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Enabling eCCRM: Content Model and Management for Financial eServices

by

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Enabling eCCRM: Content Model and Management for Financial eServices

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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 and on an implementation concept. Some implementation issues are also discussed in the context of an ongoing project with Deutsche Bank.

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virtualization and digitalization, segmentation approaches widely used in the past to target customer groups are outdated.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. [18], [5]. On mass information and customization systems see e.g. [10], [11]). 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], [7]). 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 [7] 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 – keeping "Economically Valuable" customers and repelling and eliminating "Economically Invaluable" ones – has become increasingly important.

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. (E.g. [12] states that the customer is interested in problem solving information because of an increasingly difficult search process.) 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.

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. [15]) as well as informa-

tion such as the subject of the content and other content meta information have to be considered. To automatically match contents 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 and content model and 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], [22] 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. [9], [17], [26]. For a domain model that filters the key preferences of a customer see e.g. [20]) and a variety of quantitative methods to solve "quantitative" customer problems (see especially [25]; see also [3], [22]) 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 e.g. to the concept of mediating electronic product catalogs described in [15].) 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 [14].)

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, product models, and intelligent matching rules. (See e.g. [19], [1], [13], [21] for basic information about matching algorithms. [23] 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.

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. 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. 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 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 [20].

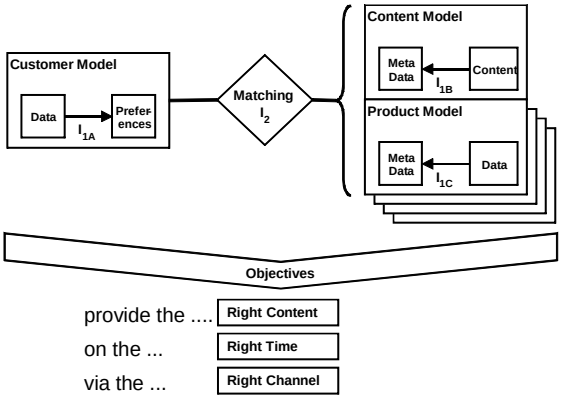

Figure 1. General research framework

The framework consists of three models as described at the beginning of the paragraph. They all have in common that they already provide for an inference I_{1X}, as a preprocess. 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 [9]):

- reduction of complexity,
- more precise specification of the matching algorithms I_2,
- 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 an inference process on both the side of the customer as well as on the side of the content has to be performed before a I_2 can be performed, 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. 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. However, the Internet not only is a formidable way of interactively and individually communicating with customers, it is also lends itself excellently as an integration platform for the different channels. It has become more and more a necessity that consistent and up to date information is provided in any communication channel offered. See e.g. [5] for a more detailed reasoning. Moreover, this 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. Concerning the WWW channel, it has both push and pull characteristics. First, it needs a customer to log on the Internet before any information can be pushed. Second, after providing for individualized links or abstracts (push), it is again the customer who has to decide, which content he wants to read (pull).

In the following we will just focus on the content model, which may be used relatively independent from the used customer model. Nevertheless, any content model is no end in itself but aims at providing customers with the right content, hence it is inherently based on assumptions 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, the right point of time and the right information channel to deliver this piece of content 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.

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 contents. These are already very well suited for matching content and customer with respect to the subject dimension (see Figure 2).

Figure 2. Literature database at ProQuest.Umi.Com – used subject and meta categories

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 paper 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 content. 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 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 fit 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 or too complicated syntax within the content, for instance.

3.3. Right time and right channel

Within the last section we derived the subject categories and the attributes “author”, “source”, “language”, “release date”, “content type”, “recommendation level”, “specificity” and “sophistication level” necessary to assess, if a content generally is a suitable one for a customer. But the sophistication level or length of a content also 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.

Besides sophistication level and length of a piece of content, there are other factors influencing the “right time” and “right channel” decisions.

For deciding, at which time via which channel a piece of content should reach the customer, it is quite obvious that urgency of an information plays a key role. The report of the latest judgement in the MICROSOFT anti-trust trial some minutes ago might not need to be urgently delivered

to a customer with no MICROSOFT stocks in his portfolio, but it will definitely have a nice effect on customer satisfaction that the report is posted immediately to the mobile phones of customers who own such stocks. We can learn from this example: Urgency influences the point of time as well as the channel of deliverance and can be derived through the subject of a piece of content and solid knowledge about the customer's current situation. Thus "urgency" cannot be assessed independently from specific customers and has to be considered within the matching algorithms.

However, not every content is suited for every channel. Posting a video interview with Bill Gates on the mobile of a customer might not have a positive effect on customer satisfaction. Obviously meta information which characterizes the suitability of the content for the available delivery channels has to be considered, such as length and especially style. That is used file formats and different media such as video, audio files, graphic elements, etc. within the content play a key role for the decision on the "right channel".

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.

Table 1. Relevant attributes

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

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. A discussion of the lessons learned on the project concludes this section.

4.1. Implementation vision

Abstracting from institutional settings, Figure 4 gives an overview of the relationships between the content and customer model and their related objects.

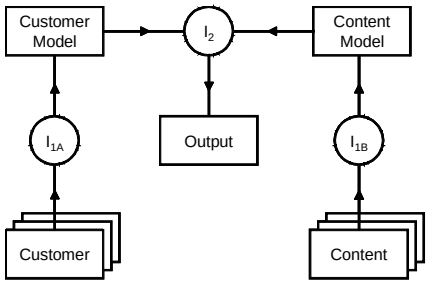

Figure 4. Static model of content and customer model relationships

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, which have to be extended by matching results identifying the right time and the right channel of deliverance, or a list of customers to deliver per content if content driven.

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. (The objects "Output" and "Customer" are not depicted in Fig-

ure 4 and Figure 5 for reasons of simplification and clearness.) 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 5; note that from the content provider's perspective the object "Meta Info" can also be seen as a content model).

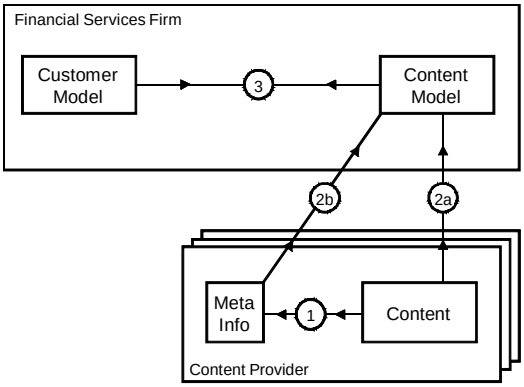

Figure 5. Process design

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 without 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 [24].

4.2. Practical experience and implementation at Deutsche Bank

We will now turn the attention to the practical project experience gained at Deutsche Bank, where such a system is currently implemented. The individualization efforts comprise the whole model 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 6 – 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).

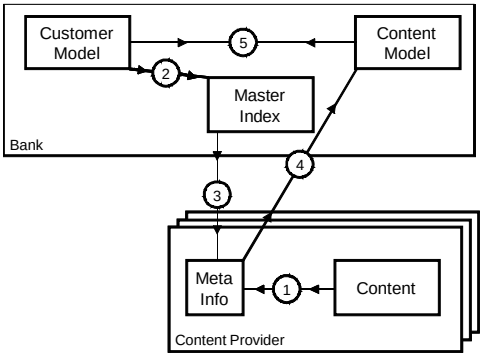

Figure 6. Implementation scenario at Deutsche Bank

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, 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. [6], [8], [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 and content model as well as product models. 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 on the one hand the development of product models that take into account both quantitative and (perceived) qualitative data and on the other hand the development of the matching algorithms.

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