Usage of Decision Support Systems (DSS) in corporate procurement process

Sasa Aksentijevic

Saipem Mediteran Usluge d.o.o.

Human Resources, Organization and ICT Dpt.

Alda Collonnella 2, Rijeka 51000, Croatia

`axy@vip.hr`

Abstract. *In efficient execution of procurement process, goods and services are obtained under best possible conditions (it usually refers to prices, time and quality), while aiming to ensure delivery at the right time in the right place in order to derive direct benefits and to support the corporate business process. While procurement may be simple and consist of repeated purchases, complex procurement procedures include mid and long term contracting to obtain strategic goods and services and may impair significant financial impact and economic blueprint on corporate business plan execution. The environment in which the procurement is executed is under influence of constant changes due to economic and political contributing factors, especially if considering global scale, so efficient procurement is under constant scrutiny to adequately support core business processes while avoiding interruptions, untimely deliveries, bottlenecks in logistics system, often contained outside of the corporate system. Considering intricacies of such system, this paper shows a basic blueprint for organization of procurement system able to incorporate transaction systems in order to utilize mid and top management decision support systems to further improve the efficiency of this business function. Such a system calls for exact alignment of business processes and transaction systems and creation of coherent reporting and finally, extrapolation and simulation systems able not to provide only detailed look at the past but also to look ahead, into the future of the business, dependant on the constant change of inputs.*
Keywords. *procurement, key performance indicators, decision support systems, transaction systems*

1 Introduction

Procurement is a process of obtaining goods and services at the best possible prices,while aiming to maximize quantity and quality, ensure delivery at the right time and place in order to derive direct benefits in execution of the business process. Simple procurement procedures include repeated purchases while complex procurement may include finding the right partner and creation of contracts for the duration of the business endeavour itself.

Even simple procurement is under influence of many factors. Of all possible options it is neccessary to choose adequate one and find the right answer to a number of questions and challenges - is it more favorable to purchase goods and services at once or in several portions, what is the total cost of procurement, what does physical execution of transport look like, which are going to be used methods of transport, logistics and storage.[1]

The limiting factor of procurement is a budget. If good decision support data is available, the procurement must be able to obtain the goods at the least possible price, fulfilling the requests of those who need the goods and services.

2 Procurement process

For the procurement process it is critical to have a good definition of goods and services to be purchased. In complex environments such requests usually originate by organization units outside of the procurement department. This definition of goods in case of services is often called a scope of work (SoW). The definition of scope of work is inherently connected with a certain need – without need per se, there is no initiation of the procurement process either.

The need and scope of work are followed by basic phases of procurement process:

---

[1] http://en.wikipedia.org/wiki/Procurement, Accessed: 5th May 2009.

1. Information gathering

If a prospective buyer does not have established relations with the functions of sales and marketing on the side of vendor, procurement has to look for vendors able to satisfy special needs

2. Contact with the vendor

When one or more vendors are identified, in this phase, requests for offers are being sent out. Sometimes, depending on the context, in this phase call for tender or quotation requests are being processed. It is possible also to make a direct contact with the vendor.

3. Background research

References for quality of certain products and goods are being evaluated, the possibility of installation, mainentance and follow up to the agreed warranty terms is being researched. In this phase, it is advisable for procurement to ask for proof of concept or samples of goods to be provided by the vendors.

4. Negotiation

During negotiation prices, availability and possibility of adjustment to the purchaser's needs is being negotiated. The delivery schedule is being agreed and both actions define procurement order or contract.

5. Execution

During execution, the vendor sends and delivers agreed goods and services, based on pre-agreed terms. Also, the payment is being effected. Delivery dates are being respected, terminating or closing the purchase order or contract.

6. Usage, maintenance and disposal

The delivery of agreed goods does not end the procurement process. On the contrary, during usage, maintenance and disposal the buying party follows and evaluates the ability of the vendor to deliver agreed deliverables and give support during exploatation and duration of the contract.

7. Renewal

After the agreed services and goods were provided, or if the contract has expired, or a need has emerged to order the same or similar services or goods again, the experience with particular vendor is being revised. In this phase a decision has to be made whether to do business with the same vendor or evaluate possibility of engaging another one.

In many complex organizations, especially those involved in complex projects or executing complex activities, especially in large project environments, in dislocated and difficult areas, procurement is often recongized as a strategic activity due to the fact that its inputs provide fundamental initiator and catalyst to the underlying business process. High value of the projects often means complex relations to the vendors. The very fact that complex projects require high purchasing volumes in terms of quantity, quality and variety of required goods and services further complicates the procurement process.

For successful procurement to support the business cause, it is important to think in terms of the total cost of ownership (TCO). This includes not only the direct purchase price at which the services and goods are obtained, but also time and other resources that are expended in the pursuit of the ownership and exploitation. By understanding the steps involved with procurement, it is possible to get a better understanding of the real cost involved with attaining any good or service.

3 Transaction systems in procurement

Most large corporations have in the past decades implemented integral systems aimed towards following business activities and providing decision supporting. Some of those systems have de facto become standards for follow up and analysis of business processes of medium and large companies. Such transaction systems usually cover typical identified corporate organizational core functions. Most often used modules are those for administration and controlling, human resource management, material management, sales and distribution, production planning and - procurement. Every transaction model is used to gather information regarding specific business function but it is usually interconnected with other modules.

There are a number of reasons why transaction systems are a necessity in procurement process. Large corporations are usually in business with tens of dozens of suppliers and a significant number of qualified vendors. Business activity is physically executed in remote and often unknown areas with emphasized local content. The environment that presents a framework for procurement activities is more and more complex and subjected to uncertainty due to corporate activities like takeovers and mergers. This is a reason why the corporations must have a centralized place to store all vendor information and purchase related data, typically in a form of Datawarehouse. Based on all stored data it is possible to identify, deploy and calculate a system of

key performance indicators (KPI) during decision procedure, perform requests over Datawarehouse and develop a system to support top management and procurement managers.

Decision support systems enable within procurement departments the following procurement process enablers:

1. Implementation of efficient methodologies of vendor management and selection
2. Follow up of vendors from the beginning (commercial phase) and contract formation to completed deliveries
3. Constant market research and existing suppliers
4. Feedback information storage as a basis for further decisions
5. Calculating KPI as a support to top management decision process

4 Goods, services and vendors classification systems

In order to improve the taxonomy of data and processes contained within the transaction system it is of great importance to classify the goods, services and vendors in order to better understand what is critical for the corporate procurement system, what is strategic and what is an operative issued. Depending on these classifications it is possible to optimize the procurement process, lower the cost, reallocate the resources and improve overall management of procurement.

In a typical corporate scenario, the goods and services that are subject of procurement are best initially classified according to their criticality for corporate performance. (Fig 1.)
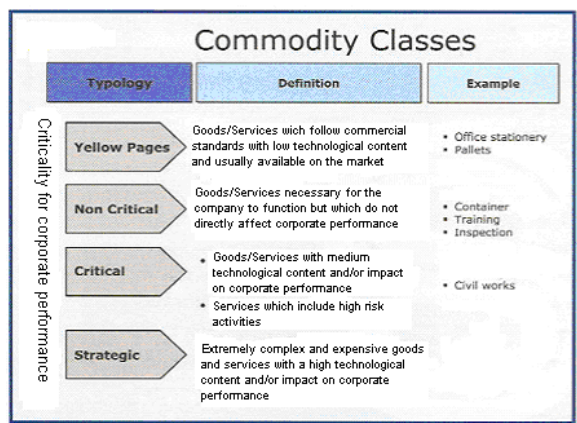
- Simple goods/services are those that have a low technological content and they are readily available on the free market. (example - stationary)
- Non-critical goods/services are neccessary for execution of business process but do not influence the corporate performance directly (typical example - inspection services, transport containers)
- Critical goods/services have medium technological content and might have influence on business process. They are usually included in activities that have higher risk levels (example - civil works)
- Strategic good/services are very complex, have high cost and technological impact on corporate business process

Depending on the involvement level in goods and services delivered, vendors are further classified into different categories. The vendor qualification rules for vendors who directly produce goods and services are generally more strict than for those who just resell them.
Based on this principle, one of the schemes that could be adopted in order to classify vendors is outlined in details[2]. (Fig 2.)

1. Vendors who do not produce goods and services directly but buy them and keep for future selling
2. Vendors who buy and sell goods and services directly on the free market without direct involvement in the production process
3. Resellers, or vendors who do not produce goods and services but represent one or more manufacturers and resell their goods and services
4. Manufacturers, or vendors who directly produce goods and services or perform subcontracting in which they are directly involved

Figure 1. Classification of goods and services within transaction system
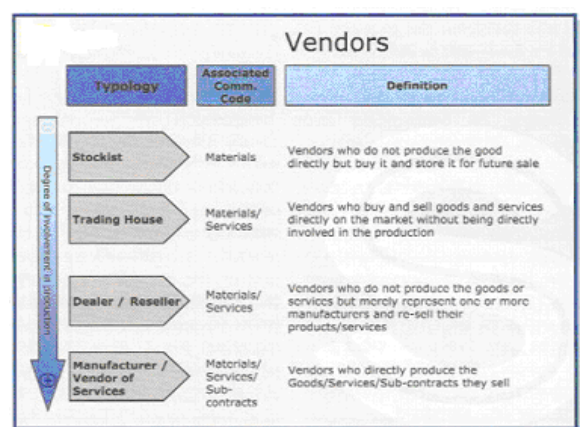
[2] Adopted according to Orizzonti Saipem, Centro Servizi Riproduzione Documentale Xerox Sieco, Milano, 12.04.2006, page 4

Figure 2. Vendor classification

Coherent and strict initial vendors, goods and services classification provides a base for creation of standard forms for contracts and purchase orders within implemented procurement transaction system.

According to adopted typology and classes of vendors, it is possible to create a criticality matrix based on which within Datawarehouse it is possible to form a qualification process, so for each purchase it is possible to apply adequate procedure of vendor qualification and selection.

In order to normalize the set of contracts entering the Datawarehouse it is advisable to implement contract drafts. Every contract usually has fixed and variable clauses. Fixed part consists of general terms, quality system requirements, specifications and drawings while variable (flexible) part is a part that refers directly to the purchase of certain goods or services. The Datawarehouse should have a possibility to dynamically change pre-existing drafts in order to improve the efficacy of the transaction system as a whole. Innovative approach during creation of contract drafts that will enter Datawarehouse will be reflected in standardization, but also the fact that they should be comparable throughout the corporation, within all business units, and could be easily implemented in new business units. During definition of the common framework special attention should be paid to specific nature of individual legal, tax and language systems that are pertinent to the environment where the corporation is executing its business. The result should be drafts that clearly reflect procurement policy of the corporation but are simultaneously flexible and adaptable to the market situation.

Innovative approach during creation of contract drafts that will enter Datawarehouse will be reflected in standardization, but also the fact that they should be comparable throughout the corporation, within all business units, and could be easily implemented in new business units. During definition of the common framework special attention should be paid to specific nature of individual legal, tax and language systems that are pertinent to the environment where the corporation is executing its business. The result should be drafts that clearly reflect procurement policy of the corporation but are simultaneously flexible and adaptable to the market situation. (Fig 3.)
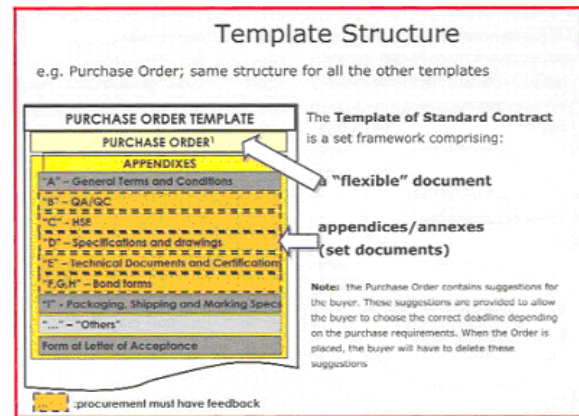

Figure 3. Classification of goods and services within transaction system

As a best practice, it is advisable to develop the following drafts as inputs for the Datawarehouse:

- draft of general terms
- draft for orders and contract
- draft for call for tender
- draft for letter of intent
- draft for offer acceptance
- draft for bank guarantee

Also, the purchase of goods and service should be clearly separated. All drafts basically contain commercial terms, links with general terms and suggestions for procurement department staff regarding negotiation and bank guarantees. As a rule all standard drafts should be available both on the corporate Intranet system and within transaction system and they represent a base point for population of Datawarehouse system important for procurement process.

5 Procurement Key Performance Indicators

Procurement management and corporate top level management are often in position to respond to a number of questions regarding efficiency of procurement process that is usually reflected also on the individual projects and business units' execution. Without key performance indicators it is almost impossible even for the most experienced managers to adequately address such questions.[3]

Some of those usually asked questions include:

1. Which goods and services are most frequently obtained and which is the best acquisition price?

[3] http://www.inteligencija.com/services.html,
    Accessed: 17th April.2009.

2. Which vendors are best partners in procurement process in terms of prices and delivery date?
3. When did during project execution the procurement department receive the purchase request? Was it on time?
4. What is the price paid according to the delivered invoices compared to the initial estimated purchase price?
5. Are goods and services delivered in time?
6. How many orders were processed by the procurement staff in a certain time period?
7. What is the duration of purchase processing for each separate purchase request?

Based on responses to these questions, the top management has to make operative, tactical and strategic decisions in order to follow up the results of all correlated activities that also include inspection, administration, finance and expediting and quickly and precisely define corrective actions in case of need and support and steer the decision making process of the management of all project and business units based on ad hoc analysis that meet specific request criteria.

Ideally, starting from a limited number of key performance indicators it is possible to widen the analysis at a higher detail level in order to gain access to adequate set of decision support information and corrective action application. A set of key performance indicators is pyramidal in shape and could be divided into three to four different levels. (Fig. 4)
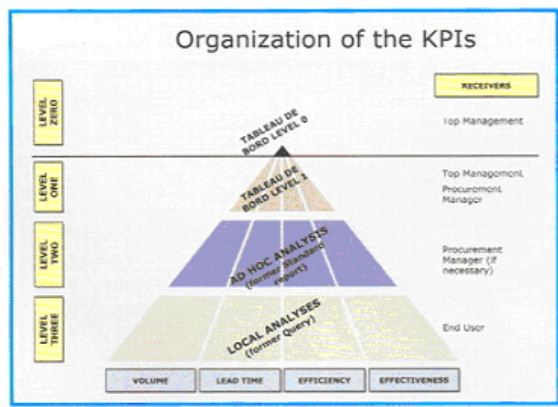

Figure 4. Proposal for organization of KPI levels

Standard reports of zero level are used by the top management and they include a limited set of key performance indicators that follow the procurement activities and their influence on the organization as a whole. First level reports contained detailed analysis of zero level indicators while levels two and three are standard reports and detailed analysis prepared based on the specific and local demands up to the level of a single product, service or vendor.

This system of KPI takes into consideration all phases of procurement, all its dimensions (quantities, key procurement time, efficiency) and all corporate entities involved in the procurement process, from the procurement department to various business units, technical departments and projects as most likely end users of Procurement services. Special feature of such procurement reporting system is possibility to reach all needed data in order to define KPI from the integrated business support system. The main advantage of such system is up to date data contained within the system because they are refreshed within Datawarehouse in real time.

Zero level reports are at the very top of the reporting pyramid and defined in advance on behalf of the procurement department. Their calculation is competence of the central procurement coordination department or regulating body. There are a number of basic indicators that are being calculated that cover basic dimensions and phases of procurement process:

1. Volumes – the amount of spent money, value of purchase with indication of deviation from the anticipated purchase budget in order to measure the difference of planned price in respect to the one that is achieved during purchasing process
2. Leading time – the time needed to process the purchasing request, calculated as a time elapsed from purchase request issue from the end user to the purchase order issue from the procurement department.
3. Efficiency – cost of procurement is calculated as a percentage of the purchase value, thus enabling the most efficient procurement units in respect to its services provided
4. Efficacy – measure of delivery latency calculated as a difference between real and projected delivery dates and charges of possible penalties for late delivery

Use of this seemingly simple and limited set of KPI enables adequate support to top level procurement management to asses the ability of procurement department to purchase goods and services at a good price, its maneuverability and incurred cost as a consequence of material and service purchase in a given time period.

First level indicators are in fact detailed indicators of various dimensions that can be used to analyze the reasons for deviations from the average expected for every procurement department and consequently measure and improve processes within the department. These indicators are calculated when zero level indicators show critical areas in order to concentrate on them. Every indicator is connected

with the set department goals assigned by the top management for the certain period in order to improve the quality of provided services.

All KPI are calculated based on the data contained within Datawarehouse. Such approach is necessary to manage report data and analysis in complex corporate realities and in order to guarantee consistency of results by utilizing a system tat enables data certification, structuring and integration from various sources by producing analysis and reports. The development of Datawarehouse should also be entrusted also to a central governing entity for coordination of all procurement activities – procurement coordination department.

Usually, all input data is obtained from a transaction system while volume data is obtained from a separate system that records purchased volumes. Modules supporting higher levels of decision supporting, or business warehouse, is used to formalize the results through predefined reports called business objects and standard business explorer queries. (Fig.5)
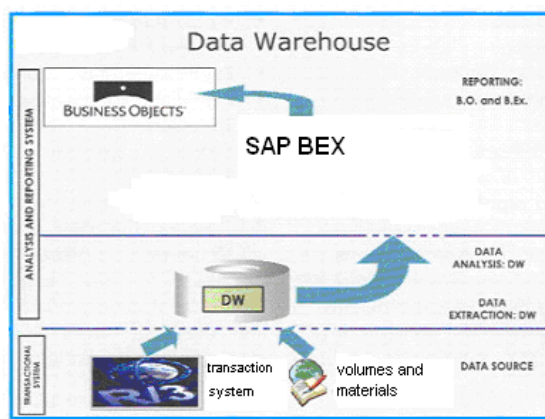

Figure 5. Datawarehouse architecture

Datawarehouse is the only system that can properly support decision making in procurement – except reach to data it enables analysis, research and report creation and organizes data obtained from other business areas linked with procurement like administration, finance or asset management. The Datawarehouse system is therefore tightly connected with various transaction systems and only its usage can guarantee the data validity and provide to the procurement department data needed for decision making. Therefore, Datawarehouse should be accessible by all users who need such data in their everyday work, not only managers, but also users involved in daily operationalization of procurement activities. The system also incorporates transversal standard reports that cover all steps of procurement activities that are especially useful during control of procurement

flow and in order to store into Datawarehouse the data about phase completion including invoicing, payments and guarantees.

6 Procurement reporting system challenges

Primary challenge that modern corporate procurement function has faced in the past ten days is change of methods of procurement from "one to many" where one call for tender was met by offers submitted by certain vendors to introduction of e-procurement, as a global marketplace for meeting of demand and supply, thus achieving more favorable prices and terms on the side of procurement organizations and better access to the market for the vendors. However, the procurement organizations themselves are facing the need for constant education of internal personnel and especially managers in area of usage of intelligent business systems and methods to improve the decision making process on all levels. Even though the procurement has been trying for centuries to control the environment surrounding it and therefore derive benefits for the organization, now it is turning inwards and has to evaluate constant training in usage of newly emerging management methods.

Procurement function is not isolated within organizations. They are only a part of overall business process. It is very important to align the procedures used by the central corporate procurement coordination department and separate procurement functions present within organizational or project units in order to achieve homogenous procurement procedures. Only in such a scenario it is possible to fully derive benefits from usage of management decision support systems.

Procurement is only a part of the overall corporate supply chain. It has to closely cooperate with other functions in order to achieve synergy – this way, purchasing process becomes cross functional purchasing working on complex projects, providing global sourcing in a multicultural environment. Managing so complex operations certainly would not be possible without efficient decision making.

Finally, procurement is also more and more involved into outsourced type of process that is represented by development of suppliers. This complex task is entirely impossible without information about suppliers, cost, volumes and provided quality of service in the past, but also extrapolation of trends in the future.

All these facts pose a significant challenge to new global procurement function.

7 Procurement decision support systems

Most prevalent problem in usage of reporting systems in procurement is inherent need to use quarterly or half-year reporting paradigm, while complete report execution is not automatic. Even though there is a Datawarehouse in place, thus creating a solid base for advanced queries and analytic reporting; most of the work is usually done in a manual or semi-automatic mode. In such a system it is very problematic and also cost inefficient to make ad hoc queries and almost completely impossible to create simulations by extrapolating procurement trends or use heuristic methods in order to anticipate entropy embedded into cyclic market movements.

Therefore, the biggest challenge imposed to procurement reporting systems is introduction of business intelligence systems over existing decision support systems based on structured queries on Datawarehouse. [4]Business intelligence helps corporations to achieve wider perspective and evaluate knowledge about all facts that have influence on business process execution, like sales metrics and realization and internal corporate operations, with final goal that business decision making becomes more aligned with the corporate mission. Business intelligence is completely leaned onto procurement data warehousing system and this eliminates any kind of bias or guessing. Such an advanced system can further strengthen intradepartmental communication and coordinate them. Furthermore, it could give corporations a competitive edge, placing them ahead of often hard recognizable trends and future events. [5]

Ideally, it would be possible to see all relevant performance indicators needed for decision supporting function to top management with automatic change of input values and analysis of output change in real time. Moreover, envisaged system of procurement business intelligence would enable simulations and ad hoc analysis and compared to existing data warehousing system business intelligence provides a view into the future while those decision support systems based on data warehousing provide only good, but relatively limited static view of the past, leaving decisions to subjective and professional competence of the top management.

Final goal of introduction of next generation procurement DSS would be implementation of dash boarding. Dashboards are in this sense procurement executive information system interfaces that are interactive and easily readable. They involve the data within transaction systems and procurement Datawarehouse as a driver while underlying information technology is an enabler. Compared to the standard mechanical interpretation of the word "dashboard", procurement dash boarding is not static, in fact, the change of inputs and instantaneous

presentation of zero and first level KPI provides to procurement top management unprecedented ability to analyze the change of procurement paradigm based on change of underlying inputs. Typically, the cost of implementation of such a system, especially when solid transaction and Datawarehouse systems are already implemented, is shadowed compared to the dangers of inadequately managed strategic procurement function and possible incurred hidden costs.

8 Conclusion

In those corporations that have already implemented systems of business transactions and procurement KPI, usually, such a system provides adequate support to basic business reasoning and decision making using KPI system, queries and analysis towards top management and procurement management. However, in case of constant environment changes and especially in case of significant correlation with certain inputs on the global market, it is possible to further improve decision making.

Such an improvement is expected if it is possible to extrapolate existing trends by using information already present in Datawarehouse and heuristic methods in order to adjust those trends to entropy embedded in cyclic movements of the market and business activity.

Prescribed method to achieve these goals would be implementation of business intelligence. In classic sense, such systems when implemented enable analysis of detailed knowledge about facts that have a strong footprint on procurement operations within corporations with the goal to more adequately create a picture of the procurement mission. Business intelligence systems are entirely superimposed over Datawarehouse contained information and this is how almost all subjectivity in decision making process is overridden. The system based on advanced principles can further strengthen the communication between departments and procurement function and coordinate them. It also provides procurement management and coordination management look into the future, possibly ahead of the trends and future events. In ideal case it is possible to see all performance indicators and facts needed for decision making with dynamic change of inputs and analysis of outputs.

Compared to classic procurement Datawarehouse systems that provide look into the future using standard data mining methods, business intelligence systems provide effectively look into the future.

---

[4] http://www.inteligencija.com/download.html ,
Accesed: 17th April.2009
[5] http://www.pmi.org/info/default.asp, Accessed: 14th April 2009.

References

[1] Orizzonti Saipem, Centro Servizi Riproduzione Documentale Xerox Sieco, Milano, 12.04.2006

[2] http://en.wikipedia.org/wiki/Procurement, Accessed: 5th May 2009.

[3] http://www.inteligencija.com/services.html, Accessed: 17th April.2009.

[4] http://www.inteligencija.com/download.html, Accesed: 17th April.2009

[5] http://www.pmi.org/info/default.asp,Accessed: 14th April 2009.