the focus of the discussion within this paper.

Only when dealing with digital products is it possible to have digital processes, since the delivery process otherwise has to be a physical one. There is a number of properties specific to digital products, which are the reason for changes in the structure of the topics addressed in retail information system design.

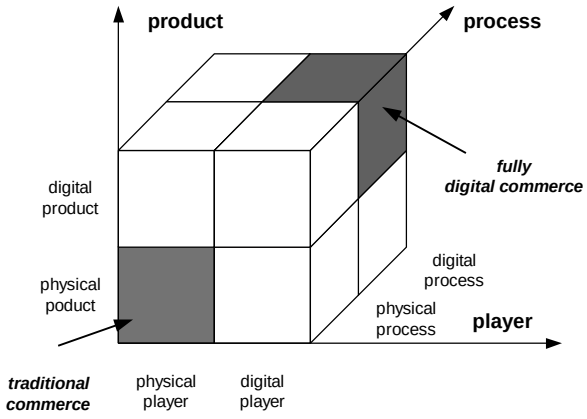

Fig. 1: Levels of Electronic Commerce

2.2 Digital Products

A number of different terms are being used in the discussion about digital products [13], e. g. intangible content, soft goods, information products. For the purpose of this investigation we will use the term digital products referring to On-line Delivered Content (ODC), a class of products introduced by LOEBBECKE [5]. She defines ODC as "[...] data, information and knowledge traded on the Internet [...]" and further limits the scope to include "[...] those products that consist only of content and whose total value therefore can [be], and usually is, produced, traded, and delivered on-line". The aspect of unbundled delivery, i. e. delivery without a physical transport media like a printed book or a CD, poses as the main characteristic for ODC. Another important aspect is the focus on content, explicitly excluding symbols or tokens representing rights to services in the real world (such as airline or concert tickets). Diverging from the definition given by LOEBBECKE, we do include software that is delivered on-line in our definition of digital products.

Digital products have certain basic characteristics, which greatly influence the business models in which they can be traded. WHINSTON [13] identifies indestructibility, transmutability and reproducibility. Indestructibility indicates that there is no wear and tear with the use of digital products. The number of uses does in no way reduce the quality of the product and there is therefore no need for consumers to replace the product once obtained. In order for repeat sales to occur mechanisms like versioning need to be implemented. These mechanisms change the product, making it necessary for the customer to, once again, buy it.

Transmutability means that digital products are very perceptible to change. This allows for customized / personalized products to be created and delivered to the customer. In a paper publication setting it is not economically feasible to produce individual versions of a magazine for each reader according to their personal preferences. The product traded in this context is the magazine, not the individual article. In a completely digital setting this changes, causing new challenges for the supporting information systems.

Probably the most noteworthy aspect of digital products is their reproducibility. This implies, first of all, that the marginal cost of producing a copy of a digital product are almost zero. Any pricing model used in trading digital products therefore needs to reflect the first copy costs and can hardly be based on marginal cost. In addition to this cost centered effect there are also implications for storage management. Not only are the costs, but also the time required for producing a copy is marginally low, making it completely unnecessary to store multiple copies of the same product. The ease of reproducing products is also the cause for one of the main obstacle in Digital Commerce. The protection of copyrights is a question posing both technical and legal questions, yet to be solved. For a successful approach to designing information systems for trading digital content all of these issues need to be addressed.

The combination of the aspects of transmutability and reproducibility leads to massive changes in the storage management function of retailing companies. Not large quantities of a comparably small variety of identical products (e. g. 100.000 copies of a CD) need to be stored, but rather single copies of a large number of different items (e. g. 12 songs per CD, or 100 articles for an issue of a magazine).

2.3 The Retail-H-Model

Frameworks have been introduced in software development in order to facilitate the design of information systems. These frameworks can either be generic like the ZACHMAN [14] framework or domain-specific like the CIM-Y [11] for production planning and control (PPC) systems or the Retail-H-Model [1] for retail information systems. A very important side effect of these frameworks has been their use to structure research topics pertaining to the specific areas covered within the framework. The Retail-H-Model has been used in a number of projects and has proven to be a valuable guideline in retail information system development, when dealing with physical products. It allows to organize all relevant functions, processes and data-objects. The Retail-H-Model represents the merchandise information system (the "H") as well as the necessary business-administrative functions, which form the foundation, and the control and decision functions, which make up the "roof" of the model.

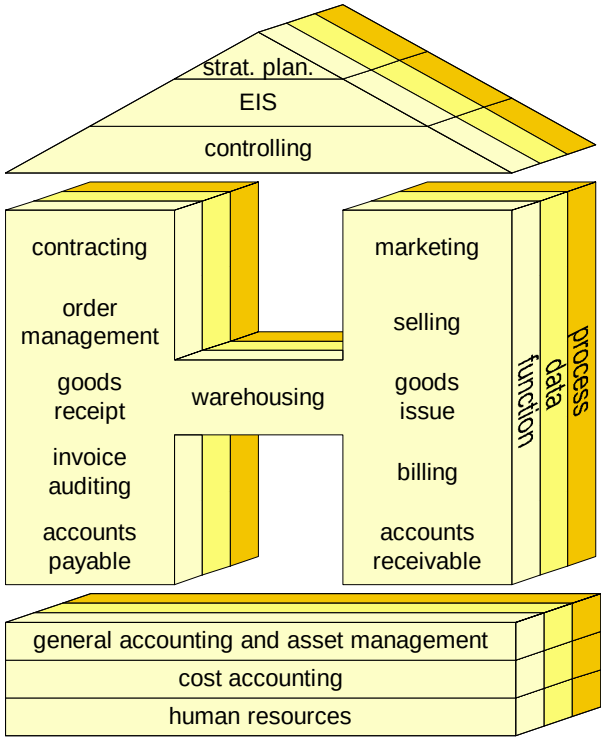

Fig. 1: The Retail-H-Model

The left leg of the "H" represents from top to bottom the procurement process of the retailing business consisting of the functional blocks of contracting (i.e. specifying master data and contractual agreements with suppliers), order management, goods receipt, invoice auditing and accounts payable. An analogue structure can be found in the right leg representing the distribution process in retailing. The gap between the two processes is bridged by the warehousing function.

We believe that the structure of this proved framework can be a valuable guideline for the discussion about trading digital products. Business models have been proposed, where no retailer is involved in the distribution of products [2]. Other scenarios include intermediaries within the value chain [10]. These intermediaries are faced with the problem of designing information systems to handle all aspects of trading digital products. Setting up a storefront on the WWW is not enough to support a successful distribution of digital products. Even when no retailer is involved in the process, most of the described functions will be part of the value chain, in this case performed by either the supplier or the consumer.

In the business scenarios we are looking at, the number of sub-functions unchanged or at least having an analogous counterpart in traditional retailing by far outweighs the unique functions found in retailing digital products. We therefore propose to adapt the Retail-H-Model to the specific requirements of digital product retailing, thereby gaining a point of reference that has proven its use in practice.

3 Business Models for Trading Digital Products

Before looking at detailed changes for the specific functional building blocks of the Retail-H-Model, the underlying business models need to be specified. Due to the specific properties of digital products, especially the reproducibility and the ability to be transported over networks, new business models need to be implemented on the procurement as well as the distribution side of the retailing "H".

3.1 Business Models for Procurement

Four different forms of contractual agreements between suppliers and retailers can be distinguished. First of all it is possible for the retailing company to obtain all rights pertaining to the product in question, secondly a time-restricted distribution contract can be obtained. The third alternative consists of buying a specified number of licenses for a product, which then need to be stored and redistributed. The last method is a consignment process in which the retail company stores the products, sells them and afterwards pays the producer according to the number of copies sold. Each of these business models poses special demands on the supporting information system, e. g. in the last business model a function has to be implemented that allows to calculate the financial obligation towards the supplier, based on the number of copies downloaded.

3.2 Business Models for Distribution

Focussing on the distribution process different methods of financing the offered products and services can be observed. First of all, the method most commonly used today, is financing via advertising. Secondly a number of companies have tried to offer content on a subscription / membership basis. Both methods require the user to repeatedly use the service offered by the retailer to be profitable. Therefore only products that are either constantly changing, like news services, or that can only be used in small units, such as database queries are suitable for these business models. They are not as closely related to traditional retailing processes, where the customer pays a specified amount for each product. However, a number of the tasks that constitute the functional requirements for retailers, e. g. bridging the temporal and spatial gap between production and consumption, are being fulfilled.

Therefore these business models are included within this research approach. The third distribution model is the selling of copies / licenses for individual products. The fourth is a payment scheme based on volume or online time. The third business model most closely resembles traditional retailing processes, since in this case individual products (licenses for digital content) are being traded. In this case the content can be reproduced at will, but the number of licenses available is limited and needs to constantly be monitored by the information systems.

3.3 Compatibility of Business Models

The presented business models can not be combined at will. Restrictions posed by the business models prevent certain constellations. It is for example not possible to buy a fixed number of licenses (procurement business model three) and finance the distribution via advertising (distribution business model one), because in this case the retailer has no control over inventory and can not control the number of licenses distributed. The following table shows possible combinations of procurement and distribution business models.

distribution / procurement	**advertising**	**subscription**	**licenses**	**volume**
complete rights	-	-	-	-
	information	information	billing	billing
restricted distribution rights	-	-	-	-
	information	information	billing	billing
buying licenses	**X**	**X**	stock keeping	**X**
			billing	
consignation	calculation of input cost	calculation of input cost	calculation of input cost	calculation of input cost
	information	information	billing	billing

Tab. 1: Possible combinations of business models

The "X" marks those combinations that are not feasible to implement. For each of the feasible combinations, it is specified whether sales information is needed for the procurement / stock keeping task (top line in Tab. 1, e. g. for the calculation of input costs) and / or for the distribution process (bottom line in Tab. 1, i. e. informational or billing purposes).

4 Implications for Retail Information Systems

Before looking at a number of selected functions in detail, a general overview of major changes is given. Fig. 3 shows the merchandise information system aspects of the Retail-H-Model, specifying major changes or new functions to be supported when trading digital products.

4.1 Overview of changes

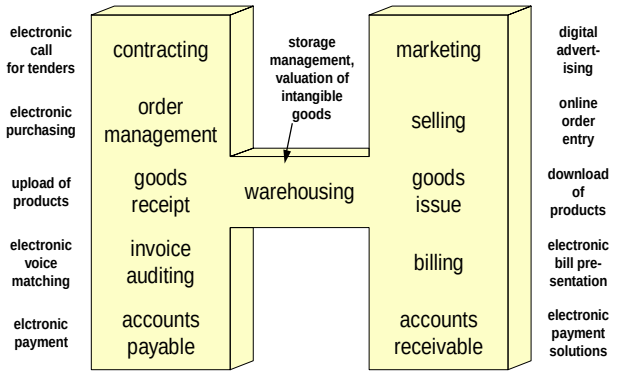

Fig. 3: Impact on Merchandise Information System Functions

Some of these implications also apply to business processes not qualifying as fully digital commerce. These changes are implied not by the digital nature of the product, but by the digital execution of the process. Electronic calls for tenders between retailing companies and suppliers can be observed when dealing with physical products as well as digital products. Nevertheless in fully digital commerce (see Fig. 1), all processes should be supported digitally, therefore these sub-functions need to be observed. The *contracting* function of retailing companies dealing in fully digital commerce needs to support online calls for tenders and to process the incoming offers automatically. Another feature in this area is the use of standardized product information databases / pools, in order to reduce the effort put into maintaining up to date master data on listed products. The *order management* function of the retailing company needs to support online ordering of products. Depending on the business model and the product traded, this can either mean automated ordering of a certain number of licenses (as in procurement business model three) or the order to produce a specific product according to automatically transmitted specifications. The upload of digital products is the digital equivalent to the *goods receipt* functions in traditional retailing. A more detailed description of changes in this function will be given in this paper (Section 4.2.1). The process of *invoice auditing* is, at least in Germany, a very

costly process in the retailing value chain. A number of steps are still performed manually due to insufficient information system support and media breaks. In fully digital commerce no, or very little, human interaction should be necessary. The incoming invoices are automatically matched with the recorded uploads of products and payment is then authorized. Within the *accounts payable* function these authorized payments are electronically transferred to the supplier, thereby completing the procurement process.

While the changes within the procurement process are occurring in business-to-business relations only, the changes on the distribution side of the "H" seem more obvious, because their effects can be observed daily simply by browsing the Internet. The number of instruments for *marketing* has increased immensely, due to new communication and observation abilities offered by Internet- / WWW-based communication. Most obvious is the digital advertising, either on the companies own homepage or using strategically placed webbanners. Due to the ease of tracking user activities and the possibility to automatically customize messages or web-environments towards the needs of specific customers, true one-to-one marketing is suddenly an option for many companies.

Online order entry by the customer is a feature once again found in the *selling* area of fully digital commerce as well as in a growing number of business applications dealing with physical products. Basically this is the outsourcing of steps in the value chain from the retailer to the customer, opening enormous cost-saving potentials for the retailing company. In order to guarantee speedy delivery the information systems usually implements an online inventory check when dealing with physical products. Due to the reproducibility of digital products, inventory checks are only necessary in the business model where specific numbers of licenses are purchased and then redistributed by the retailer.

Major changes can be observed when examining the *goods issued* function. No physical delivery is needed, but methods to support a secure, fast, and fail-save delivery need to be designed and implemented. Looking at the market for electronic books for example different methods have been set up to guarantee a secure delivery of content to the user, while at the same time preventing the creation of illegal copies. Two companies[1] have decided not to use the Internet as channel of delivery and have instead set up proprietary online bookstores. These can be accessed directly via the telephone network, but only using the dedicated portable electronic reading devices. Two other companies[2] have implemented a system where a personalized copy of the desired content is created using an asymmetric encryption mechanism. This file can be downloaded over the Internet to a PC, but can only be decrypted and viewed using the proprietary reading device, which contains the necessary private key.

Electronic bill presentation is a feature also implemented in a number of *billing* processes not dealing with digital products. Functions need to be implemented in order to create "documents", that can be used as proof of purchase / payment geared towards tax purposes and other settings where proof of cost is necessary (e. g. personally paid expenses, that are reimbursed in a company setting).

The area getting most attention in the press [12, 6] is the implementation of Internet based electronic payment solutions in business-to-consumer transactions, changing the nature of the *accounts receivable* processes. Depending on the distribution business model adopted, different requirements need to be fulfilled by the implemented system.

Last not least changes in the "*warehousing*" function occur. On first instinct one is tempted to argue that due to the digital nature of the products no warehousing is necessary, but more than physical storage is subsumed under the functional block of warehousing. Questions of storage management (one or more file servers), valuation of intangible goods, selection of products to be taken out of storage / off the server, creating an access structure for fast and easy access to all stored items, all need to be addressed and solved in order to be able to successfully trade digital content.

4.2 Selected Examples

After this quick overview of changes a closer look is now taken at the specific changes in *goods received*, *accounts receivable* and *warehousing*. Each of these functional building blocks is made up of a number of sub-functions, described for traditional retailing in [1]. A closer look will be taken at all of the traditional sub-functions and the changes they undergo when trading digital products. Afterwards sub-functions that are specific to digital retailing are introduced.

[1] http://www.softbook.com/index.html, http://www.everybook.net/

[2] http://www.nuvomedia.com/, http://www.librius.com/

4.2.1 Goods Receipt

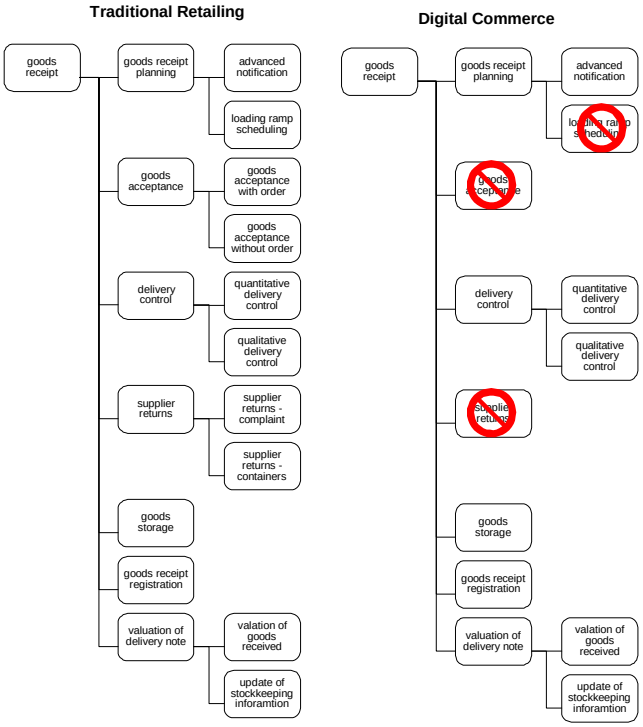

Fig. 4: Function Model: Goods Receipt

The first sub-function of goods received is *goods received planning*, which is again broken down into *advanced notification* and *loading ramp scheduling.* Advanced delivery notifications are used in traditional retailing to better plan the unloading process and to be able to set up an efficient ramp loading schedule. When dealing with digital products, there is no physical transport involved, therefore no truck loading ramps need to be scheduled. Nevertheless, especially in the news business, where a large number of different suppliers (reporters) from around the world are uploading time-critical information into the system, advanced notifications are necessary in order to plan and announce their publication. Especially with hot news, which are used as a special attraction on the marketing side, it is important to know the exact time of delivery / upload.

The sub-function *goods acceptance*, which in traditional retailing involves a lot of manual labor, is usually not found when dealing with digital products. *Delivery control* is the next sub-function in traditional retailing. The first step is quantitative product control, i. e. making sure that the delivered amount corresponds with the amount ordered and / or the amount specified on the bill of loading. The results of these checks need to be input into the information systems, as they are the basis for finding mistakes in the invoice auditing process. No manual intervention is needed to perform the task of quantitative delivery control during the delivery of digital products. The information system protocols all relevant information automatically, detecting deviations from the expected amounts and taking the necessary measures, e. g. informing the supplier, as well as the responsible manager within the retailing company. In qualitative delivery control it is made sure, that the delivered products are up to the specified standards. For digital products a number of these task once again can be automated. The correctness of transmission can be controlled on transmission protocol level by using check sums and an automatic virus scan can be performed before admitting any data into the system. These are qualitative controls on the syntactic level, which give no information on whether the product contains the desired properties. Depending on product and business model qualitative delivery control is of greatly varying importance. In the news business major efforts need to be made in order to prevent false messages to go undetected, while in the music business the semantic quality control is usually performed by the end consumer, due to great differences in musical taste.

In traditional retailing *supplier returns* are a major task, that is being performed in the goods received area of a store or warehouse. Especially in Germany a large percentage of softdrinks and beer is being sold in refundable bottles, which need to be returned to the supplier. Also containers used in transporting goods are reused and returned to the supplier. Non of this functionality is needed when working with digital products. No empty bottles or digital equivalents can be found in the digital retailing process. If products are unsatisfactory in the physical world they are returned to the supplier either directly from the retailer, or from the customer via the retailer. Non of this has an equivalent in the digital world, either. If retailer or customer are not satisfied with a product they might refuse to pay for it, but there is no need to return the digital product to the supplier. He has the master copy of the product and does not need another copy.

The *transfer* of the delivered goods *into storage* is the next step in the goods received process. Digital products do not need to be physically transferred to specific storage locations. There is however a need to transfer the digital product from an uploading directory to a specific location on the server. This function can either be fully automated (depending on certain meta-information, the product is moved to the correct directory) or manual intervention may be necessary in order to determine into which structure the product needs to be integrated. In traditional retailing the physical process of receiving the goods needs to be mirrored in the information system within the *registration* sub-function, while in fully digital commerce this is information is automatically recorded .

The final sub-function in traditional retailing is the *valuation of delivery notes*. Using the prices and conditions stored in the information system the amounts that have been delivered are valued and the corresponding values are added to the stock-keeping information. As will be shown during the examination of the warehousing functionality the valuation of digital products poses a major task for the retail information systems.

4.2.2 Warehousing

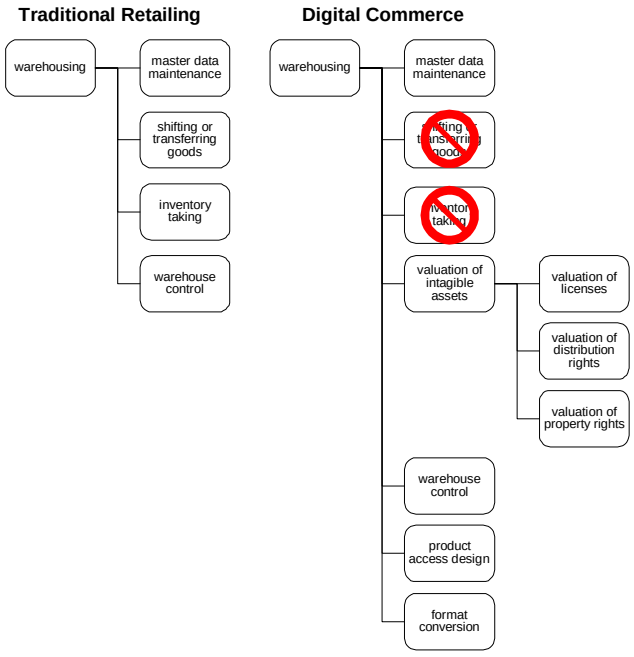

Fig. 5: Function Model: Warehousing

Warehousing probably is the most controversial function block when looking at digital content. The first thing that comes to mind when using this term are large storage shelves packed with cartons of goods. This can of course not be observed when trading digital products. These are stored on disk arrays and the only thing visible is a number of servers that could contain anything. But when looking at the sub-functions, which were identified for traditional retailing, it will become obvious, that a number of these tasks still need to be performed when dealing with digital products. In *warehouse master data maintenance* information about the storage structures are being kept. In the case of digital products this does not apply to the size and capacity of shelves, but rather to the structure used for storing information on the server. Either directory structures need to be implemented or a database concept needs to be developed and adapted, that allow for efficient storage and retrieval of the stored products.

The sub-functions of *shifting goods* or *transferring goods* to other accounts can either take place within a warehouse or between a warehouse and other storage facilities and / or retail outlets belonging to the same company. Shifting goods usually involves the physical transport of the goods, while a transfer may only take place in the inventory control system and have no physical counterpart. A major reason for shifting goods is the transfer of goods between retail outlets. If outlet A has sold out, while outlet B still has excess product in store the products are transferred to optimize sales. Multi-stage retailing with multiple outlets is not usually observed when trading digital products, therefore no goods need to be shifted between “outlets”.

The *warehouse control* sub-function covers the steering of warehousing technology like automated fork-lifts or robot controlled storage facilities. Within the fully digital process this is comparable to the control of magnetic tape robots or CD jukeboxes used to store large amounts of data.

Last not least the sub-function of *inventory taking* needs to be addressed. Unlike in physical warehouses no actual counting can take place when dealing with digital products. The inventory control system needs to be able to record any changes in inventory and periodically the inventory needs to be valued. Depending on the combination of procurement and distribution business model this valuation of inventory can take very different forms. The least complicated being the consignment procurement model. In this case, even though digital products are stored on the server of the retailing company, the ownership is still held by the supplier and therefore no valuation is needed on the part of the retailer. When looking at the valuation of licenses (procurement model number three) the process comes closest to “regular” inventory valuation. The number of remaining licenses is established and a “per license” value is determined. This can either be the current supplier market value, an average of buying prices, or any other form of traditional valuation used when dealing with physical products. A very different situation can be observed when looking at the valuation of digital products, where all rights or the right for temporarily limited distribution is held by the retailing company. The original buying price does not usually reflect the time value of the digital product. When looking at the value of limited distribution rights the value needs to at least be decreased in some kind of relation to the remainder of the sales-period. With digital products, where all rights have been obtained by the retailer, all questions regarding the valuation of intangible products know from traditional company valuation need to be observed. The process needs to be supported by the retailing information system as well as possible.

In traditional self-service retailing (e. g. supermarkets) the shelves comprise the storage facility of the retailer. The customer roams the isles looking for the products of choice. Shelf-spaces optimization is a major task in store management of physical product distribution, especially since suppliers are forced / encouraged to pay large sums of money as so called "placement fees" in order to be allotted a certain amount shelf space. In analogy to this, the structuring of *product access* for the customer is a task, that needs special information system support, when dealing with digital products.
Another feature introduced by the transmutability characteristic of digital products is the possibility to store a single version of a product, while delivering it in multiple formats. A text can e. g. be stored as a Word-file, but be delivered in HTML, PDF, PS or any other file format. The distribution of the different files is part of the goods issue function, but specifying the master formats for each data type, implementing the conversion utilities, and performing the necessary conversion must be considered part of the warehousing function.
It is technologically feasible for suppliers to directly store the products in the correct structures of the server, thereby reducing the amount of labor on the part of the retailer (once again conversions of formats may be necessary). This is especially interesting if new products are constantly delivered (e.g. news-flashes, software updates), that should not have to wait in an upload area until the retailer gets around to structuring them. If this far reaching integration of the supplier is to be implemented, a number of security aspects need to be considered while designing the retail information system.

4.2.3 Accounts Receivable

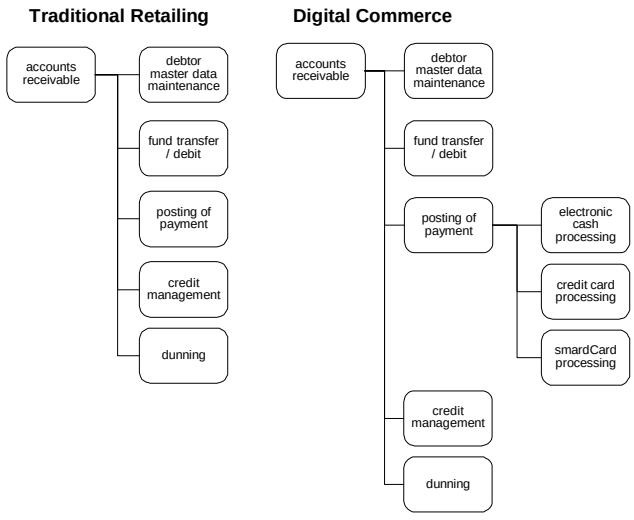

Fig. 6: Function Model: Accounts Receivable

The last functional block to be more closely examined is accounts receivable. Once again the first sub-function is the *maintenance of master data*. This sub-function is not found in stationary retailing, where the retailer deals with anonymous customers, but has roots in the wholesaling and mail-order business. For each customer the bank connections as well as credit-lines, risk class and the like are stored. The information policy in digital commerce is far more open than in traditional retailing, therefore it is necessary to implement functionality, that allows the customers access to their account information.
Fund transfer and *debit* are two sub-functions that are concerned with the actual transfer of payment from customer to retailer. The implementation of all aspects of electronic payment need to be addressed under this heading [3]. Depending on the business model and the value of the products traded different approaches are chosen. For small transactions on a pay-per-use basis electronic cash [4] / micropayment solutions are chosen (even though their success is rather limited) [7], for other transactions credit card based systems are implemented (SET seems to be a promising standard [8]) and at least in Germany there are efforts to implement smartcard-based payment systems [9]. Retailers participating in digital commerce need to implement at least one of these payment systems in their information system. In order not to discourage customers they should implement alternative payment systems. The *posting of payment* usually is a completely automated function of the information system, since all payment activities are processed online. If the connection between incoming payment and invoice cannot be automatically made, human intervention might become necessary.
Within the sub-function *credit management* the credit line, which was established during maintenance of customer master data, is constantly compared with the transactions performed by the customer. Before accepting orders, the credit limit is checked, and orders may be declined or postponed until some of the credit is repaid. If scheduled payments, like monthly subscription fees, do not come in on time the *dunning* process is triggered. All customer accounts are regularly monitored for due payments and the necessary notices are send out by the information system. Intelligent algorithms are needed in order to implement a dunning strategy that guarantees timely payment without scaring off regular customers.

5 Conclusion

Even though disintermediated processes will be emerging in certain business models a number of transactions dealing with the trade of digital products will more

closely resemble the traditional retailing structures than might be expected at first glance. For successful players it will not suffice to set up an online storefront. All aspects of the retailing process (procurement, storage, and distribution) need to be supported by RIS. Due to the fact, that the Retail-H-Model has proved its benefit in physical retailing environments, we propose to use the structure of the framework and adapt the underlying sub-functions where necessary.

The adjusted framework can be used as a reference model for the design of retail information systems for digital products. At the same time it constitutes a research map, in which all ongoing research efforts can be integrated in order to coordinate the efforts and to detect so far neglected research question.

Our ongoing research will analyze the remaining functional blocks of the Retail-H-Model. After completion of the examination at sub-functional level, the underlying data and process models need to be redesigned to create a reference model for the development of retail information systems for digital products. New developments need to be monitored and the framework needs to constantly be adapted to reflect these changes.

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