

A Review and Evaluation of Platforms and Tools for building e-Catalogs

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Abstract

The purpose of this paper is to give a comprehensive understanding of the role and importance of e-catalogs in today's e-commerce strategies. The main contribution of our work is a systematic approach towards the classification and evaluation of platforms and tools used for building e-Catalogs. Further we define e-catalogs in a broad sense and we examine the benefits introduced by their use. We attempt to make a general classification of e-catalog solutions, differentiating them in to three general models. These approaches represent the most common classification of e-catalogs in everyday use.

After a short description of each model, a representative tool for each category is reviewed. For the third approach, we evaluate, based on our extension of the evaluation framework first introduced by Ginsburg et al [9], "BookTrade" [8] B2B system. BookTrade incorporates a third-party managed catalog, which we focus on in this description.

1. Introduction

Electronic catalogs are rapidly becoming an increasingly important part of electronic commerce. Applications developed to facilitate both B2B and B2C transactions are highly dependent from their e-catalog component in order to communicate product information and content to end costumers.

In order to fully understand the value added by the use of an electronic catalog, we should make clear the role they have in to the electronic commerce environment. *An electronic catalog is thus the medium through which the user sees and interacts with the supplier information* [2]. Although e-catalogs are quite widespread and common in everyday use, especially when it comes to the case of Web-based transactions, there are some legacy applications that deliver similar services. However, their efficiency and capabilities cannot be compared to the ones that an electronic catalog can offer [3]. For example, consider the paradigm of the printed catalog model. It may seem as a very popular and widely used solution, but

it is true that end-users in buying enterprises are often having problems to physically locate the catalog. Moreover, they can never be confident that the catalog they use contains the most current and updated information. In general, costly and time-consuming processes are used, in order to check availability and price of a needed item, not to mention the manual burden of the requisition cycle (receipt, invoice, payment).

By introducing the concept of the electronic catalog, it is obvious that many of the above disadvantages are seriously alleviated. The buyers can now easily locate the newest version of the catalog. They can also search and retrieve their desired item information faster and simpler by using computer-assisted search mechanisms, instead of the printed catalog index. By integrating the catalog in to an internal e-procurement application, the whole requisition and purchasing cycle is greatly simplified and accelerated, while the buying company can maintain control over the purchases and keep track of them for future use.

The supplier is now faced with significantly lower costs in order processing. At the same time, he is able to provide his costumers with consistent and up-to-date information and an intuitive interface, through which buyers can place their orders in a uniform manner. Personalization and added value content for specific costumers can also be easily achieved.

Such capabilities and advantages, that the e-catalog concept has introduced, have lead to a wide adoption and recognition of the need for electronic catalogs. In fact, this concept has been quite elaborated, driven mainly by market requirements, so as to include, more or less, three different e-catalog models. Moreover, as more and more e-catalog design tools and platforms come in to surface, it is important and useful to be able to valuate and rank suggestions that claim to solve similar problems.

The following of this paper is structured as follows: in Section 2, we present a complete and systematic classification of e-catalog models. Common use and current research [3], [9], [10] have shown that the most important criterion in differentiating e-catalog approaches is the stakeholder that is mostly in control of the catalog.

This section finishes with the examination of a representative tool for each category. Section 3 starts with a brief discussion of a framework for evaluating e-catalog solutions, first introduced in [9]. Mainly driven from our efforts in the development of BookTrade [8] B2B system, we then extend this framework and generalize its scope. Our main purpose is to *weight* the importance that the evaluation criteria have for each stakeholder in a third-party managed e-catalog application. Finally, the conclusions drawn from this work are included in Section 4.

2. Classification of electronic catalogs

2.1. e-Catalog models

By examining the current state of the market and taking in to consideration the responsibility of developing and maintaining an electronic catalog, as well as its intended use, we identify three general e-catalog solution classes: The *Supplier Managed* (Level 1&2), the *Buyer Managed* and the *Third-Party Managed* e-catalog model.

The Supplier Managed Model (Level 1)

The buying enterprise uses catalogs that are provided by each individual supplier *and are hosted at the supplier's site*. In this case, the buying organization is responsible for requisitioner profile information, account codes, tax status and approvals. On the other hand, the selling organization is responsible for the creation and maintenance of the electronic catalog, associated prices, order entry, and inventory mechanisms.

This is a good approach especially where the supplier provides some added-value features such as search or configuration facilities that are specific to the goods or services being provided by that supplier. However, the disadvantage is that the buying enterprise (finance department, procurement team and the IS organization within the enterprise) is faced with a whole new set of processes and interface issues with every new supplier. As the number of suppliers increases, the effort to facilitate communication with a large number of different partners grows exponentially, eventually overwhelming the buying enterprise.

The Supplier Managed Model (Level 2)

The buying enterprise uses catalogs that are provided by each individual supplier *and are hosted on the buyer's premises*. This applies for the case where the buyer maintains an internal database of pre-aggregated catalog content. However, the supplier still has the total control of his content and he merely updates it for each buyer.

The merit of this approach is that the pre-aggregated catalog content allows buyers to quickly enable critical

mass of supplier content, whilst enabling most-rapid deployment with as less as possible requirements in internal IT capabilities. It also speeds up and simplifies the requisition process, because the end user first searches the internal database and only if his is not satisfied the system will search for more suitable products outside the company's intranet.

The Buyer Managed Model

The buying enterprise creates and uses an internal catalog, which it populates and aggregates with content provided by many suppliers. This approach has some value for the finance and procurement departments in the buying enterprise, in that it allows them to have firm control over the catalog. However, the implementation of such an approach is seriously challenging. Creation and maintenance of large catalogs with lots of diverse, aggregated content requires specialized tools, processes and human resources. This heterogeneous environment is characterized by the need of supporting different formats for the content being integrated and by the fact that the content comes from owners with varying relationships with the integrator of the content [15]. In fact, enterprises that have already started developing buyer managed e-catalog projects report major problems in attracting and retaining skilled resources, and major unanticipated costs in hardware, storage and software tools.

The Third-Party Managed Model

In this approach, a third party creates and aggregates a catalog with content from many suppliers. This catalog is then made available to contracted buyers on a commercial basis. Frequently, these third-party intermediaries are identified as "electronic marketplaces". There are two main variants of this approach [3]:

- *The public model*, where the third party creates a single catalog from many suppliers and makes this single catalog available to many buyers.
- *The personalized model*, where the aggregated catalog contains additional data provided by the suppliers in addition with the data to be aggregated. That means that buying enterprises can have different views of the intermediated catalog, as well as having access to selected or special content within the catalog (*added-value*). This is useful in that it ensures that any special prices or restrictions on the range of products presented in the catalog will be shown only to the appropriate (specially contracted) buying enterprises.

2.2. Application and utilization of the e-catalog models

From the above discussion, it has been made clear that not every kind of catalog model is suitable for every firm. Each model has its own characteristics and can satisfy only certain needs.

Considering the *supplier-managed model* of an e-catalog, it is not implied that the role of the buyer is totally minimized. As it has been already described, there is a kind of responsibility sharing between the two contracted parts. Instead, it is in B2C e-commerce where the selling organization maintains full responsibility for acquiring and updating accurate profile information for thousands of shoppers, while providing for dynamic catalogs. That means that the buying enterprise cannot rely on an infrastructure that simply consists of a web-browser with Internet access. It is necessary to implement and maintain at least some kind of information system that supports purchasing. This system can include for example a server that receives Order Requests from the end-users (requisitioners) within the company and returns Orders [12]. It should also provide support for handling the requisitioner profile information, trading partner information, workflow, approval, account, and tax status necessary to complete an order.

However, it is possible that small enterprises, which don't have the opportunity to develop a sophisticated information system or are not able to share such a responsibility, will eventually be able to satisfy a high percentage of their needs through an *intermediated catalog*. Even midsize enterprises will be able to accomplish a portion of their goals by relying on this kind of solution, but, as their procurement needs grow in volume and complexity, they will soon realize the need for using multiple services, such as seller managed catalogs or even buyer-managed ones.

Finally, large, worldwide enterprises should benefit from each of the above models and mostly from the *buyer-managed approach*. This is mainly driven by the fact that procurement automation and (especially) the need for strategic sourcing [6], require enhanced and centralized control over the whole purchasing and procurement process. Moreover, the selected solution should provide for scattered purchases along each node in the supply chain. It is obvious that the solution that suits better those requirements must be based on a buy-side application that has the flexibility to use multiple catalog services [5]. This implies that support for different interface "standards" is needed, in order to be able to ripe the benefits of each approach. Therefore, large buyers with a great number and variety of suppliers can organize their purchases and imply their policy in a more uniform manner, by implementing buyer-managed based solutions.

2.3. Electronic catalogs: Current state

Trying to capture better the meaning of the models presented above, we find it useful to examine the current state of the market in this area. Therefore, in the following we deal with the description of a representative example for each category. Especially for the third-party managed category, we present our efforts in the development of "BookTrade" B2B system.

Supplier Managed: The case of IBM Websphere Catalog Manager

IBM Websphere Catalog Manager (v.1.2) is a tool designated to offer catalog management functionality in to the IBM Websphere Commerce Suite. The solution uses standards-based Java and XML technologies to provide content integrators with the ability to aggregate large catalogs from many sources in different formats. Therefore, Catalog Manager can help to create and manage catalog information across B2C, B2B and e-marketplace environments. IBM Websphere Catalog Manager is characterized by the following facts:

- Customizable interface that enables both technical and business users to create, enter, update and manage catalog data
- Delivery of personalized product information according to customers' preferred language and local currency
- Information sharing between trading partners using XML format and content collaboration across the supply chain
- Standards-based interfaces that facilitate integration with other enterprise applications

IBM Websphere Catalog Manager is clearly a catalog content management tool, which has little to do with the purchasing process. This functionality is provided by the Websphere Commerce Suite, which Catalog Manager is integrated in. What's more, Catalog Manager corresponds to the Supplier Managed model, Level 1, as it seems to be entirely useful for the supplier or any other party that has the need to aggregate multiple content and make it publicly available in the form of an electronic catalog.

Buyer Managed: The case of Ariba Buyer

Ariba Buyer (v.7) is a solution designated to automate the full buying cycle from requisition to payment over the Internet. Ariba Buyer is part of the Ariba B2B Commerce Platform, an infrastructure of interoperable software solutions and hosted web-based commerce applications and services. By leveraging this platform and by utilizing the advanced search capabilities offered by Ariba Buyer,

buying enterprises can have access to the content provided by a large number of suppliers. Features of Ariba Buyer include:

- Aside from the full automation of the requisition and purchasing process, Ariba Buyer offers tools for reporting and analysis, which can be used for forecast and strategic planning
- Ariba Buyer comes in seven different localized versions to provide for varying language requirements and local commerce needs, such as taxes and payment, multiple currencies and support for regional back office systems
- Easier integration in to existing enterprise applications through adoption of standards-based technologies such as Java, XML and HTML

It is obvious that Ariba Buyer is not only a simple Buyer Managed catalog application. It is a highly sophisticated e-procurement solution and its functionality extends far beyond the automation of the purchasing process. However, this example is useful in that it shows that advanced control over the business processes as well as full automation of the entire procurement process and chances for strategic decisions and planning can only be achieved through complex solutions developed and operated on the buyer's side. It is also important to notice that Ariba Buyer comes in an ASP (Application Service Provider) Edition as well. In this case, Ariba ASP partners host the solution in particular. This is consistent with the fact that developing a buyer-side application, external help can be obtained, but the buying firm continues to maintain full responsibility and control over its solution.

Third-Party Managed: The case of "BookTrade"

BookTrade is a system for hosted business-to-business electronic transactions for the vertical market of books [7], [8]. Design of BookTrade was based on specific requirements collected through interviews and market research on a large number of potential users (publishers-booksellers). BookTrade supports all fundamental trading transactions including a searchable electronic catalog, multi-merchant orders and electronic as well as conventional payments. BookTrade's hosted deployment specifically targets Small and Medium Enterprises, but can also accommodate larger companies through integration with customer ERP systems. Wide adoption of Internet and market specific (EDI) standards renders the system open, flexible and extensible.

BookTrade consists of three discrete subsystems: i) Electronic Catalog of Book Titles ii) Ordering Mechanism and iii) Payment subsystem. For the scope of this paper, we keep to the description of the electronic

catalog subsystem, which is the spindle around which the rest of the system functionality is build.

The *back-end* of the catalog draws heavily from an existing database, which is used as a "pool" of titles. Thus, BookTrade exploits the data and part of database structure as they are found in it. However, the database schema was extended in order to map better to specific requirements and functionalities. All additional data is manually provided through a form-based interface, while a separate component deals with the synchronization between the two databases. Trading data such as prices, offers, stock, etc can be also easily imported into the catalog from individual customer ERP systems located at merchants site, through a custom import/export component.

The *front office* catalog component gives users the opportunity to choose between five search methods. These methods vary in complexity and searching strength and are the following: the Simple Search (enter words describing specific characteristics of a book such as title, author or ISBN), the Advanced Search (enter words describing specific characteristics of a book that can be combined using logical "AND" and "OR") and the Subjects Search (which actually is a tool for navigating through the subjects hierarchy). Additionally a user can perform searches against the entities of publishing house and author, finding records matching his criteria and all the books associated with an entity. Moreover, BookTrade supports discrete company and user roles, thus providing with a set of administrative operations, according to the role and the rights the individual user has currently in the system. In general, there are seven utilities integrated in to BookTrade:

User Management Utility, which deals with the attributes of each individual user,

Company Management Utility, which deals with the information about each company that participates in BookTrade,

Catalog Management Utility, which provides the functions necessary to manage the company's catalog,

Agreements management utility, which provides the functions needed to manage the one-to-one contracts between trading partners that are supported by the system, *User Authentication*, an LDAP based subsystem for authenticating individual users,

Company Registration-Initialization, a utility that, through a series of forms, helps companies to provide their initial information and subscribe in to the system,

Statistical-Informative Reports, a tool that provides the user with statistical information based on his use of the system that can help him redefine his trading strategy.

From the above discussion we conclude that BookTrade provides book buyers and suppliers with a

vertical marketplace environment, which specializes in automating the purchase cycle of books. Therefore, BookTrade's e-catalog subsystem can be classified in the Third Party Managed catalog model. Being a custom-made solution, BookTrade bears all the advantages and disadvantages of a system developed to meet specific requirements and qualifications: It captures business processes and logic more thoroughly, but it may not be suitable in situations where there are different demands.

3. The extended evaluation framework

Having examined the three catalog models, we have by now a thorough way of understanding the functionality offered by an e-catalog, as well as the varying circumstances under which e-catalog solutions are operated and utilized. However, it is of equal importance to be able to recognize the differences between e-catalog initiatives, especially when they belong to the same category. These differences regard, for example, design goals, target user groups, underlying costs and requirements. An evaluation framework is necessary, not only because we need a basis for comparison, but also because it offers a detailed set of guidelines for optimizing the design and implementation of e-catalog solutions.

3.1. A systematic e-catalog evaluation approach

Ginsburg et al. present in [9] a framework to evaluate electronic catalog solutions. First, three general solution classes are introduced: the "Do-It-Yourself", "Third-Party Integrator" and "Real-Time Knowledge Discovery" approaches. The first two correspond roughly to the three models we presented in *Section 2.1*. The third approach represents a rather novel and radical but difficult to apply solution. Eight evaluation variables are suggested, which are meant to represent the most important criteria that characterize electronic catalog solutions in current practice. This set of variables addresses a wide range of critical catalog attributes such as benefits, costs and underlying technology requirements. Six of them are focused on the buyer's side, while the rest two deal with the supplier's perspective. Moreover, the framework specifies a number of parameters that each evaluation variable depends on. These variables are summarized in the first column of *Table 1*, alongside with two more variables we deliberately add (*see Section 3.3*).

3.2. Extending the framework: Need and motivation

After examining the proposed evaluation framework introduced in [9], we conclude that it offers a consistent and thorough way to evaluate electronic catalog solutions. Indeed, as common practice has shown, the included variables capture the most important criteria that have to be taken in to consideration before adopting an e-catalog application. Nevertheless, the framework is intended to estimate the value of three general e-catalog solutions, resulting thus in a rather generic – although useful – approach. Moreover, it doesn't pay much attention to the developing efforts and tangible factors that e-catalog developers and designers must have in mind; rather, it focuses mainly on the benefits and costs that buying firms are usually confronted with, while it identifies two more supplier-centric variables.

In our work, we try to extend this framework towards the case of the Third-Party managed model. Apart from the buyer and the supplier we identify the intermediary authority as a stakeholder of equal importance. Furthermore, we generalize the framework's scope, by recognizing the fact that each framework variable can have some significance for *every* stakeholder that takes part in the Third-Party managed catalog. To reflect this, we assign each criterion three individual weights, according to the relative importance they may have for each of the three parties involved.

In addition, we complement the framework with two more variables that capture the perspective of the intermediary. The framework then can match better to the specific case of intermediated (e-marketplace) catalogs.

The conclusions and experience gained by the development of BookTrade's electronic marketplace have provided us with valuable material and have been highly motivating for the elaboration of this extension.

To give a better understanding of our efforts, we then apply the extended framework to BookTrade's electronic catalog.

3.3. Weighting the evaluation variables for the case of the Third-Party catalog model

As described in *Section 3.1*, six of the evaluation variables are focused on the buyer-side, while the other two concern mainly the supplier. However, each of these variables can have some (or even not at all) importance for every stakeholder. For example, *Flexibility and Control* can be of great significance to the supplier, considering that, in the case of an electronic marketplace, he is very much interested in maintaining control over his content, which is being published. Moreover, some of the variables may be important for the intermediary as well, who is the main responsible for the operation and management of the marketplace.

In *Table 1*, we give a measure of the potential importance each variable may have for each stakeholder using a 0-3 scale. Each time a criterion is extremely important for an involved party, we indicate this significance with (+++). We denote with (++) when a variable is fairly critical and with (+), when it has some significance, but not much. Finally, it is denoted with a (0) each time a variable does not concern at all the respective stakeholder. In fact, there is a case where a

variable has negative importance for the supplier, thus using (-) to indicate this. *Table 1* also contains the two added variables that focus on the intermediary, namely the *Intermediary Interface Cost* and the *Special Relationship Motivation/Support*. The last column of the table contains the parameters that the variables are assumed to depend on. A number in brackets next to each weight stands for the estimated variable value for each stakeholder in the case of BookTrade (see *Section 3.3*).

Table 1: Variable weighting according to stakeholder interest for the Third-Party Catalog Model (Marketplace)

Variable Name	Buyer	Supplier	Intermediary	Function of (parameter1, parameter 2...)
Flexibility and Control	++ (2)	+++ (2)	+ (2)	$f(\text{number of intermediaries})$
Purchasing and Bargaining Power	+++ (3)	0 (3)	+ (3)	$f(\text{purchasing volume, number of end users})$
Buyer Interface Cost	+++ (1)	0 (1)	++ (1)	$f(\text{number of catalog partners that need a different system interface})$
Technology Cost	++ (3)	++ (3)	+ (1)	$f(\text{sophistication of solution, required technology knowledge})$
Usability	++ (2)	++ (2)	+++ (2)	$f(\text{control over system interface design})$
Catalog Reach	+++ (1)	0 (1)	+++ (1)	$f(\text{total number of items accessible via the catalog system})$
Supplier Adoption	+++ (2)	0- (2)	+++ (2)	$f(\text{number of competitors included in the system})$
Supplier Interface Cost	0 (1)	+++ (1)	++ (1)	$f(\text{number of partners that need a different system interface})$
Intermediary Interface Cost	0 (2)	0 (2)	+++ (2)	$f(\text{number of partners that need a different system interface})$
Special Relationship Motivation/Support	+ (3)	+++ (3)	+++ (3)	$f(\text{agreement management \& information syndication policy})$

In order for our extension to have some practical value, it is important to have a consistent way of assigning numerical values to variable weights as well as to variables themselves. By calculating the weighted sum of the variable values, we have the score of the evaluated e-catalog –in our case, Third-Party managed – for each individual stakeholder. If S_{sh} represents the catalog solution score for the respective stakeholder, then

$$S_{sh} = w_{sh}^T v_{sh} \quad (1), \text{ where } w_{sh} = \begin{bmatrix} w_1 \\ \vdots \\ w_{10} \end{bmatrix} \text{ is the weight}$$

$$\text{vector for the specific stakeholder and } v_{sh} = \begin{bmatrix} v_1 \\ \vdots \\ v_{10} \end{bmatrix} \text{ is}$$

the variable value vector for the specific stakeholder and

the specific tool being evaluated. We have already mentioned that we recognize 4 different weight values

($w_0, w_{low}, w_{med}, w_{hi}$). In order to be fairly distributed, the weights must be equally distanced from each other. Therefore, letting $w_{low} = a$ (2), we have

$w_{med} = 2a, w_{hi} = 3a$ (3) and, of course, $w_0 = 0$ (4).

Notice that variables can be estimated in any scale, provided that the weight vector is *normalized*, that is

$\sum_{i=1}^{10} w_i = 1$ (5). We then replace in (5) w_i with the

estimated weights for each stakeholder from *Table 1*, and, by taking in to consideration equations (2)-(4) we finally

get $a_{buyer} = \frac{1}{19}, a_{supplier} = \frac{1}{13}$ and $a_{interm} = \frac{1}{22}$ (6).

It is important to understand that each variable in *Table 1* can have a different value for each stakeholder. That is true, especially when it comes to variables such as Technology Cost or Flexibility and Control, where the intermediated e-catalog may have varying impact on each involved party. We define this kind of variables as *multi-valued variables*. However, there are also variables, like Buyer Interface Cost, that are too specific to be generalized, because buyer cost cannot vary. In fact, the difference lies in the different weights this variable has for each stakeholder. We use the term *single-valued variable* to describe a variable of this kind. In the following, each variable is briefly discussed and the different weights for each stakeholder are explained.

By *Flexibility & Control* we mean the control that the customers (i.e. buyers and sellers) have over the e-catalog and the level of provided flexibility. We consider it to be of medium importance for the buyer, because he may be interested in having the system adjusted to his needs, but this is not his main expectation from a marketplace e-catalog. On the other hand, the supplier is especially interested in maintaining as much control as he can over his content, which is being published by the intermediary to numerous end-users. Moreover, he needs to be provided with enhanced flexibility through special management utilities and tools for updating content, processing requisitions and so on. We can say that the intermediary is least interested in providing customers with maximum flexibility and control, because that means that he has to sacrifice a portion of his own administration over the catalog. Flexibility and Control is assumed to be a multi-valued variable.

Purchasing and Bargaining Power is extremely important for the buyer, as it represents a measure of the buying firm's purchasing significance. However, it has nothing to do with the supplier's concerns, as it is mainly buyer-oriented. The intermediary should be a little

interested in leveraging purchasing and bargaining power of his potential customers, but this is something he can achieve by other means (e.g. Supplier Adoption). It is obvious that Purchasing and Bargaining Power is a single-valued variable.

Buyer Interface Cost, which is a single-valued variable as well, needs to be kept low for the buying firm to appreciate the solution. Therefore, in order to get buyers involved, the intermediary must provide for low interface costs. The supplier doesn't seem to care about buyer costs in general. *Supplier Interface Cost* is however the other way around. It is significant for the supplying company and for the intermediary (though somewhat less), but not important for the buyer. On the other hand, *Intermediary Interface Cost*, that is the number of different interfaces that the intermediary authority has to provide for in order to communicate with buyers and suppliers, concerns solely the intermediary and no one else.

Technology Cost is a multi-valued variable. It is of medium importance for the catalog customers, as they may be interested in the connection and operation costs of the marketplace (required infrastructure etc), but they care more about their direct benefits from utilizing the system. In addition, the intermediary is faced with his own technology cost for setting up, implementing and maintaining his solution. Nevertheless, he is often able to afford a highly sophisticated solution through rapid ROI.

Usability, a single-valued variable, measures the ease of use and the efficiency of the user interface that an e-catalog system provides its customers with. As it is directly connected to user acceptance it is of critical significance for the intermediary. Buyers and Suppliers are also interested in the usability of the system, but they find its functionality more important. Sometimes, usability value can vary between the buyer and the supplier.

Both the buyer and the intermediary need the *Catalog Reach* to be as high as possible. The former wants many opportunities and market transparency, while the latter wishes his solution to expand and become widely adopted. Catalog Reach is however negligible for the supplier, as long as his content is efficiently published. This is also the case for *Supplier Adoption*. Without sufficient supplier enablement [1], [11] no marketplace can be operated and maintained and buyers find no point in participating in it. On the contrary, high supplier adoption means high level of competition and thus great transparency, which may attract many buyers, but it can keep suppliers away. Both the above variables are considered single-valued.

Finally, we introduce *Special Relationship Motivation/Support*, a single-valued variable, which is mostly intermediary-oriented. It is used in order to capture the extent to which a third-party managed

solution facilitates and motivates one-to-one relationships and special agreements between the buyers and suppliers. As shown in *Section 2.1* the public marketplace model does not support personalized or special treatment of buyers. However, in the personalized model, the supplier can provide specific buyers with different views of the same content, as well as with additional data (like special prices, discounts etc) or restrictions. This can have some merit from the buyer's perspective as it gives him the opportunity to develop personalized trading relationships with the suppliers and take advantage of any volume discounts, offers etc. Still, it is the supplier who is mainly favored by the possibility to treat each buyer personally and be more competitive. Moreover, the intermediary must take this criterion very much in to consideration, for it can be the determinant between his solution and another self-made or proprietary effort. We assume that Special Relationship Motivation/Support is dependent on the agreement management and information syndication policy [4] that is adopted by the third-party.

3.4. Application of the proposed framework

In the following we apply the extended framework introduced in *Section 3.3*, on the third-party managed catalog of BookTrade. First, we try to estimate the value of each of the ten variables presented earlier, based on BookTrade's description in *Section 2.3* and on our experience from the development of the system. We then derive BookTrade's score for each stakeholder, using equation (1) and replacing in it the respective variable values and weights.

This methodology can be used as a guide of how to apply and use the proposed evaluation process for every third-party managed electronic catalog. Notice moreover, that our proposed extension can be easily applied for any electronic catalog model in as similar fashion as the one presented in the previous section. In the following, we use a 1-3 scale to represent the value of each variable; however, any scale can be used (*see Section 3.3*). BookTrade's score is summarized in *Table 1*.

Flexibility and Control

As a solution that was based on analytic research, interviews and thorough modeling of user requirements and business logic, BookTrade is expected to exhibit a high level of adaption to current user needs. Moreover, support for discrete company and user roles, combined with a variety of management tools and functions provide users with total control over system use and functionality at any given moment. Still, BookTrade's marketplace system involves an intermediary. Consequently, any changes needed by the evolving user requirements should be first posed to the third-party who must first consent,

before any changes take place. Moreover, as more and more buyers and sellers participate in the catalog, the more difficult it is for the system to adapt quickly and easily to the demands of every individual customer. Therefore, BookTrade is awarded a grade of 2, for Flexibility and Control and for every stakeholder involved.

Purchasing and Bargaining Power

It is assumed that Purchasing and Bargaining Power depends on the purchasing volume and the number of the end users. However, the system has not yet been officially deployed; thus, there is no objective way as to estimate system's utilization and acceptance amongst its target-user group.

In any case, BookTrade's utilization cannot but be beneficial for the buying firms. Wide adoption of the system can automate and simplify the purchasing process directly and fast, resulting therefore in an increase of order requisitions by internal users. In addition, one-to-one relationships between buyers and suppliers that are supported by the system, in combination with security and transparency during order placement and processing can substantially leverage purchasing and bargaining power, short after system adoption. Thus, we assume a grade of 3 for this single-valued variable.

Buyer/Supplier/Intermediary Interface Cost

Interaction between BookTrade and its end users is facilitated through a usable and user-friendly web interface, providing thus a simple and inexpensive means of interaction. In addition, the system supports integration with customers ERP and MRP applications, through a "flat files" approach. Notice however that real-time communication with customer ERP systems is not supported. In the case, for example, that a user has installed an electronic procurement application at his side, on-line connection and efficient communication between the two systems will be limited, if not impossible, without manual intervention. This applies both to buyers and sellers, leading thus in a grade of 1, for these two involved parties. However, since BookTrade offers its own, though simple way of interacting with its customers (including mail notification capability), we award a grade of 2, for Intermediary interface Cost.

Technology Cost

It obvious from the discussion in *Section 2.3* that technology cost is as least as possible, from the end-user's perspective; what is required is merely a computer with Internet access. However, the actual cost is substantially higher. Booktrade's technology infrastructure is characterized by high level of complexity and required state-of-the art technology knowledge. Application

architecture follows the 3-tier model, thus causing an increase in software and hardware requirements. Moreover, the complex security system implemented needs a sophisticated and costly network topology and respective equipment. Therefore we award a grade of 3 for both supplier and buyer; in the case of the intermediary, we give a grade of 1 instead.

Usability

We should mention once more, that BookTrade system was developed in close cooperation with all involved parties, fulfilling thus their expectations and requirements to a great extent. In addition, the web interface being adopted provides a simple, attractive and familiar way to interacting with end users.

Yet, there is lot to be done in the area of personalization. Although individual users and companies are provided with different administration and access rights, there are no strong profiling mechanisms for these entities. For example, each user in the system is treated in a general and a common way, while personalization according to user actions is not supported. Moreover, there are no coordination pathways for the end-users of the system [9]. We assume then a grade of 2 for the Usability single-valued variable.

Catalog Reach

We have mentioned before that book titles that are included in BookTrade's electronic catalog come from Vivlionet's database. As a result, data completeness and timeliness depends directly on Vivlionet's data. As the system does not provide suppliers with an "add new titles" facility, there is no other way to update BookTrade's catalog. Buyers cannot perform any ad-hoc or external purchases either, for the same reason. However, the supplier is able to update some information about his titles, using the flat files interconnection subsystem. Consequently, we give Catalog Reach a grade of 1.

Supplier Adoption

Supplier Adoption is a variable that cannot be objectively estimated, as BookTrade has not been officially deployed yet. Considering system architecture though, we conclude that BookTrade is able to accommodate any number of suppliers and provide them with efficient administration and hosting of their catalog data. Typically, a large number of competitors in the system means low supplier adoption. Nevertheless, the specialized management utilities in addition with the great level of personalized relationship motivation and support (*see below*) that BookTrade provides for, cannot but attract and be beneficial for suppliers. We thus award a grade of 2 for Supplier Adoption.

Special Relationship Motivation/Support

Cornerstone is BookTrade's development has been the notion that buyers and suppliers should cooperate and trade in a personalized basis. Each time a buyer or supplier logs in to the system for the first time, generic trading links with each potential partner are established. At any time, the company administrator is free to change or specialize this information through the agreement management utility. There he can specify parameters like volume discounts, seasonal discounts, preferred currency, payment and shipping ways and more. This information will later apply only to the special relationship the company has with the specific partner, provided that he will agree with these specifications. We realize therefore that personalized relationship establishment is not only supported, but also strongly motivated by BookTrade's system. We thus award the respective single-valued variable a grade of 3.

It is now simple to calculate the respective BookTrade's score for each involved stakeholder. We first replace in (1) the values we just estimated, alongside with equations (2)-(4), thus having:

$$S_{buyer} = 38a_{buyer}, S_{supplier} = 28a_{supplier} \quad \text{and}$$

$$S_{interm} = 40a_{interm} \quad (7).$$

We then replace (6) in (7) to get normalized numerical results in the 1-3 scale chosen:

$$S_{buyer} = 2.0, S_{supplier} = 2.1, S_{interm} = 1.8$$

The result is fairly rational if we consider that although Booktrade incorporates a Third Party Managed Catalog it was developed based on the needs of the Suppliers and Buyers and merely on the needs of the intermediary party.

Nevertheless, notice that each stakeholder score converges to 2, in an integer scale. Consequently, we conclude that BookTrade succeeds to meet sufficiently each stakeholder's individual requirements ($S_{average} = 2$).

4. Conclusions

In our work we tried to establish a comprehensive, consistent and extensible way of classifying and evaluating electronic catalog solutions. Although there has been some research in this field, we feel that there is still confusion regarding this very important component of electronic commerce. Our efforts try to capture the current understanding of the electronic catalog concept and the way it is applied in common practice.

However, we must point out this is neither the whole nor the permanent picture. Radical changes and major

shifts are constantly occurring, under the pressure of the market and the changing requirements of stakeholders [13]. More and more companies opt for the automation of their procurement process, leading B2B e-commerce transactions in to an amazing outburst [14], [16]. At the same time their demands, filtered through the experience gained from utilizing early solutions, are becoming more insistent and specific, thus shaping the future of next generation e-commerce solutions.

Our efforts are intended to help project managers and system developers, as well as everyone that is involved in the design, implementation or adoption of an e-catalog solution. Thus, the extended evaluation framework can be exploited in the design phase of any e-catalog as a vector of design goals that should be addressed by the designers. Therefore we trust that our proposed evaluation framework can contribute towards a more systematic evaluation and optimization of e-catalog approaches, both at the conceptual and the implementation level.

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