Can Indirect Goods Sourcing Be Supported Electronically? An e-Catalogue Approach to the Issue

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Abstract - The introduction of the information technology and the use of innovative communication meanings have made companies rethink the way they deal with their suppliers, especially in the direct goods field. However, in the area of indirect goods and services, although the relative early start of these IT solutions, companies still not applying the information technology to manage their sourcing processes. Therefore, this article proposes the expansion of the well-know e-catalogue functionalities to support not only the transaction procedures as it has been done for years, but also the sourcing process, improving so from one side, the business transactions efficiency and from the other side completing the procurement cycle within an unique system.

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Keywords : e-Commerce, e-Sourcing, e-Catalogue.

I. Introduction

Most organizations seek to manage their purchasing activities in the most efficient way, with the goal of reducing their materials costs and intra business processes, while ensuring the quality of their services and products.

With buying processes generally involving a large amount of information and communication procedures, purchasing is well suited for information technology support and automation (Gebauer et. al. 1998).

Hence, inter-organizational information systems have become an important enabler of this strategy and the application of the internet to do business a crucial factor in modern business relationships.

In order to support the great variety of product and services purchasing processes, supplier relationship management systems (SRM) have been developed to coordinate the process concerned with the supplier integration and communication.

Supplier relationship management describes the business structures and processes required by companies to communicate and execute commercial transactions with their suppliers, while providing methods, processes and tools to support the different phases of a supplier relationship (Eyholzer et. al. 2002).

In this paper, the focus of the analysis is on the sourcing aspect of the supplier relationship management field. The main goal of an e-sourcing system is to support buyers to find the most appropriate supplier for a good, and the foreground is the negotiation phase of the purchasing process.

Nowadays, a new generation of sourcing systems based on business intelligence technology allows the negotiation of multi-attribute criteria during the online negotiation.

However, this reality still not true in the field of indirect goods procurement, in which most negotiation processes still be done manually without any information technology support. Being, only the transaction phase of the supplier relationship procedure supported electronically, often by the implementation of an e-catalogue system.

The e-catalogue combines and extends many functionalities of traditional channels, such as the rich content of print catalogues, the convenience and intimacy of on-line shopping, and the sophisticated searching capability of CD-ROM catalogues. They also let suppliers customize content and views to different buyers, and allow all parties to immediate track orders electronically (Macduffie , 1997; Perlman, 1990).

Nonetheless, this application of this technology in the way that is done nowadays in companies are leading to the loss of process efficiency, a lower return on investment and poor decisions the indirect goods procurement practices.

Due to this fact, this article is concerned with the following research question: How could be the actual e-calogue technology expanded in order to cover not only the transaction procedures, but also the negotiation and supplier evaluation processes electronically?

Therefore, the study has performed a vast literature analysis to establish the state-ofthe- art of SRM systems in the indirect goods and services area with the goal of creating the technical basis needed to develop a concept applying an e-catalogue platform as the key tool to realize the complete purchasing cycle from the source to order process.

The article describes first the electronic catalogue sourcing tool designed, which is further detailed throughout the description of the e-sourcing processes and the systems functions, ending the paper

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with the portray of the ETL tool designed especially to support this new approach.

II. E-Catalogue Sourcing Tool

In order to support the indirect goods and services sourcing process in companies, the work introduces the application of the e-catalogue platform combined with the spend analysis tool, q.v. (Campelo Filho, 2008).

This approach extends the existing functionalities of the two modules to offer an environment in which alongside spend analysis features, buyers have the possibility to execute their indirect material sourcing process electronically based on reliable data and employing statistical and simulation methods, see figure 1.
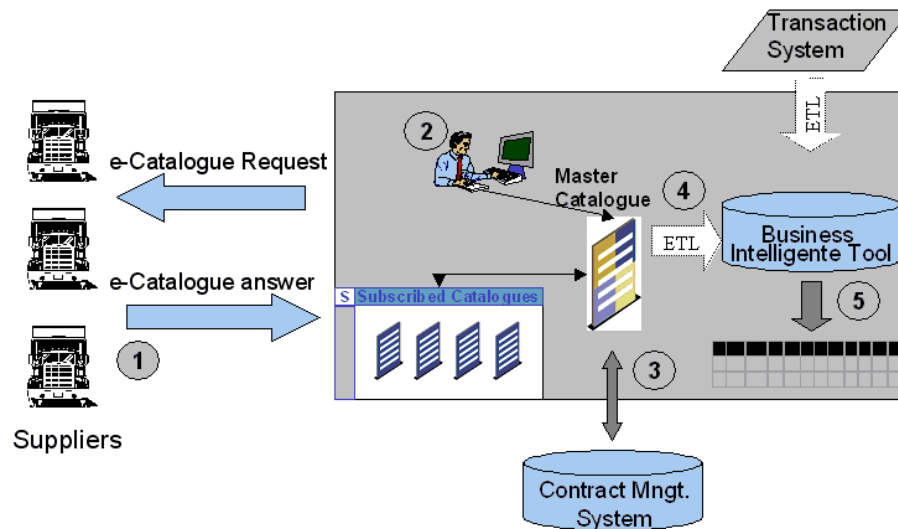

Figure 1 : Solution Concept

The required information to support the negotiation process is extracted mainly from the e-catalogue platform and its respective search engine, though deploying a marginal different ETL process, data storage and data structure methodologies that is presented in section 4.

The purchasing master data, e.g. product ID, product description, is obtained directly from the e-catalogue platform, while the relevant ordering information, e.g. product price, monetary volume, product quantity, etc., is extracted from the search engine. The spend intelligence tool, q.v. Chapter 6, is applied then to collect, normalise, classify and display the information in a user-friendly way.

Based on this information, sourcing relevant analyses, e.g. suppliers' price behaviour, e-catalogue portfolio simulations, customer satisfaction level, etc., as well as electronic request for quotation (e-RFQ) processes, can be carried out to determinate an appropriate source strategy and potential suppliers for a buying organisation.

The e-catalogue sourcing tool has been designed according to current purchase process' practices, which involve the following demands on the overall system concept:

– Support the purchase strategic planning;
– Demand recognition;
– Identification of potential suppliers;
– Negotiation capabilities;
– Spend saving analysis;
– Supplier performance and customer satisfaction measuring;
– Content management.

The approach can be used in a number of different sourcing scenarios, although its main objectives are the reduction of manual tasks and the boost of companies' bargain power via the increase on the process control.

For the purpose of understanding the introduced approach, the next section describes the suggested e-sourcing solution, applying for it, the description of an ideal sourcing process based on the solution functionalities.

III. E-Sourcing Process And Function Description

The lead buyer principle is employed in several large organizations in the area of indirect goods procurement. This method applies the product segmentation into material groups as a pre-requisite for the introduction of a material group management, thus a precise classification of goods and services in classes or groups is crucial to the success of this approach.

This is reflected in all purchase activities, i.e. at the strategic, tactical as well as operational levels, q.v. (Campelo Filho, 2008).

A material group management team is composed of buyers and technicians of various business units, which are managed by a superior lead buyer, who establishes together with the high management the purchasing department objectives and often negotiates with the organisation's key suppliers.

The main objectives of the lead buyer concept are the cost reduction of the products acquired as well as the indirect costs of purchase and supplier management processes, mainly by the application of bundling strategies, process reengineering and the deployment of information technology.

At the beginning of each year, the material group management team establishes the goals of the purchase department, which has often as its main goal the cost reduction of the department in a certain monetary value or in a defined percentage of current material as well as process costs.

After the annual strategic goals are defined, the superior lead buyer has to analyze with his/her team the procedures that have to be carried out, and as the case may be, to decide in which material groups, suppliers, and in which extension the cost reductions will take place to achieve the organization's strategic objectives.

Once the goals of each purchase group have been established, buyers start to seek with their respective suppliers the commercial conditions to attain their personal objectives by means of price reductions and product portfolio bundling.

The concept introduced in this paper assists buyers from the strategic planning process described above to its execution by the application of the e-catalogue platform and the spend analysis module as presented in the following sections.

Nonetheless, before introducing the sourcing process and the respective system functionalities, the entities that are involved in the process are introduced for a better understanding of the described process and their involvement in the framework:

Buying Organization

The buying organization is the highest element (entity) of the system. It represents an organization and as the case may be its subsidiaries as well as their relationship between each other.

A Buying organization can be considered either as a consolidated group of enterprises, thus having just a general company code, or it may be embodied by a group of individual companies, each having its company code and been connected with a higher entity which is the holding company.

Buyer

The entity buyer embodies the purchase department's employee, who is responsible for the operative as well as the tactical procurement business processes, it executes most tasks in the introduced framework, including in its duties the systems' administrative assignments as well as the control over other entities activities, e.g. supplier, system user, third part service provider.

Manager (Lead Buyer)

Under this concept is represented the purchase department employee, who has a key role in the strategic purchase process and assumes the responsibility and control over the purchase department activities and results. In the illustrated sourcing process, it can be also indentified as the lead buyer personnel.

Internal system user

The internal system user is the entity, which performs the purchase requisition from any department of an organization, although the procurement activities are not part of their function. It represents the internal customer of the purchase department and along with the purchase requisition task, it may incorporate also the supplier evaluation function.

Goods receiving department

In case an organization adopts a central receiving department approach, there is the necessity to include a new entity, i.e. goods receiving department, in the organizational design, which will take over the supplier evaluation task from the internal system user entity.

Third part service provider

Third part service providers can be deployed to intermediate the business relations between a buying organization and its suppliers, thus they incorporate part of the sourcing process tasks, according to company's purchase strategy.

Supplier

The entity supplier represents a company's commercial partner, and it requires a link or domain in the e-catalogue sourcing solution to communicate and exchange information with an organization or its third part service provider.

This entity can be divided into two sub-groups, current business partners, which have access also to the e-procurement functions of the e-catalogue platform, and potential suppliers, which have access temporally just to the e-sourcing function of the platform.

a) *Strategic Planning*

A crucial task of the strategic planning is the forecast of the future purchase demand of an organization. This forecast should not be done based just on products and services, but instead it should take into account material groups, suppliers as well as the buying organizations.

In order to perform the demand forecast, the material group management team requires actual as

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well as historical information to investigate the purchase behaviour of the buying organisation and its suppliers. Only after a detailed analysis of this data they can decide for logical and reachable objectives for its department.

The spend analysis module offers a number of reports to boost this evaluation, which includes diverse OLAP functionalities such as Roll up and Drill down functionalities as well as filter features.

First of all, the management team has to find out the total purchase volume of the previous year and its evolution along the past years to compare them with other relevant business information, e.g. commercial and financial reports, pre-defined company's goals, etc., with the aim of predicting the future demand of the purchase department.

This analysis is based on business objects, e.g. product group, supplier, buying organization, etc., which can be dispersed in a flexible time approach. The aggregation and disaggregation of the business objects can provide a data portray in different consolidation levels, which enables the design of diverse reports to support the forecast process.

A large number of forecasts can be performed on a high aggregation level, e.g. material group, and for a long period of time, e.g. a year. Hence, a Top X ranking report has been designed to support this analysis and it can be customized to generate ABC-curves of favoured material groups, as shown in the example from table 1.

Material Group	2011		2010		2009		2008	
	Spend Volume	Number of Orders	Spend Volume	Number of Orders	Spend Volume	Number of Orders	Spend Volume	Number of Orders
Office Products	$ 40.000,00	950	$ 38.000,00	870	$ 35.000,00	810	$ 32.600,00	740
Tool	$ 37.000,00	1350	$ 36.000,00	1150	$ 33.654,00	1005	$ 31.000,00	870
Electric Engineering	$ 32.000,00	750	$ 30.000,00	700	$ 28.200,00	608	$ 27.150,00	532
Marketing	$ 25.000,00	650	$ 23.500,00	600	$ 21.250,00	459	$ 20.864,00	389
Home Technology	$ 21.000,00	100	$ 19.300,00	86	$ 17.250,00	71	$ 16.532,00	62
...	$ 38.750,00	1800	$ 36.700,00	1560	$ 33.963,00	1420	$ 32.000,00	1294
Total	$193.750,00	5600	$183.500,00	4966	$ 169.317,00	4373	$160.146,00	3887

Table 1 : Top X Ranking Report

The material spending, classified in rankings and/or using the ABC-curve, can be illustrated with graphical representations in different colours, e.g. A-material groups in green, B-material groups in yellow and C-material groups with no colour. In addition, chart functionalities are available to transform the table figures in visual friendly diagrams.

In this report, the columns Spend Volume, Volume Evolution, Number of Orders and their impact on the total purchase volume can be determinate and sorted as required. Thus buyers can learn at a glance which material groups have the largest/lowest impact on

the total purchase volume and their evolution, on a historical basis.

The report, in the example above, demonstrates precisely which material groups impact most the purchasing costs and in which groups cuts can be done to achieve the global goals of the company. A detailed view of a specific material group is also possible, clicking on the desired material group on the report.

The new report that will open, shows the list of suppliers within this material group and their sales volume, regarding this specific product group with the buying organisation, see table 2.

Suppliers	2011		2010		2009		2008	
Office Products	Spend Volume	Number of Orders	Spend Volume	Number of Orders	Spend Volume	Number of Orders	Spend Volume	Number of Orders
Office Depot	$ 16.500,00	41%	$ 14.050,00	37%	$ 11.423,00	33%	$ 10.560,00	32%
Corporate Express	$ 8.050,00	20%	$ 6.500,00	17%	$ 5.600,00	16%	$ 4.800,00	15%
MRO	$ 7.600,00	19%	$ 5.900,00	16%	$ 4.950,00	14%	$ 4.100,00	13%
Gilbert	$ 5.006,00	13%	$ 3.540,00	9%	$ 2.980,00	9%	$ 2.560,00	8%
Karstadt	$ 1.524,00	4%	$ 1.230,00	3%	$ 1.150,00	3%	$ 1.150,00	4%
...	$ 1.320,00	3%	$ 6.780,00	18%	$ 8.897,00	25%	$ 9.400,00	29%
Total	$ 40.000,00	100%	$ 38.000,00	100%	$ 35.000,00	100%	$ 32.570,00	100%

Table 2 : Supplier per Material Group

Of course, if necessary, a deeper view of a vendor can be provided including the supplier's total sales divided by material groups and their evolution. It

has to be noted that the analysis can be executed in various detail levels, as the information available in the data warehouse has been stored at the document level.

The price indicator report shows the product price behaviour based on a time series analysis of the material prices. This evidences the average supplier price comportment, whether it was constant, increasing or declining, thus indicating if a price increase/decrease was long overdue, or if the suppliers of a segment tried to maximize their profits in the last years.

Nonetheless, for a better appreciation of company's spend analysis, it is recommended the integration of key ratios and benchmarks. Hence, a global strategic analysis should not be just oriented by organisation's internal data. A comparison with external indices, e.g. inflation, material groups and market segment price development, etc., may illustrate better the real company's performance and facilitate the decision making process, based on external and independent market trends.

After the overall objectives have been decided and the cost reduction goals in each material group are arranged, the superior lead buyer and his/her team can select and execute the best sourcing strategy for their materials and suppliers:

– Negotiation with current suppliers;
– Initiation of a negotiation process with current or new suppliers;
– Suppliers bundling;
– Etc.

b) *Current Supplier's Portfolio Negotiation*

The negotiation price with current suppliers is the most common negotiation process in companies and it is also the simplest process supported by the solution. The standard process is automatically triggered by the nearing of the purchase contract expiration.

The management team decides a timeframe in which the product price negotiation should take place, before the contract ends, e.g. two months before it. Once the defined timeframe is achieved, the system checks both, if the buyer has already started a negotiation process with a supplier, or if there is the necessity to begin this process through the procedure start approval, from the side of the responsible buyer.

In case there is the necessity to carry out this process, the e-catalogue platform sends via its notification system, an e-mail requiring a new e-catalogue version of a supplier, with the prices for the next contract period. This process is repeated until the supplier imports its new e-catalogue version in the platform.

Once the new e-catalogue version is approved by the seller, the catalogue is published and an e-mail is sent to its responsible buyer, who has to perform the new price proposal analysis, before approving or rejecting the new supplier e-catalogue and, as a consequence, its new price conditions.

The evaluation of new price conditions has two main purposes, first to assess the financial impact of these new price conditions, and second, in case the negotiation took place out of the platform, to control the conformity of the contract's conditions previously negotiated with a supplier.

The framework backs the assessment task in different ways:

1) Multiplying the previous order volume of a product (Qa) with its new price (Pan) and adding this result to all the products ordered from the catalogue of this supplier, during the last contract or in a defined period of time.

New purchase volume

$$(Np) = Qa*Pan + Qb*Pbn + ... + Qx*Pxn$$

Optionally, it can be configured the possibility to add an index to the previous formula, e.g. the average consumption evolution (Ca) concerning a product group along the years.

New purchase volume

$$(Np) = Qa*Pan*(1+Ca) + Qb*Pbn*[1+Cb] + ... + Qx*Pxn*[1+Cx]$$

2) In order to demonstrate the total monetary difference between the two periods and in consequence its respective financial impact, the tool calculates the difference of the new purchase volume, based on the new price conditions (Np) and on the former price terms (Nf).

$$Diff = Np-Nf$$

Nevertheless, the single estimation of the financial impact is yet not enough to evaluate the new price conditions. Buyers have also to detect which products are the cost drivers and which of them had high price increases, especially because, the practices show that in the area of indirect goods purchasing, suppliers often have frame contracts with hundreds of products, although less than 20% of these products are effectively ordered by the buying organisation.

Hence, the framework enables, through the use of filters, the selection of just ordered products and their visualisation in different ways to analyze their price comportment and the impact on the supplier product portfolio, see table 3.

Office Depot	Order Volume (PP)		Order Volume (FP)		Total Volume Difference		Proposed Price (PP)		Former Price (FP)		Unitary Difference		Order Quantity
Product A	€	10.920,00	€	9.800,00	€	1.120,00	€	1.560,00	€	1.400,00	€	160,00	7
Product B	€	11.200,00	€	10.800,00	€	400,00	€	1.400,00	€	1.350,00	€	50,00	8
Product C	€	6.860,00	€	7.350,00	-€	490,00	€	980,00	€	1.050,00	-€	70,00	7
Product D	€	6.000,00	€	5.800,00	€	200,00	€	150,00	€	145,00	€	5,00	40
Product E	€	4.160,00	€	3.900,00	€	260,00	€	160,00	€	150,00	€	10,00	26
Product F	€	2.470,00	€	2.350,92	€	119,08	€	95,00	€	90,42	€	4,58	26
Total	€	41.610,00	€	40.000,92	€	1.609,08	-		-		-		

Table 3 : Products' Purchase Volume Behaviour

In case the supplier's price suggestion is accepted, the e-catalogue is approved and the negotiation process is concluded. Otherwise, the new or the actual e-catalogue version can be applied to perform price simulations to support buyers during their next negotiation round with this or other potential suppliers.

These simulations can be done directly on an Excel sheet, which can be generated exporting the data sets from the system and converting them into a spreadsheet format. The originated table may contain all or just selected products, so buyers can adjust the product price analysis as desired, taking advantage of the known MS Excel features until he/she reaches his/her desired cost reduction.

This information can be either sent to the supplier or used to back the negotiation process. In case an agreement is not met, an alternative supplier has to be selected. The solution assists this search and selection processes, by seeking a supplier in the internet and supporting the appropriate negotiation process.

c) *Supplier Evaluation*

The supplier selection process is a complex task that can take place in different ways, e.g. selection of a complete new supplier, selection among current suppliers, division of a supplier portfolio into several suppliers, etc.

At the same time, the criteria to select new suppliers are numerous and depending strongly on company's politics. The most common attribute used to select a supplier in the indirect goods procurement field is price, along with other qualitative information, which in the last years it has become the most appropriate approach to support the supplier's selection process.

In the market, there are few examples of internet application systems, which support both kinds of sourcing analysis processes. Therefore, the framework concept suggests the expansion of the electronic catalogue dashboard functionality to assist a multiattribute e-RFQ process.

The supplier evaluation process is designed to be performed by the e-catalogue platform's end users and in companies that apply a central receiving department, by the employees of this division.

In this approach, end users have an additional task during their buying process: the assessment of companies' current suppliers, via the application of structured ratings based on scales, which will be available in the e-catalogue search engine.

The decision to apply solely ordinal and cardinal scales was taken to facilitate the normalization, extraction and analysis process of end users' assessments. A free text evaluation approach would increase drastically the complexity of this procedure, thus it would be hardly possible to be effectively deployed in organizations' procurement department routine.

This task must be executed by an end user or a receiving department employee, due to the often deployed decentralized approach, in which buyers are responsible from one side for the supplier selection, but end users execute the order requests and the product receiving process.

Therefore, the concept has incorporated the end users into the evaluation process, including them indirectly in the decision-making process, via the appraisal of company's suppliers performance.

The end users evaluation supports then the decision-making process of company's buyers, concerning either the extension of a frame contract with a supplier, or the development of a supplier into a strategic partner.

The data acquisition is conducted, while either the end user or the receiving department employee gets the material ordered and verifies the criteria established by the purchase department. This employee enters then his/her evaluation in the system, using a cardinal scale to indicate his/her satisfaction level on each criterion, for example:

- Product quality;
- Price;
- Inquiry response;
- Service;
- Delivery time punctuality;
- Supplier assortment.

The collection of numerous users' feedbacks enables buyers to abstract their internal customer approval regarding a supplier, based on their objective judgment of a supplier's performance.

Nonetheless, companies have to decide if the data acquisition is configured to be an obligatory task of the purchasing process, or if it will constitute an optional activity for their internal users.

The data input is done via the utilization of a standard form at the users' interface. Once the data acquisition has occurred, the data sets are stored in a database to be normalised and grouped with the evaluations of other users.

The aggregation process happens in the data warehouse of the spend intelligence tool. The aggregation and normalization route is performed in a way that no user has a higher weight then another, so before the addition process is started, the system has to execute a mean calculation to gather all evaluations of a particular user in a single position.

This procedure increases the appraisal quality related to a supplier performance, providing buyers with an additional subside to carry out their decision making process, while evaluating a seller or comparing its performance with other suppliers that provide the same material group to an organization.

d) Alternative Supplier Search

The simulation of the purchase cost of an alternative provider and its comparison against competing suppliers is a crucial aspect of the supplier selection process. Companies often have a major supplier of a product group, who is its primary reference source, though a couple of alternative providers of the same product group are generally available in the enterprise's portfolio.

Before companies search for an alternative supplier outside of its current business relations, they should first look for an alternative among their available suppliers. The framework facilitates this job by the search of substitute suppliers in the same material group and their comparison in the spend analysis tool.

The illustration of two or more suppliers who offer products within the same material group can be done without problems. Nonetheless, the exact conciliation between two suppliers at the product level requires a much greater effort, as in their product catalogues the same product may contain several discrepancies in their product attributes, e.g. different short description, different manufacturer, but the same material group, etc.

In the case of a similar product, produced by the same manufacturer, it is possible the adoption of classifications based on a unique and unambiguous identification criterion such as the International Article Number (EAN).

However, in the case of two identical products, but from different manufacturers, the identification has to be carried out using the product descriptions and their technical properties.

This leads to the situation in which the more the complexity of the product the more the matching effort, thus with the purpose of solving this problem, the following alternative supplier searching approach was conceptualized.

The semi-automatic mapping concept aims at the allocation of identical products from both different manufactures and different suppliers, based on the current catalogue version of those suppliers.

The application tries, on the basis of technical product properties and the deployment of a specific algorithm, to find potential substitutive products in the selected supplier electronic catalogue.

For products for which no corresponding counterpart in the alternative catalogue can be found, the system will deliver a set of products that may fit the product mapping requirements.

At this point, the buyer has to select manually from this set the products that fit the specifications and to delete the ones that could not be allocated to any product of the alternative catalogue.

After the identification and allocation of substitutable products, the expected financial impact when replacing the supplier, in absolute and relative values, can be calculated as well as the price difference of specific products. In addition, a link between *Expected purchase volume (Ep2) =* individual products and a detailed view of their attributes can be configured.

This analysis may be done based on the order quantity of the reference catalogue (1) or with the addition of the order quantity of both catalogues (2). The formulas below demonstrate both of the evaluation methods:

1) Multiplying the order volume of a product (Qr) from the reference catalogue with the product price of the alternative catalogue (Pa) and adding this result to all products ordered in the catalogue during the last contract or other defined time period.

Expected purchase volume

$$(Ep1) = Qr1*Pa1 + Qr2*Pa2 + ... + Qrx*Pax$$

2) Multiplying the sum of the order volume of a product (Qr+Qa) from both catalogues with the product price of the alternative catalogue (Pa) and adding this result to all products ordered during the last contract or a defined time period.

Expected purchase volume (Ep2) =

$$(Qr1+Qa1)*Pa1 + (Qr2+Qa2)*Pa2 + ... + (Qrx+Qax)*Pax$$

The total monetary (Mdiff) and percent (Pdiff) difference between the total order volume based on the alternative catalogue price (Na) and the reference price conditions (Nr), can be calculated applying the formulas:

$$Diff = Na\text{-}Nr$$

$$diff = Na/Nr$$

It has to be noted that different suppliers may apply different units of measure to market their products. If this is the case, the calculation must be expanded to convert the different unit of measure into an unequivocal value. The computation is done by the conversion of the unit of measure adopted by a supplier in a unique parameter at its basic unit, q.v. conversion into basic units in chapter six.

The introduced alternative supplier searching approach shows whether the alternative supplier would offer more favourable terms compared to the reference supplier or not. Nonetheless, this functionality is not only for the analysis of alternative provider eligible.

It is also recommend checking at any time if similar products or product groups from different suppliers are available in more favourable condition and indicating them as the "best buying" product to end-users. This would reduce costs and open future possibilities for a bundling program.

However, this concept has some disadvantages:
- The error prone and costly manual intervention;
- The product mapping may not be always sufficiently accurate;
- This method ignores the cost reduction possibility, while bundling the suppliers.

e) e-RFQ Function

Having this in mind, another method has been designed to support buyers to define the best approach to select a supplier, whether a new supplier or an alternative supplier from current organization's portfolio.

The framework applies an e-RFQ based on the electronic catalogue technology to compare and select suppliers based on quantitative data. This method solves the problematic regarding the product matching through the application of e-catalogue templates, generated on the e-catalogue platform of the buying organisation, see an example in the table 4.

e-RFQ	Order Volume (Pa)	Order Volume (Pb)	Order Volume (Pc)	Proposed Price (Pa)	Proposed Price (Pb)	Proposed Price (Pc)	Order Quantity
Product A	€ 8.400,00	€ 8.750,00	€ 8.050,00	€ 1.200,00	€ 1.250,00	€ 1.150,00	7
Product B	€ 10.000,00	€ 10.800,00	€ 9.200,00	€ 1.250,00	€ 1.350,00	€ 1.150,00	8
Product C	€ 5.250,00	€ 4.550,00	€ 5.950,00	€ 750,00	€ 650,00	€ 850,00	7
Product D	€ 6.400,00	€ 6.200,00	€ 5.800,00	€ 160,00	€ 155,00	€ 145,00	40
Product E	€ 1.950,00	€ 1.820,00	€ 2.080,00	€ 75,00	€ 70,00	€ 80,00	26
Product F	€ 2.548,00	€ 2.626,00	€ 2.470,00	€ 98,00	€ 101,00	€ 95,00	26
Total	€ 34.548,00	€ 34.746,00	€ 33.550,00	-	-	-	-

Table 4 : e-RFQ Analysis

There are two application scenarios in which this methodology can be used:
1) The analysis of alternative suppliers within company's portfolio: In this procedure, buyers need first to identify the suppliers which have a substitutive product portfolio oriented by the material groups, deploying thereof either the method described above or simply the products' material group. After these vendors are identified, the e-RFQ process should be conducted, including those suppliers.
2) The e-RFQ is carried out with actual and other potential suppliers; hence the decision about the execution of an open or closed e-RFQ has to be made. By an open e-RFQ, any supplier who has access to the supplier portal can participate; on the other hand, by a closed e-RFQ, just suppliers who were invited can join the process.

On the condition that the necessity to execute an e-RFQ is identified, the catalogue template, including those products for which the RFQ will be done together with their technical proprieties and their brand/mode, has to be created.

The e-RFQ data model should provide users the data structure necessary to exchange the required information to support this procedure. Hence, the information regarding the products that are part of the e-RFQ process is a critical issue of the data model concept.

The goal of the e-RFQ data model is to create a product description that from one side, makes possible the unambiguous identification of a product or service, and from the other side, allows the entry of variable data from suppliers.

For this reason, it is necessary the division of the data model into two categories, see tables 5 and 6:

– Fixed attributes, which are product specifications adopted by the buying organization with the aim of describing the products to suppliers. They cannot be edited by the suppliers and generally it includes parameters to characterize the desired product and service;
– Variable attributes, are the product specifications that are going to be edited by the e-RFQ

participants and define their commercial conditions or proposal to the buying organization.

The necessary information is defined by the buying organization, although the effective information regarding the commercial conditions and supplier identification is given by the suppliers.

Table 5 : e-RFQ Data Model (Fixed Attributes)

Product Attribute (Fixed)	Data Type	Mandatory	Comment / Example
Product_id	Alphanumeric	Yes	Unambiguous / Unique identifier
Short Description	Text	Yes	Product description with less than 40 characters
Long Description	Text	No	Product description containing between 41 and 200 characters
Standard Classification System	Code	No	eCl@ss
Organization's Classification System	Code	Yes	Proprietary or standard classification system
Currency	Code	Yes	Transaction currency
Organization	Text	Yes	Buying organization
Quantity	Number	Yes	Product contract quantity
Unit of Measure	Code	Yes	Piece, Kilogram
Size	Number	No	Product's size
Weight	Number	No	Product's weight
Other product parameters	Alphanumeric	No	In case, there is other product specifications

Table 6 : e-RFQ Data Model (Variable Attributes)

Product Attribute (Variable)	Data Type	Mandatory	Comment / Example
Supplier	Text	Yes	Supplier legal name
Supplier product number	Alphanumeric	No	Product number at the supplier side
Price	Number	Yes	Product price proposal
Delivery time	Number	Yes	Expected delivery time
Payment condition	Reference	Yes	Selection of one of buying organization's payment conditions
Quantity discount	Alphanumeric	No	Possible discount models
Order Unit	Number	Yes	minimum / standard order unit
Image File	Multimedia	No	Picture, film
Manufacture	Text	No	In case product from another producer

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The templates containing the product specification is then sent electronically to the supplier portal, at the same time that an automatic e-mail is sent to potential suppliers. The template can be either manually generated by buyers or, in case the products already exist in the e-catalogue platform, a derived catalogue containing just the descriptive attributes can be extracted.

Simultaneously, the system allocates an e-RFQ number for each potential participant, which consists of the e-RFQ number plus the supplier number, to guarantee an unambiguous identifier.

In the case that a supplier is still not a member of the network, the e-mail should contain also a provisory login and password as well as a short tutorial / leaflet about the template editing process.

The suppliers can either participate on the selection process or they can reject it, in this case they should provide a reason to refuse the e-RFQ, which can be given in free text or selecting from a pre-defined list available in the system and standardized by the buying organization, which will use the response for future buying decisions.

Supplies which decide to participate on the bid process, need to identify the products that they have in their portfolio, according to the information disposable in the template, and complete the template on-line or in an excel sheet with the quantitative data requested, e.g. price, deliver time, discount quantity and so forth.

The products that they do not have in their portfolio should be refused and the system represents the lack of the product with an empty field, so that they will not be part of the analysis.

After the supplier has completed the information and approved his/her inputs, the complete catalogue is sent back to the buying organisation along with a communication e-mail.

This procedure closes the supplier processing task and generates in the system respectively the status supplier e-RFQ completed and received, including the respective timing as soon as the buying organization system acknowledge the template receiving.

Once all the participants have sent their fulfilled templates back to the buying organization, purchasers can initiate their analysis process, applying for it the OLAP functionalities and filters, and if the case may be, select the most appropriate provider for those products or start a new selection process.

For tiered prices products, a filter was designed to allow buyers to select between the analysis of these products based either on their first lower bound, the average order volume or the most common order volume of each product.

An on-line tracking functionality has been designed to provide buyers with the possibility to trail their e-RFQ events via the access of the workflow data and its status. In this manner, the e-RFQ can be controlled from its start until the final supplier analysis and potential selection. And in case it is required, communication mechanisms, e.g. e-mail, can be applied to speed the procedure up.

The tracking functionality has it focus on the collection of data concerning the e-RFQ process and its representation to the responsible buyers, for this purpose the status information is gathered and stored in the data base for on-time checks and future process control and improvement proposals.

Before a buyer approves and publishes a selected e-catalogue in the e-catalogue procurement platform, the contract conditions as well as the contract itself, has to be generated and sent to the supplier to be signed.

Therefore, the e-RFQ data sets can be exported to a database system, e.g. Access from Microsoft or to a customized database in the e-catalogue platform, which contains contract models of different products groups and can be configured in diverse forms, e.g. create new contract, additions, configuration of different paragraphs, deployment of standard contract model.

The generated contract can be sent electronically to the supplier including an electronic signature and once the supplier has agreed with the contract conditions, a template with the complete product information is sent to the supplier for its import, in the e-catalogue procurement platform, following the usual approval process.

On the other side, the e-RFQ data will be once more used to check, at the buyer side, if the contract conditions have been respected during the creation and approval of the new supplier catalogue.

The proposed approach is an effective method to identify and evaluate suppliers of indirect goods with no single or large product offers due to its capacities to appraise electronically the financial implication of multiple products quotation, without the product identification issue, at the same time that it assists buyers with their bundling analysis.

IV.   The ETL And Storage Process

The data necessary to perform the e-sourcing process is extracted from the e-catalogue platform, e.g. product, organisation and supplier data, and from the search engine database, e.g. ordering data, as well as from other less relevant external data sources.

Nevertheless, the ETL-process has incurred in some modifications to attend the requirements of the e-sourcing activities. The acquisition of the e-catalogue data, which includes information about products and the e-catalogue itself, is triggered via both the approval of the supplier e-catalogue, as well as the buyer catalogue, see figure 2.
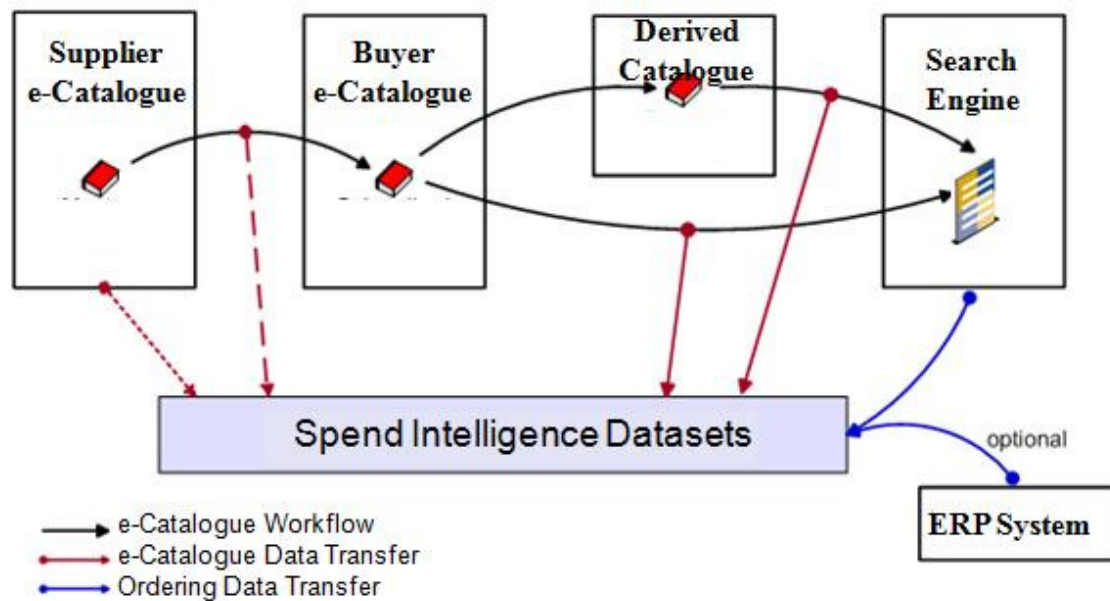
Figure 2 : e-Catalogue Workflow - Sourcing ETL Process

The catalogue data export is integrated directly into the system workflow, and since this is configured independently for each catalogue, the system administrator has the chance to select the appropriate workflow for every catalogue, i.e. include an instant data export to the spend analysis module.

On the other hand, the ordering data acquisition is configured to occur once per day, at night, to not affect end-users daily operational activities, by the deployment of a scheduling program that controls the interval of the data transfer, from the search engine database to the business intelligence solution.

The e-catalogue data extracted from both the supplier catalogue and the e-RFQ catalogue, which are used essentially for the assessment of alternative material sources, are temporary stored in the business intelligence database.

From these two e-catalogue types, just pre-defined assessment relevant attributes are transferred to the temporary storage and used in the product portfolio evaluation process, e.g. price, product description, delivery time, discount quantity, material group, etc., and only when the e-catalogue is approved by the buying organisation, the definitive storage in the database takes place.

In the case of the e-RFQ catalogue, the template has to be first created by a buyer, who can do it either manually or by preparing in the e-catalogue platform a derived catalogue, which may contain a complete catalogue, a subset of a catalogue or a combination of several supplier catalogues.

After the template is generated and sent to the RFQ participants with the descriptive product information, the suppliers can complete the catalogue information and sent it back to the buying organisation, where the data are extracted and analyzed.

In both scenarios the primary product identification key of the e-catalogue platform data structure is the "product_id", which does not offer a clear identification of identical products from different suppliers.

Therefore, there was the necessity to create a supplementary secondary key on the ecatalogue platform, to allow the comparison of identical products from different providers through the use of a well-defined and analytical friendly identifier.

The identifier consists of a "product_id" and the combination of the "supplier_id" and the "catalogue_version". This combination creates a unique code that appears just once on the table and gives the system an appropriate identification code to back the sourcing process.

The essential information is temporary stored in the database, in a separate data structure, to increase queries and computation performance. The main advantage of this approach is the reinforced consideration of the functional requirements during the modelling of the two data structures to increase the system capacity and reduce the respective data structure complexity.

The e-catalogue data transfer to the storage area is an independent process, which is specialised on the acquisition of the temporary data and its singularities. The extraction of the permanent data is handled by a second ETL-process.

The temporary data is kept in the database during a pre-defined timeframe. However, it is given to buyers the possibility to recover this information if the

data has been deleted before the necessary business analysis has been carried out.

V. Conclusion

The later developments in the global economy and the increase in market competition caused mainly by the concentration process of companies, the reduction of markets' entry barriers, the increase on customer's demand and the high speed on product innovation, have forced companies to look into their business functions more critically with the purpose of finding new ways to gain and maintain distinctive competitive advantage.

The purchase department due to its high potential to impact company's performance has happened to be one of the main functions to be addressed in order to leverage enterprise's competitiveness, which has changed dramatically their employees' routines and the department status within the modern organization, from a merely administrative division towards a strategic driving function.

In this context, the information system technology has played a key role and has been implemented in companies for the last decades coming a long way, ranging from EDI to connect organizations to their strategic suppliers, ERP systems including dedicated purchasing functions, to extensive and specialised supplier relationship management solutions, which aims to cover the entire purchasing cycle from the demand identification to the order process of direct goods.

However, the indirect goods and services have been left to a second plan, with companies concentrating their investment mainly in direct goods purchasing solutions, although the notorious advantages to implement IT system to support the indirect goods procurement.

Therefore, the research has been concerned about obtaining crucial information in this field with the purpose of creating a concept, which can be employed to expand the capacity of e-catalogue systems to communicate with other solutions and manage a wider scope of activities within company's supply chain.

The e-catalogue sourcing tool introduced in this paper has been designed to improve the current practices of indirect goods' sourcing process due to the fact that most sourcing activities in this areas are done currently manually or with a limited level of information systems application.

The work introduces an ideal process model in which the framework may be applied to support the negotiation process of catalogable products and services. The ideal model is consisted by a step-by-step process description of an e-catalogue based sourcing process.

The process phase is divided into strategic planning, current supplier portfolio negotiation, supplier evaluation, alternative supplier search and the e-RFQ procedure.

Furthermore, the specific ETL process, required to acquire and convert the data in the right format to enable the execution of the e-sourcing activities, has been described.

The solution includes supplier negotiation as well as supplier evaluation functionalities, which together with the other functionalities of the framework, provides companies with an innovative environment in which buying organizations can perform their entire source-to-order process electronically.

It is expected that with the implementation of this new concept companies will improve their indirect goods and services procurement process, increasing the return on investment of the e-catalogue solutions and narrowing the entire purchase process supported by a unique and integrated solution.

References Références Referencias

1. Campelo Filho, E.G., A Send Data Classificaiton Model, The e-Business Review, v.8, p.64-68, 2008.
2. Campelo Filho, E.G., A Cost Effective Spend Intelligence Model, In: the 17 Th IPSERA Conference, 2008.
3. Eyholzer, K., W. Kuhlmann, and T. Münger, Wirtschaftlichkeitsaspekte eines partnerschaftlichen Lieferantenmanagements. HMD - Praxis der Wirtschaftsinformatik, 39(228): p. 66-76, 2002.
4. Gebauer, J., Beam, C., and Segev, A., Impact of the internet on procurement, Acquisition Review Quarterly, Spring, pp. 167-184, 1998.
5. Macduffie, J. P. and Helper, S., "Creating lean suppliers: Diffusing lean production throughout the supply chain", in California Management Review, 39, pp.118-151, 1997.
6. Perlman, K. I., Handbook of Purchasing and Materials Management, Probus Publishing, 1990.