

The Evolution of Electronic Reverse Auctions: Towards a Multi-Criteria Approach

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Abstract- Internet proposes services and tools which transform in depth the on-line transactions B-to-B. So, the electronic marketplaces are considered as a real revolution since about twenty years. The first objective of this article is to explain the process of two types of electronic reverse auctions organized in marketplaces. In the second part, we try to answer the question: *Do electronic reverse auctions really optimize the supply chain after more than two decades of use?* We will also try to show the interests of a global vision and not only on prices reduction in the process of these reverse auctions. On the other hand, the case of public procurement in France will be studied in order to highlight the new opportunities offered by "multicriteria reverse auctions" with regard to the traditional electronic reverse auctions.

Keywords: e-procurement; e-SCM; marketplace; multi-criteria reverse auction.

I. INTRODUCTION

Effective procurement management often leads to optimization of a company's entire supply chain. This optimization results in the reduction of costs, not only for strategic purchases (production) but also for non-strategic purchases (non-production). The competition of new suppliers on the Internet is also a very effective process of reducing costs for buyers. It is in this context that electronic tools are emerging to help companies better manage their supplies. Among these tools we distinguish more particularly the marketplaces.

Thus, the actual democratization of the Internet makes electronic procurement through marketplaces accessible to businesses of all sizes. Indeed, the appearance of marketplaces in the B2B universe is a fortunate thing for SMEs / SMLs. "As proof, B-to-B marketplaces have been rolling out at high speed since 2017. That year, the platforms for professionals from the two global giants Alibaba and Amazon had generated respectively no less than 11 billion and 4 billion dollars in business volumes! These results suggest much greater prospects in a B-to-B ecosystem in full digital acceleration" (TEISSIER and DE CATHEU, 2019).

According to the Mercator dictionary, a marketplace is defined as "a meeting place [on the Internet] between supply and demand: negotiations, purchases and associated services". Indeed, a marketplace provides several services such as e-sourcing (search and selection of suppliers), e-

procurement (automation of the process managing orders), electronic reverse auctions, etc.

However, the electronic reverse auctions become progressively a very interesting tool for certain buying companies. The motivation for these companies is the significant gain and the drastic reduction in procurement costs. Conversely, the suppliers consider these auctions as a tool that degrades their competitiveness.

As there are different types of electronic reverse auctions, we will focus in this article on the use of "open" and "sealed" electronic reverse auctions.

The main objective of this article is first to explain the process of electronic reverse auctions and then to present the two types of electronic reverse auctions most used by companies doing their e-procurement. In addition, this article addresses the interests of a "global vision" and not just "price reduction" in the electronic reverse auction process. Finally, the case of Public Purchasing in France will be treated to show the new opportunities offered by "multi-criteria electronic reverse auctions" compared to the classical electronic reverse auctions usually used.

However, the strategic, secretive and evolving nature of these auctions makes it difficult, if not impossible in some cases, to obtain first-hand information and documentation. This forced us to base our research mainly on secondary sources. These are very essential in addition to the theoretical analysis of reverse auctions that we will present.

II. ELECTRONIC REVERSE AUCTIONS

Reverse auctions have been considered for more than two decades as the new electronic purchasing technique. This is "an electronic bid selection process that allows candidates to lower their prices and change the value of certain other quantifiable elements of their bid" (BALU, 2012).

Electronic reverse auctions "now represent 15-20% of the total volume of B-to-B transactions worldwide." And the markets involved can be considerable, such as an operation organized by the British National Health System, which was concluded for an amount of 1.8 billion euros" (BRUNAT, 2017).

On the other hand, the French government declared on June 20, 2019 that "the process of reducing public procurement to a minimum of 1 billion euros by the end of 2022 has been launched. In less than 6

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months, the State Purchasing Department (DAE) must develop and start this budget savings plan, accompanied by a consulting firm, soon to be appointed, for an amount of approximately 35/40 million euros¹.

The first suppliers who participate in electronic reverse auctions were motivated and enthusiastic. Quickly, some of them realized the weakness of their logistics which could not follow. Indeed, by participating in these auctions, the costs of storage, transport and delivery have become very high according to them. In order to understand this phenomenon, we will try to analyze it.

There are traditionally two types of electronic reverse auctions: open and sealed reverse auctions.

a) *Opened electronic reverse auctions*

Auctions are opened when the bids sent by the suppliers are known to all the other participants, which allows them to react accordingly. This leads to a dynamic auction process as each supplier knows in real time the value of the leading bid in the auction and can exceed it to become the leader himself.

The operator of electronic reverse auctions (the marketplace) must be a trusted, objective and neutral third party. He not only conducts the auction event, but also he functions as a business associate with buyers and their suppliers.

An open electronic reverse auction session generally takes place in several phases. The example in the following table clearly illustrates these phases:

Table 1: Example of electronic reverse auction phases for public procurement²

Admission phase (phase 1)
Opening of administrative and technical files
Examination of parts
Eviction of competitors not admitted
End of the list of eligible candidates
Electronic information of the excluded competitors individually
Electronic invitation of competitors admitted at least 2 days before phase 2
Price negotiation phase (phase 2)
Access via the link provided by the electronic invitation
Start of auction at the appointed time
Proposal of offers
Competitor ranking
End of auction time + Timed rounds
Final classification of competitors
Allocation phase (phase 3)
Invitation to the lowest bidder to produce the documents in paper format
Documents accepted?
Eviction or Attribution
Electronic reverse auction report

¹ Web site j360. info < https://www.j360.info/actualites/actualitesmarches_publics/Diminution_cout_achats_publics_commande_publicque_Etat/> November 23, 2020.

² Kingdom of Morocco Public Purchasing Site <<https://www.tgr.gov.ma/wps/wcm/connect/368a33f4-0745-429f-9af5-2f34665bbb42/Echères+électronique.pdf?MOD=AJPERES&CACHEID=368a33f4-0745-429f-9af5-2f34665bbb42>>

The negotiation phase (phase 2) is the key step in electronic reverse auctions. In order to participate, the supplier just needs to enter (in a participation window) a response to the buyer's offer. He also has the possibility in certain cases to ask questions or request information.

During this phase, the auction usually takes place in two stages: a continued stage and a timed stage. During the continued stage in an open reverse auction, suppliers publish their bids and have the option to bid up (downward direction) after a new bid. Before the end of the contained stage, the leader bets are recorded as they are sent, regardless of the time between them and the previous one. So an hour or two could go by between bets. During the timed stage, which typically begins ten minutes before the end of negotiation time, each new bet results in an overtime period (for example 5 minutes) called a round. Receiving a bet during one of these five-minute rounds marks the start of another round, and so on until a round ends without any new bets being registered.

At the end of the timed stage, two situations can happen. If the total price of the winning bid³ is lower than the total reserve prices (price set by the buyer), we automatically go to the allocation phase (phase 3). On the other hand, if the price of the winning bid is greater than the total reserve prices, the buyer must decide whether or not to accept the conclusion of the transaction. If he wishes to accept it anyway, the buyer then has to modify his reserve price to become greater than the total price of the winning bid. So can begin the allocation phase (phase 3) of the auction.

b) *Sealed electronic reverse auctions*

Sealed electronic reverse auctions are identical to the previous ones, except that during the negotiation phase (phase 2), suppliers do not have access to other bids and are not able to see the prices of their competitors' bids. They do not therefore have the opportunity to bid against their competitors in real time as in opened electronic reverse auctions. In this type of auction, suppliers must decide on their final bid before the beginning of the reverse auction. The amount of the bids therefore remains secret until the end of the negotiation phase. It is archived by the operator of the marketplace and disclosed to other participants on condition that they request it after the close of the auction. Thus, this mechanism implies a more important role for the operator of the marketplace, which must be an objective and neutral third party (BENTALEB, 2010). However, under no circumstances may the identity of the candidates be disclosed during the electronic auction phases.

³ The total price is calculated by multiplying the price and the quantity of each item, then adding the sum of the amounts thus obtained.

III. ARE THE ELECTRONIC REVERSE AUCTIONS SUFFICIENT TO OPTIMIZE THE SUPPLY CHAIN AFTER MORE THAN 20 YEARS OF USE?

With globalization and international competition and in order to get the best deals for their supplies, more and more companies are opting to find and compete with new suppliers through marketplaces. Reverse auctions in this perspective were the star tool and cause controversy over the opportunism of the buyer vis-à-vis the supplier. The experience feedback in this regard is interesting as we want to highlight the opinions of many managers who decide on electronic reverse auctions over its two decades of use.

For the past twenty years, many studies have dealt with electronic reverse auctions in the context of B-to-B marketplaces (BEAM and SEGEV, 1998; HANNON, 2003; BRISSET, 2011; CARLI, 2017). These studies have clearly shown the benefits of these auctions. The following advantages can be distinguished:

- They generate indisputable savings (especially for the buyer);
- They encourage collaborative relationships;
- They drastically reduce the error rate associated with communication;
- They make transactions more transparent (especially opened reverse auctions);
- They allow greater openness of the panel of suppliers;
- They allow an indisputable saving of time for some types of products.

Indeed, as mentioned by Franck LE TENDRE, Managing Director of Synertrade France: "Almost all products can be purchased by electronic reverse auctions, then the gain effect will vary. On large series products, reverse auctions are quite effective but not on the service sector. If, for example, the labor part is important in the finished product, the auctions will have little effect" (DAVID, 2017).

However, it is commonly accepted that, especially with regard to non-strategic (non-production) purchases, if the buyer finds a similar product at a lower price from another supplier, even if their relationship has lasted for several years, he cannot hesitate to change it in favor of this new supplier. Therefore, electronic reverse auctions can present an extremely worrying threat to suppliers who can react accordingly (decline in service, faulty delivery, lower quality, etc.).

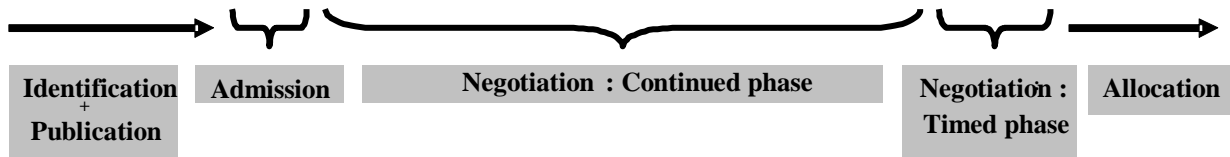
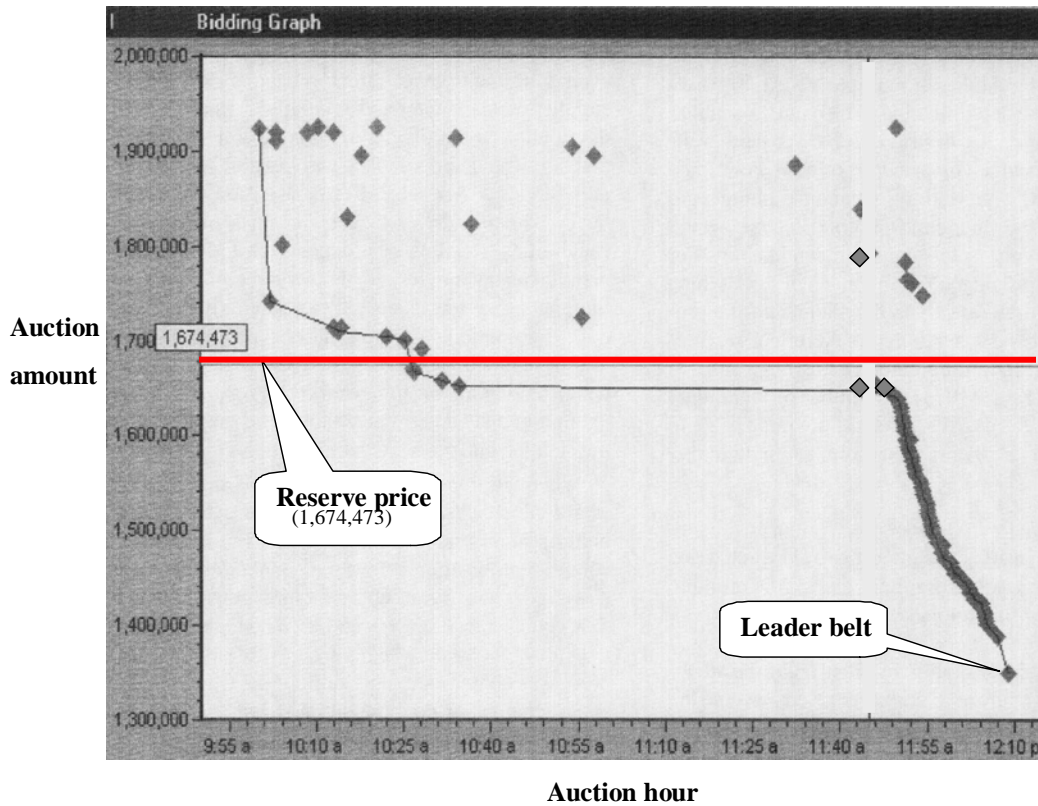
In addition to this threat, which can "poison" the relationship between buyer and supplier, saving time and money is sometimes disputed by some academic research.

Through this article, these theoretical arguments will be confirmed by numerous testimonies in the

professional world in order to try to detect the best way to use reverse auctions.

a) *Saving time and money not always easy*

While the most dramatic phase of the electronic reverse auction is the phase of falling prices in real time, this phase alone creates very little value in some cases.



Numerous studies have shown over the past twenty years that sometimes more than 80% of the value created in a reverse auction is linked to the rigorous preparation of the upstream and downstream of this one. A study carried out by ACCENTURE in 2001 on a reverse auction sample - involving similar categories and under homogeneous starting conditions - showed that:

- Rigorously prepared auctions (clear product specification; logistics capacities; understanding and analysis of the supplier market; precise composition of the supplier panel; definition of the auction strategy; anticipation of selection criteria and contractual clauses) allowed to carry out gains between 15 and 30% of the starting value.

- Auctions for which only information and preparation of the suppliers had been carried out in advance only allowed to obtain price reductions between 2 and 10% of the initial value.
- Finally, the only electronic reverse auction process only allowed marginal gains to be generated between 0 and 2% of the starting value (<www.accenture.fr>, 2nd quarter 2001).

In addition, the studies of EMILIANI (2000, 2007) and EMILIANI and STEC (2002) seems very interesting to us in this perspective. Indeed, the authors explain that buyers can negotiate with suppliers in order to establish long-term agreements for specific products and to concentrate purchasing volumes with the minimum number of suppliers. Rationalization of the

supplier portfolio can be an emotional event, since buyers tend to favor certain suppliers over others and

may impose subtle barriers to rationalization (EMILIANI, 2000).

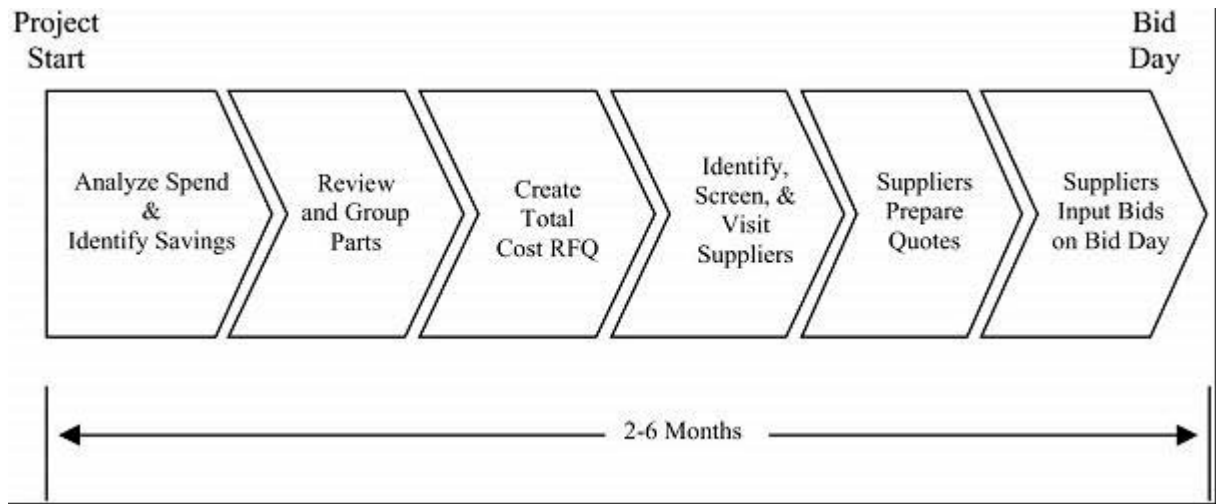


Figure 2: The process of an electronic reverse auction (EMILIANI, 2000)

Figure 2 illustrates a typical process for an electronic reverse auction, from project start to bid day. These steps are usually standard activities that the majority of buyers can accomplish on their own, without assistance from the marketplace operator. The losses incurred by detailed bid analysis after electronic reverse auctions are sometimes greater than the actual savings gained through these auctions. Indeed, at the end of the auction, the buyer evaluates the data of the offer. Typically, it asks the marketplace operator for additional detailed information, including quality and up-to-date information on delivery performance, changes in supplier capacity, etc. The evaluation of offers and additional data can take several weeks and should include other functions such as quality, product management, manufacturing engineering, etc. The time lag between the finalization of the offer and the allocation of the contract can generate additional work without added value. For example, a supplier can participate and win other additional auctions with other partners. As a result, he may not be able to honor his commitment to the buyer. Consequently, the buyer may have to re-evaluate the data and allocate the deal to the second-place candidate (the second-prize offer) (EMILIANI, 2000).

After the auction, the buyer makes the decision either to confirm the supply order or to cancel it. In each case, there is an introductory period during which the buyer and supplier must come to an agreement. The introductory period can be 12-18 months for some types of products, which is significant if the long-term agreement is for three years, for example. This is because the agreed agreement contains information on the price, cost and delivery performance targets, as well as other terms and conditions. The necessary signatures are obtained from the buyer and the supplier,

which therefore gives the supplier the possibility to start the work. If the supplier already has the requested products in stock, he can proceed immediately to delivery, with the new price already agreed during the auction. However, it is clear that the ability to immediately reduce prices gives an advantage to the buyer's usual suppliers. Thus, the buyer avoids the costs associated with changing his usual supplier. It is important to note here that the likely choice of usual suppliers by the buyer during electronic reverse auctions will discourage other suppliers to participate.

If the requested product is new to the supplier, he must therefore obtain updated information and specifications from the buyer, order the raw material, design the process, manufacture the tools, etc. last two to four months. The buyer will not begin to receive any benefits generated by the auction until after receiving the products from the supplier. In addition, the total recommended savings will only be realized when the buyer receives the total annual quantity of the products, which requires more or less a year, depending on market demand.

Additionally, according to EMILIANI's 2007 research at Central Connecticut State University on the use of reverse auctions, marketplaces that offer reverse auction services want us to believe that today reverse auctions have improved a lot, but there is no improvement after more than 10 years of effort. "Be sure that they will generate more work and more time for you" (EMILIANI, 2007).

In addition, some claim that the relationship between the buyer and the suppliers deteriorates using reverse auctions. "This process destroys everything related to the know-how of buyers and sellers. Reverse auctions are a deadly system", declared Jean-Claude VOLOT, president of the national joint fund (AGFPN),

during a conference at the CCI of Côte d'Or in France (BRUNAT, 2017).

These analyzes are reassuring because they demonstrate how the consideration of other criteria besides the single price criterion is extremely important and remains the key in the success of electronic reverse auctions. Indeed, the price is only one criterion, admittedly important, but incapable on its own of optimizing supplies via reverse auctions.

As a result, more and more buyers are considering other criteria besides price when performing a reverse auction. Thus, a buyer can mention in his RFP (Request for Purchase) other criteria that come into play in the evaluation of a supplier. These criteria generally relate to its logistical capacities, its geographical location, its flexibility, the history of the relationship with other buyers, its size, its turnover, its customer references, its policy concerning human resources or sustainable development, etc. Thus, "the result of the reverse auction-a price-can be weighted by the technical score of the response given by the service provider to the specifications. For Hicham ABBAD, commercial director of K-Buy (now KLB Group), the price represents, depending on the case, between 20 and 80% of the overall score "(COSTA, 2008). In addition, the reverse auction process is extensively detailed in the 2006 Commercial Code in France, which stated that price could not be the only criterion for an auction (MAILLET, 2009). Thanks to these prerogatives, the company "Phone Régie" (France) won a reverse auction although it had not offered the lowest price (COSTA, 2008).

As a result, reverse auctions can guarantee efficiency for both the buyer and the supplier through the development of collaborative tools. Beyond the purchase price, it is also possible to increase the efficiency of the relationship with suppliers.

It seems to us that the use of reverse auctions simply to reduce the price is a bad practice which can have sometimes serious consequences: strained relationship with suppliers, delivery problem, quality problems, etc. "It is possible to lose a call for tenders for a tiny price difference, even with a higher quality of service. Companies now want the cheapest products, full stop "recognizes Michel MILCENT director of Office Depot (SCHOTT, 2009).

Likewise, to purchase general services, Barry Callebaut France, which specializes in the manufacture of cocoas and chocolate products, uses consulting firms rather than performing reverse auctions. "These do not make it possible to clearly define everything that is included in the price. Certain criteria such as the definition of the performance of the service, the training policy or the progress plan of the candidate companies do not appear ", deploras Jean-Michel PONTHEUX, purchasing and general services manager of Barry Callebaut France (COSTA, 2008).

Thus, suppliers suspect opportunistic behavior by buyers. In fact, some buyers involve their usual suppliers in reverse auctions in order to confront them with new suppliers. The aim is to put pressure on the usual suppliers to force them to lower their prices (JAP, 2007). The risk of deterioration in the supplier relationship is a major and very complex issue for the Purchasing department, because this risk occurs at multiple levels: financial, legal and above all ethical.

b) *Multi-criteria weighted reverse auctions as an alternative*

Weighted multi-criteria reverse auctions can be a very attractive alternative in order to minimize and reduce the strain on suppliers. Indeed, other criteria that the price must now take into account: such as the detailed specification of the products, qualities requested, contractual clauses, notification of suppliers, etc. "Modern reverse auctions introduce multi-criteria competition; we are far from a simple request for a quote! » (BRUNAT, 2017).

In this perspective, multi-criteria reverse auctions have shown their effectiveness in public procurement in France. In fact, the dematerialization of public procurement is growing strongly. "Announced on June 20, 2019 by the government, the process of reducing public procurement to a minimum of 1 billion euros by the end of 2022 has been launched, and must move forward quickly. In less than 6 months, the State Purchasing Department (DAE) must develop and start this budget savings plan, accompanied by a consulting firm, soon to be appointed, for an amount of approximately 35/40 million euros. [...] The objective now is to achieve more than 4% savings on 24 billion public purchases divided into 10 areas, real estate (including leases) and infrastructure works representing the first item with 42%. In addition, the 30 main suppliers account for 29% of this expenditure. However, the trend in the total amount of orders from the State and its operators is up by almost 20%" (L'ACTUALITÉ DES MARCHÉS, 2019).

In fact, as part of a process to consolidate its purchases, the French Ministry of Culture organized a multi-criteria reverse auction for the purchase of supplies. The criteria adopted concerned not only the price but also sustainable development (labels), delivery times, the candidate's commitments to meeting these deadlines and the quality of the company's workflow (BRISSET and MARECHAL, 2011).

Thus, weighted multi-criteria reverse auctions rather focus on valuing technical quality in the context of the use of reverse auctions. We are now moving from a "low price" transaction to a "best price" transaction. It is therefore about highlighting the best value for money. It is in this context that a mathematical formula emerges. This formula incorporates the weighting of all the criteria set to determine the most favorable offer. The criteria

taken into account must be objective and precise so as not to leave an unfair freedom of choice to the buyer. The weighting assigns a coefficient to each of the criteria. The economically most advantageous offer is then evaluated overall, with regard to all the criteria that make it up. As a result, the analysis of offers becomes more refined, which favors the choice of the "best-performing" offer. The above-mentioned mathematical formula is used in order to determine the automatic reclassifications, with each new presentation of prices, must be brought to the attention of the candidates in the invitation. This formula must incorporate the weighting of the criteria as announced in the consultation documents of the multi-criteria reverse auction. In addition, the buyer freely chooses the most suitable coefficients for him (CCP⁴, 2019).

The method therefore consists in attributing a bonus to candidates (suppliers) by means of a technical rating. For the purchase of a laptop, for example⁵, the technical rating N assigned to the configuration is the sum of the weight rating, the technical quality rating and the docking station rating, weighted by their respective weight (respectively 30%, 50% and 20%):

$$N = (0.30 \times NtPo) + (0.50 \times NtQt) + (0.20 \times NtSa)$$

Where

NtPo: weight rating;

NtQt: technical quality rating;

NtSa: workstation rating.

In addition, the technical quality rating, for example, can be the result of several sub-criteria scores (Table 2).

Table 2: Detail of the technical quality score for a laptop computer

Score of the sub-criterion	Purpose of the sub-criterion	Percentage in NtQt
Ntcrit1	Quality of the shell, materials, coating, general ergonomics of the product	20.00%
Ntcrit2	Quality of the hinge system, laptop locking device	10.00%
Ntcrit3	Screen quality, brightness, displayed resolutions Any screen smaller than or equal to 12.1 inches will result in the application of a maximum score of 5 Any screen of a size greater than or equal to 13 inches will result in the application of the minimum score of 9	15.00%
Ntcrit4	Quality and ergonomics of the integrated pointing device	10.00%
Ntcrit5	Keyboard ergonomics	15.00%
Ntcrit6	Effectiveness of stop / start, resume and computer standby devices	10.00%
Ntcrit7	Additional hardware and software devices provided in addition to the minimum stipulated in the specifications and described in the technical report attached to the offer	20.00%
	Total percentage	100.00%

Thus, as stated previously, the objective of weighted multi-criteria reverse auctions is to enhance other criteria alongside the price criterion. It is indeed about highlighting the best value for money. The formula used is:

$$Me = Mo \times (1 - (Pnt \times Nt)).$$

Where:

Me = Amount of the weighted bid;

Mo = Amount of the offer submitted by the supplier;

Pnt = Percentage weight attributed to the technical note⁶;

Nt = Technical score (between 0 and 10);

The higher the technical score, the greater the candidate's bonus.

However, the use of weighted multi-criteria reverse auctions alone is not sufficient to anticipate and avoid as much as possible the risk of deterioration of the

⁴ Public Order Code in France applicable to contracts launched from April 1, 2019, https://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/conseil_acheteurs/fiches-techniques/mise-en-oeuvre-procedure/examen-des-offres-2019.pdf

⁵ DCE (Public Procurement Companies Consultation File) for the purchase of laptops on behalf of the French State in 2012 (Service des Achats de l'Etat, <<http://storage.ugal.com/6151/sad-et-encheres-electronique---sae-mai-2012.pdf>>).

⁶ For example if the weight attributed is 7%, we will have the formula: $Me = Mo \times (1 - (0.07 \times Nt))$.

supplier relationship. Indeed, the marketplace operator must organize, for example, a preliminary interview with the buyer and suppliers in order to explain to them the operating principle of the auction and to answer their questions. This process becomes more humanized and collaborative, through the training of the buyer and participating suppliers. It also encourages suppliers to seek the ability to meet a company's requirements in order to be eligible for selection. We are now far from classic electronic reverse auctions, where the human aspect was almost non-existent accompanied by often ill-defined rules (POIRIER, 2017).

In the same vein, Synertrade (specialist in e-Purchasing solutions) launched in December 2016 its "Auction-as-a-Service" offer. The offer includes the creation and management of electronic reverse auctions via the Syner Trade Accelerate platform and, depending on the desired level of service, application on boarding⁷ and supplier training, or even total management of the auction: from the definition of the strategy to its launch and its restitution (DAVID, 2017).

IV. CONCLUSION

A marketplace is a virtual meeting platform between buyers and suppliers on which they can form "Many-to-Many" relationships. It allows more tangled relationships and offers additional services to the various partners such as negotiation spaces, tenders, electronic reverse auctions, etc. By fundamentally transforming the business buying process, electronic reverse auctions are opening up real opportunities for the business world.

Whether used to carry out purchasing or sourcing operations, the electronic reverse auction makes it possible to streamline the Supply Chain process by reducing its cost and its execution duration. But even more, it offers the company the opportunity to reorganize the purchasing function, to simplify the procedures and to optimize the sequence of tasks. Electronic reverse auction is a way of working that changes the behavior of buyers and suppliers.

However, today the task of the management of the company is to find the most effective price reduction methods. Since the products and services purchased constitute a large portion of the cost of goods sold, buyers may put ongoing pressure on suppliers. Indeed, it is well known that suppliers are often forced to accept this pressure to continue to receive orders. This, however, can be detrimental to their logistics performance.

⁷ Application onboarding refers to the process by which a user who has just installed a mobile application is accompanied and guided during its first use through the display of specific screens.

The article showed how managing the global supply chain remains the key to successful reverse auctions in the B2B sphere. Indeed, the buyer as the supplier must rigorously prepare the upstream and downstream of the auction in order to take full advantage of this technique. It is in this perspective that weighted multi-criteria reverse auctions have shown convincing results via marketplaces. By moving from a focus primarily on reducing the price to a more global view allowing a better relationship between buyers and suppliers. Public purchasing departments in France are now particularly very interested in this type of reverse auction insofar as it takes several other criteria besides the criterion of price reduction.

Despite the growing interest in multi-criteria reverse auctions and the advantages they suggest, we must not lose sight of the training and support of suppliers, which are a mandatory condition to successfully conduct and benefit from this type of reverse auction.

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