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Discussion Paper WI-91

Enabling eCCRM: Multi-Channel Model and Management for Financial eServices

by

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April 2001

in: The International Journal on Media Management, 3, 2, 2001, p.91-104

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Enabling eCCRM: Multi-Channel Content Model and Management for Financial eServices[+]

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[+] This is an extended and revised version of the paper "Enabling eCCRM: Content Model and Management for Financial eServices" presented at the 34th Hawai'i International Conference on System Science 2001 by Dennis Kundisch, Peter Wolfersberger, David Calaminus, and Elisabeth Kloepfer.

Enabling eCCRM: Multi-Channel Content Model and Management for Financial eServices*

Abstract: *In the paper a formal content model for the financial services industry as an example of one of the most important eServices industries is presented. Generally, a financial services firm can provide its customers with a great variety and quantity of self-produced and externally bought content. However, the challenge is to offer information about the proper subject, at the appropriate sophistication level, the right length, at the right time for the customer's specific situation. Meta information about the customer as well as about available content may be used to match content with customer problems in order to get proper solutions that satisfy or exceed customer needs. The focus of the paper lies on both the theoretical identification of relevant attributes to formally describe finance related content in a multi-channel distribution environment and on an implementation concept. Some implementation issues are also discussed in the context of an ongoing project with Deutsche Bank AG.*

Keywords: Content Model, Content Management, Customer Model, Customer Relations Management, Matching, Individualization, Financial Services Industry, Multi-Channel Distribution

1. Introduction

With the advent of the Internet and the ongoing virtualization and digitalization, segmentation approaches widely used in the past to target customer groups are outdated. In the Information Age Economy one-to-one marketing approaches are applied using information technology (IT) to individually target customers according to their specific needs and preferences (see e.g. [22], [5]. On mass information and customization systems see e.g. [12], [13]). Currently, the financial services industry – as an example of one of the most important eServices industries – is undergoing a fundamental shift since it is questionable whether the traditional approach of just selling financial commodity products in increasingly transparent and global markets will still be profitable in the future (see e.g. [2], [9]). Most likely, a financial intermediary that "owns" the customer (trust) relationship will be the only one able to enhance the shareholder value of the company in the long run. Particularly [9] present some evidence that no shareholder value has been created by traditional banking institutions in the last years. Therefore eCommerce Customer Relations Management (eCCRM) that enables financial services firms to individually and professionally manage their customer accounts –

* We would like to thank Deutsche Bank AG and Deutsche Forschungsgemeinschaft DFG for supporting the underlying research of this paper.

keeping "economically valuable" customers and repelling and eliminating "economically invaluable" ones – has become increasingly important. For an assessment of the MIS research into eCCRM see [26].

An intelligent solution to a customer's problem in finance typically consists of multiple components one of which surely is domain specific background information, which we will refer to as content. Frequently there will be other components, such as a financial product or a combination of products, but content will always be part of the solution.

In the information age, access to information 24 hours a day and seven days a week is ubiquitous. With the rapidly spreading technology of mobile data transfer, for example cellular telephony, the location of the customer becomes irrelevant for his access to information. Content providers and intermediaries have the means to serve their customers better than in the industrial age: content can be delivered to the customer via multiple communication channels 24/7, if the customer wants to be informed. However, the time and effort a customer can spend gathering and absorbing information becomes the limiting factor. For instance Kerschner states that the customer is interested in problem solving information because of an increasingly difficult search process [15]. Therefore, new methods of filtering and providing information have to be developed, enabling information providers to deliver the right content at the right time via the right channel, thus optimizing customer benefit by using his scarce time and effort efficiently for his information, or even exceeding customer expectations by actively delivering important and urgent content. In fact, there seems to be a high demand especially for finance related content in the WWW. GVU's 10th WWW User Survey Graphic found out that 25% of the people who use the WWW want to access financial materials on a daily basis (in Germany even 33% at the end of 2000 [8]). More than 45% of the respondents of the same survey felt that they were not able to find the information they were looking for [14]. Hence customers either have the alternative to search for content (for a search cost model see [18]) or they can leave it up to the financial services firm to provide them with relevant information.

Generally, a financial services firm can provide its customers with a great variety and quantity of self-produced and externally bought content such as research, market reports, and CFO interviews. For the decision, if a special content is the right one for the customer with respect to the above formulated objectives, meta information about the customer (particularly the WWW is a well suited medium for gathering customer data and conducting marketing research, see e.g. [17]) as well as information such as the subject of the content and other content meta information have to be considered. To automatically match pieces of content on the one hand and the customer's interest and effort limits on the other hand by an inference mechanism, we need fixed attributes, which have to be known at the design-time of the matching rules.

Hence, a customer model, a channel model and a content model as well as intelligent matching-rules have to be developed to satisfy the informational needs of customers and to provide smart Sophistication Banking solutions. (See e.g. [3], [25] for some smart Sophistication Banking solutions, that is intelligent solutions to complex financial problems that maximize a specific objective function, e.g. the after tax net present value of the cash flow. Specific information on Sophistication Banking can be found in [2].)

Recently, there has been written a lot about customer modeling in literature (see e.g. [11], [21], [31]. For a domain model that filters the key preferences of a customer see e.g. [24]) and a variety of quantitative methods to solve "quantitative" customer problems (see especially [30]; see also [3], [25]) that is the financial dimensions of the customer problem have been presented. However, there is a lack of content and product models that combine both quantitative (such as cash flows, marginal tax rate) and qualitative data (such as risk attitude or preferences for specific markets or products). As first step, the paper shall close the gap with respect to the content management perspective. We suggest a model for content on finance related issues, which is suited for the matching of information to specific customer problems. We achieve this by identifying relevant attributes which describe finance related content. The values of the attributes are mainly derived by an IT-enabled inference process directly from the content by methods of automatic content analysis and partly by human content managers. This approach relates to the concept of mediating electronic product catalogs described in [17]. With an appropriate content model, eCCRM will be substantially supported and financial intermediaries will be able to intensify trust relationships with their customers. Here, we will particularly focus on "Customer Interaction" as one of the seven building blocks that constitute the Management of Customer Relationship concept described in [17].

The presented model for content management will be put in the context of a framework for a one-to-one marketing tool comprising a customer model, a content model, a channel model, a product model, and intelligent matching rules for a multi-channel environment. (See e.g. [23], [1], [16], [25] for basic information about matching algorithms. [28] discusses two matching techniques, rule base matching and collaborative filtering, for individually addressing virtual community member segments.) In our research we draw both from the German National Science Foundation (DFG) funded theoretical research and an ongoing project with Deutsche Bank AG.

The paper is organized as follows: After these introductory remarks, we will present the general framework for our research in section 2. Section 3 presents the model for content management and a concept for multi-channel content distribution. Consequently we will draw the attention to the applicability of the content model in section 4 both on a

theoretical level and from our project experience. We will discuss some limitations of the model and prospects for further research in section 5, before concluding with a summary and outlook in section 6.

2. General framework

The problem of providing customers with individualized solutions to their problems is very complex. Firstly, the customer himself has to be modeled and a machine readable representation of his (changing) preferences and (latent) needs has to be provided. Secondly, the quite different financial products in terms of cash flow effects, liquidity, risk, complexity to name just a few, have to be modeled in order to generate a sound bundle of financial products based on customer's needs. Thirdly, a customer not only wants financial products, he also wants to be informed about finance related issues and financial products. There are various reasons why a customer might want to be informed.

- He wants to be informed about companies and markets he has already invested in.
- He wants to be informed about companies and markets he is interested in and considers to invest in.
- He expects that solutions to his financial problems are properly explained to him.
- He is looking for advice how to invest his money.
- He is looking for general information on specific topics such as taxation, monetary policy, and legal aspects.

Certainly, this list is not exhaustively enumerative but it shows that the "informational needs" of a customer can have various reasons and that it is not an easy task to individually offer a customer the right content at the right time using the right communication channel. This holds also for intelligent bundles of financial products.

Fourthly, there are various channels that can be utilized to distribute pieces of content to specific customers and each channel has it's own characteristics and restrictions. Finally, intelligent matching algorithms are needed to combine the customer on the one hand and the products and content on the other hand, that is, there has to be a matching based on the information provided in the customer, content, channel, and product models.

Example 1 shall illustrate how content may be individually targeted at specific customers. Though Example 1 is quite simple it should become clear that a thorough knowledge about the customer, his situation, and his preferences as well as about the content is necessary.

Example 1:

Customer: A family father wants to put money aside for his retirement and to secure the education of his children. He is conservative but considers stocks as having the best long term growth perspectives.

Provided Content: Market research about blue chips in the national currency and pension funds is provided.

Customer: A young single loves to speculate in high tech stocks. He is willing to take high risks in order to have the chance of receiving high returns.

Provided content: Latest material on an IPO of a dot.com-company is provided.

Note that we do not claim that the inherently applied matching rule is the correct one. The issue of this paper is to build the content model that provides the relevant data that may be used in a variety of different matching algorithms.

Figure 1 depicts the general framework of our research approach. A similar approach can be found in [24].

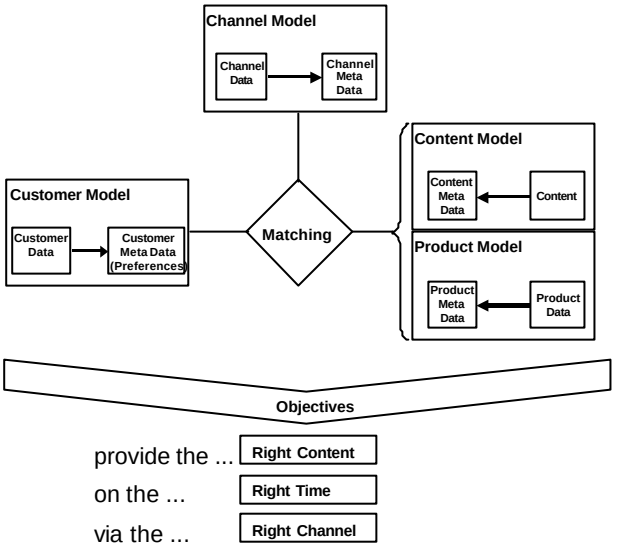


Figure 1. General Research Framework

The framework consists of four models as described at the beginning of the paragraph. They all have in common that they already provide for an inference pre-process. By those inferences meta data about the modeled objects is generated. In a second step meta data of the different models is matched to provide individual contents or products. Main advantages of this approach are the following (for a detailed discussion see [11]):

- reduction of complexity,
- more precise specification of the matching algorithms,
- the different inference processes can follow different paradigms,
- the 2-step approach provides more flexibility,
- and the processes of knowledge generation can be traced more easily.

We should mention though that there is one major deficiency affiliated with this approach. Since inference pre-processes have to be performed in all models, the matching cannot take place in real-time.

At this point, we should emphasize that this framework has to be applied in a multi-channel environment and has to be scalable to account for new channels arising. In particular increasingly demanding customers in the financial services industry expect their providers of financial services to offer their services through various channels, such as branch, Internet, pagers, mobiles, sales force, phone, and fax (a refined and more precise definition of the term "channel" will be introduced in section 3.3). The Internet plays a vital role in this multi-channel architecture since it is not only a formidable way of interactively and individually communicating with customers, but it also lends itself excellently as an integration platform for the different channels. It has become more and more a necessity to provide consistent and up to date information via any communication channel offered (see e.g. [5] for a more detailed reasoning and description). Moreover, content should not just be provided on a pull-basis, that is the customer pulls the information he likes to receive. In contrast, especially when talking about urgent information that should reach the customer as soon as possible, a system that facilitates pushing information via the best suited channel in the given circumstances is needed.

In the next section we will put our focus on the content model, which may be used relatively independent from the applied customer model. Nevertheless, any content model is no end in itself but aims at providing customers with the right content at the right time using the appropriate channel, hence it is inherently based on assumptions and knowledge about the customer.

3. Content model

3.1. Methods

In the following, a content model will be suggested, which ensures that the information about the available content needed to identify the right one for a specific customer is accessible to an automatic matching process. To achieve this, we deduce the necessary content attributes by arguing from the customer's point of view, since it is the customer's needs which have to be satisfied with the matching process using the attributes. This is done by finding valid arguments why a certain attribute contributes to the objectives discussed in the following paragraphs.

Although it could well be the case that an attribute contributes to more than one of the objectives discussed, having identified at least one contribution, the attribute is added to the catalog of relevant attributes. Generally, we will not

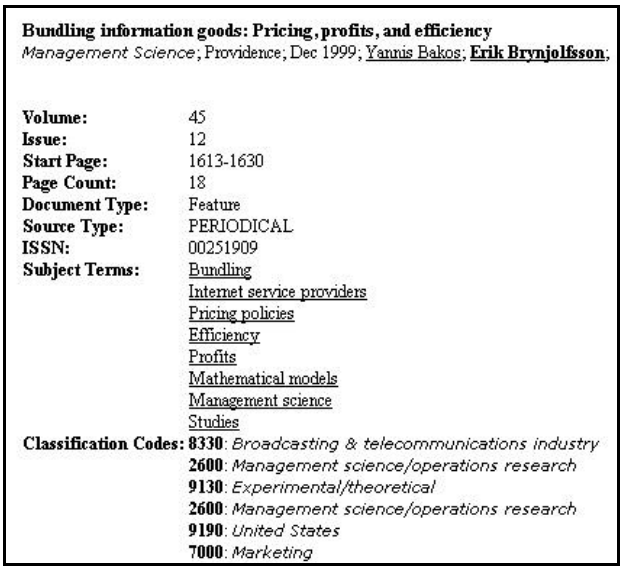
discuss why a rejected attribute does not contribute to an objective. Both of those two issues mentioned above are part of identifying matching rules. There might be attribute candidates which seem close at hand but on a closer look are either redundant or their value is not derivable from the bare content directly. In these cases we will argue why we do not need them as attributes. For identifying the right point of time and the right channel combination to deliver this piece of content, we will not only identify relevant content attributes, but also present a conception for a multi-channel distribution architecture.

It has to be stated that the identification of the content attributes is done by theoretical discussion and lacks empirical evidence in the first place. But in our opinion this procedure is a good starting point for building hypotheses for further empirical research, which seems to be underrepresented in scientific literature in this specific area.

3.2. Right content

The right piece of content for a customer is one which satisfies the customer's explicit and latent informational needs as well as it has to match his mental abilities and also the current situation of the customer and his environment.

While explicit informational needs are easily assessable by online profiling techniques or by using a questionnaire, the assessment of latent informational needs is not quite as easily done. However, normally a financial services firm has access to a vast amount of customer information, which can be used with the help of data mining techniques to identify future customer's informational need. To match the identified customer's interest with the subject of the content, content providers on the market already use subject catalogs and match the content to the subject terms. When a relevant subject for the customer is identified, the matching can be triggered for content with the categories in question. Those catalogs normally are flat lists of keywords, subsets of which are attributed to pieces of content. These are already very well suited for matching content and customer with respect to the subject dimension (see Figure 2).



Bundling information goods: Pricing, profits, and efficiency
Management Science; Providence; Dec 1999; Yannis Bakos; **Erik Brynjolfsson**;

Volume:	45
Issue:	12
Start Page:	1613-1630
Page Count:	18
Document Type:	Feature
Source Type:	PERIODICAL
ISSN:	00251909
Subject Terms:	Bundling
	Internet service providers
	Pricing policies
	Efficiency
	Profits
	Mathematical models
	Management science
	Studies
Classification Codes:	**8330**: *Broadcasting & telecommunications industry*
	2600: *Management science/operations research*
	9130: *Experimental/theoretical*
	2600: *Management science/operations research*
	9190: *United States*
	7000: *Marketing*

Figure 2. Literature Database at ProQuest.Umi.Com

Some information providers already deliver language and length information along with information about the author, type information of the text (research report, rumor, etc.) and the source of a piece of content (see Figure 3). There might be customers with strong preferences or aversions towards specific authors or sources. For example a scientific oriented person might reject to read any rainbow-press article. We therefore suggest to incorporate source and author information into the set of relevant attributes for the matching process.

Obviously, language information also is mandatory for providing readable information for the customer: who would like to read this article in German?

As already argued above, time is a scarce resource and hence bothering the customer with too long articles with poor information density contributes to customer dissatisfaction. Thus length is a key attribute.

Also type information about the content might be vital to help the customer assess its reliability and objectivity. As we can see in Figure 3, some providers already provide type categories like for example “commentary” or “review”, which state that the content does not represent objective information. We therefore suggest adding it to the catalog.

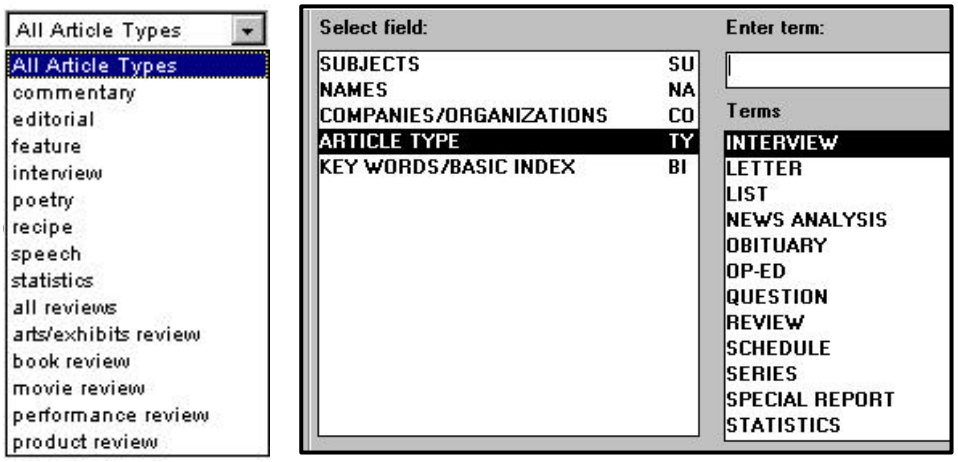


Figure 3. Content Types at ProQuest (left) and New York Times (right)

It is quite clear that temporal information as the release date of the content has to be available additionally to provide topical news and information and for expiration of the content. Finding the right time of expiry of a piece of content is very important for customer satisfaction. However, it is much too complex to be modeled solely by a content attribute, since there are several different situations and possible triggers for the expiry of a piece of content. Normally expiry originates from the environment rather than from the content itself: finance specific content is regularly outdated by the market, additionally it can be outdated by changes of tax laws or other events. Therefore we will not add an attribute “expiry date” to our content model, but in section 5 we will present some ideas which might contribute to ensure timely expiry of the content.

Above we considered attribute candidates which are already derived and provided by content providers. However, considering the mentioned attributes exclusively endangers customer satisfaction. When reading a piece of content, there are numerous other factors which influence the attitude of the customer towards the content, as we will see in the following.

If the customer needs a recommendation, all the barely informing content would waste his time and effort if presented to him, if alternatively a recommending piece of content could be presented. In contrast, if the customer only wants to be informed, he might feel distressed when reading recommendations. To avoid this, every piece of content needs to be categorized in terms of its recommendation level, which is low, if only information about a subject or product is given, and high, if the customer is urged to buy a product.

In some countries, recommendations must be handled with care. Especially, if the content is about risky assets, there might be legal restrictions. Content providers might be hold liable for (wrong) recommendations within the con-

tent. Moreover, it is generally a valid question, whether for instance content about high-risk stock options should be delivered to a person, which is rather risk averse and not versed in the subject anyway. If we want to avoid this, at first glance it seems to be a good idea to introduce a content attribute like “risk”. On a closer look, this turns out be unnecessary. The already introduced subject catalog usually provides information about the products and markets mentioned in a piece of content. With the newly introduced attribute “recommendation level”, liability problems can be avoided by appropriate rules within the rule base. Also content about inappropriate products due to risk assessed by volatility measures or ratings, can be sorted out. E.g. consider a content with the subject “NASDAQ stocks options” and a high recommendation level. The provided information about the content comprises the complete information about the risk involved for the customer and the liability risk for the provider. Also assigning the value “high” to an attribute “risk” would produce redundancy and thus would not be efficient.

Correspondingly to the recommendation level, the customer might want to receive general information about a subject rather than special information about a certain product. If for example, the customer wants to inform himself about retirement planning, he will not be satisfied with a recommendation to buy a life insurance from ACME insurance company. On the other hand, if he only wants to be informed about a certain product or service, he might not want to be bothered with content of a more general nature. The generality of information is of great importance, but normally not treated within the above mentioned already established methods of cataloging subjects of content. A flat subject catalog as mentioned above does not necessarily contend information about generality or specificity of the content. In order to achieve this, the catalog has to be at least hierarchical, hence there are categories and subcategories to be found. However, hierarchies have the problem that subcategories become redundant if they are subcategories to different supercategories. We therefore propose an attribute categorizing the specificity of the content. If a piece of content belongs to more than one subject category, a measure of specificity to multiple categories could be a fuzzy approach to categorization with the subject catalog, where the association degree would be a specificity measure for the respective category.

The customer’s expertise level can be matched and deliberately raised by introducing an attribute “sophistication level” of the content and treating it properly within the matching algorithm: On the one hand a slight raise within the sophistication level of the content above the customer’s present expertise level will tend to raise his expertise level. On the other hand, customers get frustrated or even aggressive if they do not understand a text because of too many scientific terms, technical terms, or too complicated syntax within the content, for instance.

Within the last section, content attributes that help to identify "the right content" for a customer were derived. In the following, attributes are identified which help to distribute this content via multiple channels. To do this, first the involved matching and distribution processes are sketched, and consequently a multi-channel distribution architecture is presented.

3.3. Right time and right channel

Having categorized our content with ten attributes to determine "the right content" (inference process I_{1B}, see Figure 4), the matching process I_2 with customer meta data takes place.

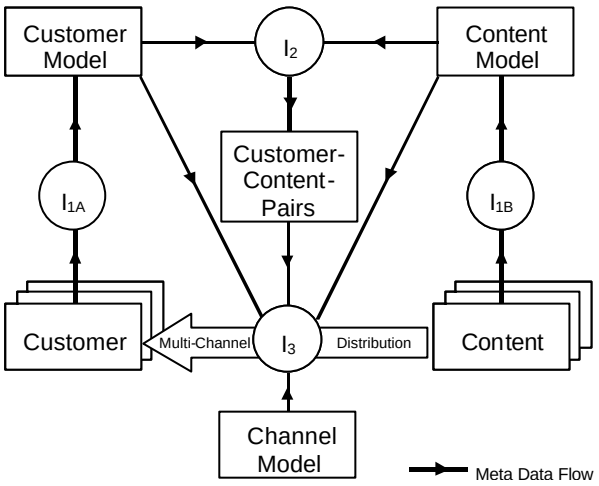


Figure 4. Information Flow and Inference Processes

Meta information is derived by the already mentioned pre-processing inferences I_{1A} and I_{1B}, respectively. It is important to note that the matching I_2 can be triggered both customer model and content model driven. That is, on the one hand new content and on the other hand a changing or new customer profile may trigger the matching process. It is necessary to facilitate both types, since it may be necessary to act immediately based on new information. Example 2 shall elucidate that both scenarios are relevant and important.

Example 2

Content driven: In a pre market report it is expected that the Microsoft stock will most likely plunge heavily at the stock market. A specific customer holds a big position in this stock. He should be informed as soon as possible to allow for actions.

Customer driven: In December, a customer marries which he reports to his financial services firm. Since different taxation laws are relevant for married couples, the customer should be informed about the new opportunities before year end.

Depending on the trigger for the matching process, matching output is either a prioritized list of contents per customer if customer driven, or a list of customers to deliver per content if content driven. The amount of content pieces to be received by a distinct customer has to be restricted, so that it can be handled by the distribution process and suits the information processing capability of the customer, i.e. the time and effort he wants to spend consuming finance-related content.

For further processing the result list is disintegrated into customer-content-pairs. In the following part, we focus on the distribution of these pieces of content to the corresponding customer using the appropriate channel combination at the right time which is enabled by the inference process I_3 (see Figure 4).

We should be very precise about what we mean when referring to the term "channel". Often Internet, branch or call-center, just to name a few, are referred to as "channels". For our purposes, this is not sufficient. The Internet offers a number of different services (and respective protocols), such as WWW (HTTP), Wireless WWW (WAP), email (SMTP). For the content distribution it makes a significant difference which of these services are used. Also the technical characteristics of the devices used by the customer clearly restrict the presentation of the content or do not even allow for it. For example most cell phones currently do not support the display of colored content. However, if the cell phone is just used to connect a laptop with the Internet, completely different presentation circumstances have to be taken into account, i.e. may and should be utilized. Therefore, a channel in our terminology is always a combination of the presentation device and the used service to transmit the data.

Clearly, understanding a channel as a combination of a service and a presentation device requires a very good knowledge of the devices the customer owns or has access to. For instance, the cell phone Nokia 6210 offers different presentation options compared to a Siemens C35i. If the distributed content cannot be correctly displayed on the site of the customer, it will cause massive customer distress. Since we cannot exhaustively list all channels, i.e. all service-device-combinations, we will argue by illustrating our concept by examples.

Apart from the mentioned differences within the technical characteristics of the channels, customer access time and direction (push or pull) are also relevant channel characteristics. For example a call via cell phone might be the fastest

way to contact a customer, and content can be pulled and pushed through this channel. While the popular GSM (Global System for Mobile Communications) paging service SMS (Short Message Service) has similar access time, it does not offer personal contact. Web access is pull, but not always available to the customer, thus customer access time on average will be longer. These channel characteristics have to be taken into account within the decision about the appropriate distribution channel for a given content, according to its urgency and importance. Sometimes it might be the case that a single channel is much less suitable than a combination of channels. For instance if an urgent and important content is too long for transmission via cell-phone or SMS, transmission of the content via email and WWW and a short note by SMS to check email might be the right solution.

So the tasks, the inference process I_3 has to accomplish, are firstly to classify every incoming customer-content-pair with respect to importance and urgency of the content for the customer, secondly to select the appropriate combination of channels according to this classification, the values of the other relevant content model attributes, and information about the customer, and thirdly to adapt content in case it is not yet in a suitable form for the appropriate channel combination. We therefore suggest a three-tier architecture for the distribution layer which performs I_3. Figure 5 gives an overview of this three-tier architecture. Technically, those tiers are referred to as sub-layers of the distribution layer.

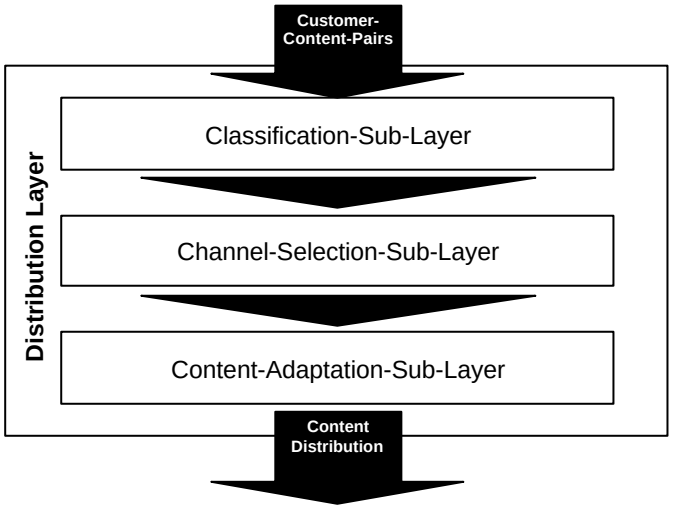


Figure 5. Distribution Layer Overview

3.3.1 Classification Sub-Layer

As stated above, the first step of distribution is to classify the content with respect to its urgency and importance within the context of the customers current situation. The concepts of urgency and importance are well known from time-/self-management literature (see e.g. [6]) and are needed to decide about the appropriate combination of channels

for the distribution of the content. Concerning urgency, the system has to decide within which time the customer should get knowledge of the content. Considering importance, a decision about to what degree it must be ensured that the customer receives and understands the content must be made.

With this classification, a place within the space depicted by Figure 6 can be assigned to each content. This can be achieved by rules, which derive the respective value of urgency and importance from constellations within the attribute values of the content and the knowledge about the customer and his situation. For example if a content has been matched to the customer, and the trigger from the matching was from the market side, the subject of the content can give a nice hint about urgency. E.g. if it is about shares the customer owns, it could be vital to deliver the content within minutes to hours from the trigger event. If it is about a change within the tax system which is relevant for the customer, and the deadlines for reaction are due six months later, it might as well be sufficient to deliver the content within the next 7 days.

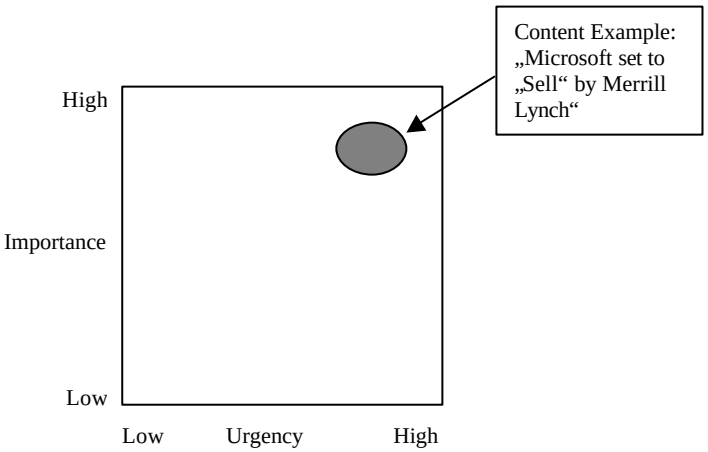


Figure 6. Urgency-Importance-Classification of Content

Also, the level of importance can be derived by using content attributes and information from the customer model. For example if the matching process identified a content about the latest development within the stock market as relevant but the customer does not have stocks in his portfolio (but his interest in stock issues has been recorded within the customer model), it could be nice for the customer to receive the content, but not receiving it at all would not damage his wealth either. The formal specification for the deduction of the rules cannot be enumerated completely here and shall be subject to further research.

Within the last paragraph we have illustrated how attributes of the content and the customer models can be used to derive the levels of importance and urgency. Particularly the urgency classification provides us with a time frame when the content should be ideally accessed by the customer. The next part will illustrate, how these two dimensions affect

the right choice of the combination of distribution channels trying to get as close as possible to the optimal delivery time. Thus, the question of right time and right channel are strongly interrelated.

3.3.2 Channel-Selection-Sub-Layer

The selection of the appropriate distribution channel combination for a given customer-content-pair has to be based on the technical channel characteristics and restrictions as well as on information about the content, the customer, and the attributes derived within the last paragraph. It also requires a lot of detailed knowledge about the customer, which channels are used, and how they are used by him. Figure 7 gives an overview about information that is needed to make the channel combination decision.

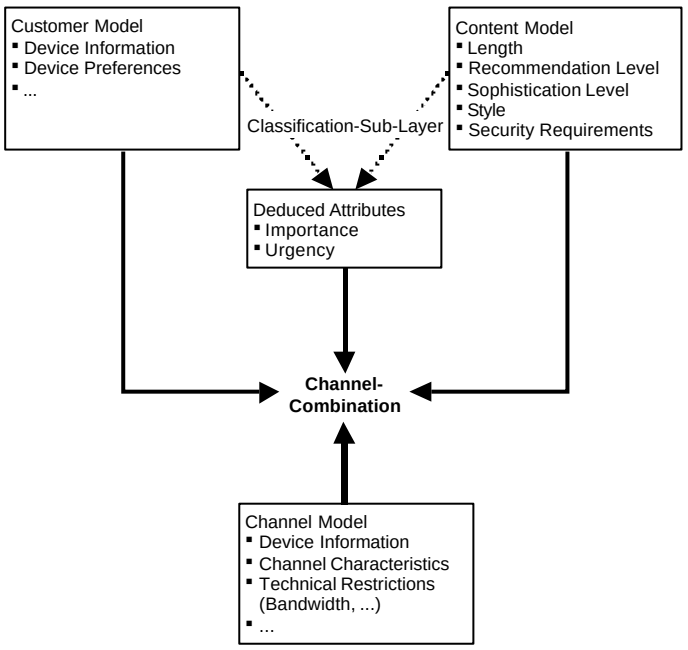


Figure 7. Input for the Channel Combination Selection – Process View

Within the identification of the right channel combination, four groups of channel characteristics have to be taken into account.

First of all, the technical restrictions of the channels have to be addressed. As one important issue, the security requirements imposed by the customer have to be met by the channel characteristics. This applies especially to the Internet, where not encrypted IP-Packages travel unpredictable and uncontrollable routes and thus could be sniffed out by anyone eager to do so. If sensitive data has to be transmitted, Protocols such as HTTPS or SSL may be used as far as WWW is concerned or emails can be encrypted using for instance PGP. Thus, the attribute “security requirements” should be added to the attribute list. With respect to the level of confidentiality, the security requirements may be high,

be high, moderate or low. Generally, the more the content contains personal information such as the status of the portfolio, the higher the security requirements will be. Another important channel restriction to be addressed are display features of the respective channel. The file format of the content will also play an important role here. Depending on whether it is a video, an audio file or just plain text, it makes a big difference for the requirements of the device used by the customer. Hence, the attribute "Style" should be added to the attribute list. Also length information will help to determine, which channel is appropriate for a specific piece of content. For instance the SMS service is restricted to 160 characters, also some POP-servers (the receiving servers for emails) restrict single emails to 5 MB in order to be able to process the mailspool for a high number of users.

The second group to consider are customer's preferences for channel usage. Does he like to use email as a means of communication between the financial services firm and himself or does he prefer printed material that comes to his home by traditional mail? Perhaps a CEO let his secretary check his emails and thus does not want to get information about his personal financial dispositions sent by email. Also time windows set for channel usage by a customer are very important. Consider a young father who doesn't want to be phoned after 19:00 because the phone might wake up his children. Or consider a stylish person who doesn't want to do any business at lunchtime. But also the content attributes "sophistication level" or "length of a content" already mentioned above influence the timing of deliverance: it might be disturbing for the customer to receive a complex or long piece of content delivered by a phone call from his financial consultant during his lunch break, when he tries to relax from his very complex and straining job. Hence, those attributes always have to be set into the context of channel usage restrictions to ensure customer satisfaction and avoid customer disturbance. Lots of cases, where time restrictions apply, are thinkable, and it is quite important for customer satisfaction, that those restrictions are not violated.

The third group of channel characteristics to be considered are those of customer access time. Not all channels are accessible at any time by the customer, so there is always a time lag between the initiation of a transmission process and the reception of the content by the customer. This lag varies from channel to channel. E.g. cellular phones might well be the fastest, most direct and with respect to the access time most predictable way to communicate with a customer, whereas the average time between two visits on a personalized website may be quite long and rather unpredictable, as is for some people the interval between two checks of their email account.

The fourth important group of channel characteristics to be addressed is the degree, to which a personal or even face-to-face-contact with the customer can be established. For important and sophisticated content it might be vital

that the customer not only receives it, but also fully understands its consequences to his situation. To ensure this, establishing a connection with the possibility of immediate feedback might be necessary. It might even be essential to establish face-to-face contact for content a special degree of trust is involved with or recommendations are made with, e.g. for content about a high investment with a high recommendation level.

Sometimes it is necessary to use characteristics of different channels at the same time. In this case, channels have to be combined, and content may have to be adapted to channels, it is not originally suited for. Consider a customer who likes to communicate with email as well as by using services such as WAP or SMS on his mobile. Now take a content that was classified as very important as well as very urgent for the customer. However, the content may be in the PDF-file format and may contain 20 pages. Thus, it cannot be delivered on the customer's mobile phone. Using the email-channel, i.e. the SMTP service and a desktop or laptop as a device, might be the appropriate channel, but then the high urgency has to be captured by another channel, and the original content has to be adapted for this channel. For example sending an SMS on the mobile phone to notify the customer, that an important email can be found in his inbox might take care of the urgency. Also, a short hint of the email-subject within the SMS might be a valuable content adaptation for the customer. This illustrates nicely, that there are circumstances, where one channel will not suffice to account for the classification of the content but channel combinations have to be used.

3.3.3 Content-Adaptation-Sub-Layer

In the content-adaptation-sub-layer, the content to be delivered to the customer has to be adjusted to the channel combination selected for this task. In general a content will not be suitable for all the channels of the selected channel combination. Vital information has to be brought into a suitable form for the channels, the original content is not suited for. E.g. this could be the SMS notification with a hint of the subject of the content and the advice to check the email inbox for further information. Or it could be the covering note in an email the content, which e.g. might be a PDF-file, is attached to. Thus, the original content itself is not changed but just the information necessary for the distribution has to be generated in this layer and transmitted by the respective channel of the selected combination. To change the format of the content itself or just selecting some paragraphs of the text which are highly relevant for the customer is subject to further research and will not be discussed here. Now, as the content-customer-pairs have passed all three sub-layers, the content distribution can take place.

3.4. Relevant attributes

In the paragraphs above we derived multiple content attributes by arguing from the customer's point of view (for the complete list see Table 1). Although we cannot guarantee exhaustiveness and consistence of the model, as mentioned above, we think that this argumentative approach is a good starting point for empirically identifying the attributes necessary for achieving customer satisfaction.

Objective	Attributes
Right Content	Author, Source, Subject Categories, Language, Release Date, Content Type, Recommendation Level, Specificity, Sophistication Level, Length
Right Time	Subject Categories, Length, Sophistication Level
Right Channel	Subject Categories, Length, Content Style, Security Requirements, Recommendation Level, Sophistication Level
Complete Attribute List	Author, Source, Subject Categories, Language, Release Date, Content Type, Recommendation Level, Specificity, Sophistication Level, Length, Content Style, Security Requirements

Table 1: Relevant attributes

After having presented the relevant attributes and arguments why we are convinced that these are quite suitable ones, we will now discuss the application of the presented model.

4. Application

In this section we will present a visionary implementation design as well as the first steps towards the realization of this vision at our partner Deutsche Bank AG. We will restrict this discussion to a single channel application (namely the WWW service) which also was the objective within this project. A discussion of the lessons learned on the project concludes this section.

4.1. Implementation vision

Based on this model, we will now refine the right hand side of Figure 4, discussing the processes that have to be performed to facilitate the whole matching process I_{1X} and I_2. (The objects "Output" and "Customer" are not depicted in Figure 8 and Figure 9 for reasons of simplification and clearness. Abstracting from institutional settings, Figure 4 gives an overview of the relationships between the content and customer model and their related objects.) In Figure 4 we have already presented that an inference process has to be performed in order to derive content meta information that can be used for a matching process. This pre-processing is partly already performed by content providers (step 1, for this and the following steps see Figure 8; note that from the content provider's perspective the object "Meta Info" can also be seen as a content model).

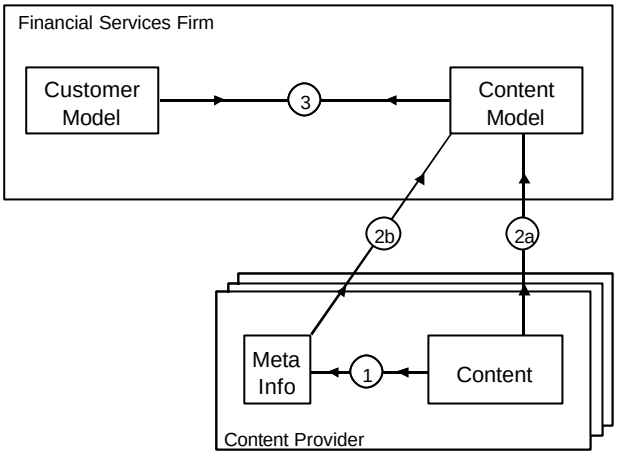


Figure 8. Process Design

For instance content categorization is done and content length is determined by most content providers (see Figure 2). We have enumerated and discussed the relevant attributes to describe finance related content in section 3. Certainly, not all these attributes (see Table 1) are captured by content providers up to now. Furthermore, the semantics of the derived meta information is not standardized across the content providers. For instance content provider A may save the number of words for the length of an article whereas content provider B may store the number of pages.

Thus, a second pre-processing has to be performed. Except for the subject terms and type of the content, we propose to derive all other attributes (see Table 1) by a standardized and IT-enabled inference process (step 2a). In contrast, subject terms and type are (partly) determined by human content managers and for cost reasons we do not propose to derive these values for each content again but we propose to use the already determined ones. Consequently, for the subject terms and type, an additional standardization process has to be performed in order to receive consistent meta information (step 2b). This process adapts the different terms and types to a major catalog maintained by the financial services firm. The standardized pre-processing for the remaining attributes can be performed in at least two different settings. Firstly, the content providers can send their content to the financial services firm and the remaining meta information may be derived there. Secondly, meta information can be derived at the content providers' sites using an inference process provided by the financial services firm. Finally, the matching can take place (step 3).

In summary we get a matching process that is based on consistent meta information which has been mostly derived by an automated inference pre-process. The approach convinces by its flexibility and modularity. New attributes may be easily introduced or already established attributes may be altered by simply adjusting the standardized inference pre-process provided by the financial services firm. Also, new content providers can be added to the framework with-

out difficulty. The new content provider has either to be equipped with the standardized pre-process or it just sends the content to the financial services firm. Nevertheless, its subject terms and type information have to be included into the semantics of the financial services firm's subject index and type information. The meta information deduction is widely independent of the content providers as well as of the employed customer model.

It is also important to note that in our understanding the "content provider" is not a certain industry, but a role, which can be played by several companies belonging to very different industries. For syndication as a possible business model for content providers see [29].

4.2. Practical experience and implementation at Deutsche Bank AG

We will now turn the attention to the practical project experience gained at Deutsche Bank AG, where such a system is currently implemented. The individualization efforts comprise the steps I_{1X} and I_2 depicted in Figure 4.

However, the current market situation does not allow for a solution as described above. Content providers are neither willing to send their content for a pre-processing to the financial services firm nor allowing the financial services firm to equip the content providers with a standardized pre-process. Therefore, the concept of the master index has to be introduced. The master index – as a new element in Figure 9 – is a union set of the (subject) categories and attributes that are provided by Deutsche Bank's content providers. That is, the master index serves as a central reference catalog of meta information categories and attributes that comprises all individual catalogs of the different content providers and is used in the matching process. Note that the master index is just a representation of the different subject categories and attributes and their possible values.

Step 1, namely the inference pre-process at the content providers, has already been described above. To prepare a matching, a customer profile of the customer model is populated with fitting items out of the master index (step 2).

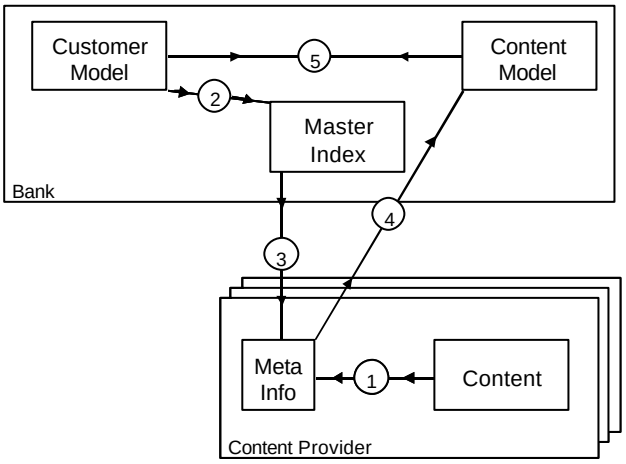


Figure 9. Implementation Scenario at Deutsche Bank

In result, we get a query that is sent to the content providers (step 3). In case the specific customer is already quite well "known" by the system, the query will be more specific as if only some general preferences have been derived so far. For example, if it is known that a customer is interested in U.S. high tech stocks, a query will deliver much better results compared to the situation where just a general preference for U.S. stocks is assumed. Due to missing standardization the result set of a query may vary extremely with respect to fit between the result of the query and the customer. For instance, if a content provider just offers a few categories, a query will not deliver high quality results. To cope with the problem of not standardized categories, attributes, and inference processes at Deutsche Bank an implementation of an intelligent layer is planned, which adapts each query to the specific content provider's attributes and categories before it is sent.

The result set of each content provider is sent back to Deutsche Bank (step 4), where another matching (step 5, analogously to I_2 in Figure 4) with the customer model takes place. (We should note that the content model in the Deutsche Bank scenario differs in so far from our content model described in section 3, section 4.1 and Figure 4 that it does only contain the results sets with the values of meta information based on the master index.) This is necessary, since in the Deutsche Bank setting, a priori it is not sure how the result set will look like due to not standardized inference processes at the content providers sites and due to differing categories and attributes.

In the course of the project with our partner Deutsche Bank AG, we have learned that players on the financial services market are keen on the application of individualization and personalization concepts in order to intensify their customer relationships and thus achieve sustainable unique selling positions. Moreover, it could be shown that state-of-the-art technology already enables such concepts. With vital parts of our vision being implemented, the Deutsche Bank project is a big step in the right direction towards efficient eCCRM.

Nonetheless, there remain three major deficiencies:

- The concept of the master index portrays just an interim solution, since it has to cope with inconsistency and standardization problems. It is necessary to have just one consistent inference process (I_{1B}, see Figure 4) based on standardized subject categories and attributes. However, most likely, it will still take some years until this may be achieved. Therefore, the master index is a helpful concept right now, even if Deutsche Bank cannot influence the categorization and inference processes used at the content providers' sites.

- In terms of the subject categories, we already have quite good meta information about the content, whereas on the remaining attributes, this is not the case. In addition to the already provided attributes, such as “length” or “language”, it is inevitable to provide the above enumerated attributes (Section 3 and Table 1), like “sophistication level”, “recommendation level” or “specificity”, in order to be able to fully match the customer’s preferences with the right content at the right time in a multi-channel environment.
- At Deutsche Bank, the implemented system just allows for personalized one-to-one marketing and relationship management via the Internet channel. However, a comprehensive eCCRM has to serve all available channels in order to satisfy customers’ needs. Nevertheless, since the Internet may serve as an integration platform and once the basic functionality and implementation is understood and tested, the system may be relatively easily adapted to comprise the remaining channels.

With these concluding remarks for the application scenario at Deutsche Bank, we will now address some limitations of our analysis and present prospects for further research activities.

5. Limitations and prospects for further research

Firstly, the content model is domain specific, hence the suggested attributes might not necessarily be valid in other contexts. However, we are convinced that based on the presented analysis, a transfer to other knowledge domains can be quite easily performed. The underlying technique and methodology will stay the same: fixed attributes, an inference pre-process, and arguing from the customer’s perspective.

Secondly, though both practical experience and theoretical models tend to support the perspective that it is well worthwhile investing in such one-to-one marketing concepts and performing eCCRM, it is quite difficult to provide an accurate cost/benefit-analysis which would support our vision. To conduct a thorough and correct analysis is not possible since the efforts will only payoff over the long term due to more satisfied and loyal customers.

Thirdly and most important, it is not possible to prove theoretically that the chosen attributes are indeed the relevant ones. Though we have tried to find good reasons why we think an attribute is relevant, even after the full implementation at Deutsche Bank, there will be no proof of correctness and completeness. This should not be a prohibitive obstacle to perform such kind of research. In case it turns out that one or more attributes are either missing or dispensable, the model may be easily adapted to the new set of relevant attributes. Nevertheless, we are convinced that the “core attributes” are the ones presented in this paper.

With these limitations of our model we turn the attention to prospects for further research. One of the most important tasks in the future will be to conceptually combine the models of the framework. Special attention has to be put on the matching algorithms that will serve as the glue that holds the different models together. One possible design for the customer and content model may be to represent each piece of content and each customer as a software agent. This would facilitate the opportunity to have both customer and content driven triggers that cause a new matching process. The suggested design has already been successfully applied in a distributed multi agent environment in the German National Science Foundation (DFG) funded research project ALLFIWIB and a similar approach at Advance Bank, one of Germany's leading direct banking firms. (See e.g. [5], [10], [4].)

Also, the expiry of content is challenging. On the one hand it should be possible that content agents themselves interact with each other to determine whether one of them is outdated by the other. For instance a content agent containing meta information about an old quarterly report of a specific company should be terminated by a content agent that contains the meta information about the new quarterly report of the same company. On the other hand, market or legislative driven events should generate expiry agents that screen content agents and determine whether they are outdated or not. For instance, the above mentioned example of the latest judgement in the MICROSOFT trial (see section 3.4) might trigger the creation of an expiry agent that terminates all content agents that contain meta information about earlier hearings. Modularity, maintainability as well as scalability are just some advantages of an agent based approach. However, the scale of Deutsche Bank may require new methods and tools in order to reach an acceptable performance and security.

Another area of interest will be to develop product models that are capable of representing the different financial products in terms of quantitative and qualitative data and are able to facilitate the solution of complex financial problems. This should not only be possible for individual problems but – much more important – from a portfolio perspective. Finally, for validation and gradual improvement of the content model, empirical evidence on the relevance of the identified attributes is necessary.

These prospects for further research conclude the paper. We will now summarize our findings and give a brief outlook on our further efforts in the context of the Deutsche Bank project.

6. Summary and outlook

In this paper, a model with respect to finance related content has been presented. The model has been put in the context of a general one-to-one marketing framework comprising a customer model, a content model, and a channel

model as well as a product model. It has been argued that a number of attributes besides the subject and length of the content have to be derived in order to properly match customer's preferences. Meta information is mainly derived by an IT-enabled inference process and partly by human content managers. In addition to the model, implementation issues – especially with regard to our project experience at Deutsche Bank – have been addressed and it has been shown that vital parts of our vision can already be implemented with current technology.

The presented paper is the basis for ongoing research and serves as one building block for the completion of the described framework. Besides the full implementation at Deutsche Bank, next steps are the development of a product model that takes into account both quantitative and (perceived) qualitative data, the development and refinement of the matching algorithms and the implementation of the multi-channel architecture.

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