PUBLIC E-PROCUREMENT -

DEFINE, MEASURE AND OPTIMIZE ORGANIZATIONAL BENEFITS.

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ABSTRACT

This paper analyzes how *e-Procurement* could impact the purchasing process of Public Services. It aims at proposing a model pinpointing and quantifying performance benefits among organizations. A review of existing literature about e-Procurement and the impacts of IT-based innovations has been taken into account. The critical factors of success are examined, and six of the main impact dimensions of electronic procurement are precisely set out. The key contribution of this paper is a model, consisting of a specific measurement framework -for each impact dimension- and a cockpit. These instruments are employed to monitor the performance of procurement personnel and the overall effect of the implementation of e-Procurement. This model has been applied through an analysis of the public healthcare sector in *Lombardia* (the Region of Lombardy). The results are herewith exposed.

SUMMARY

1. INTRODUCTION

E-procurement is a specific set of instruments, technologies and organizational solutions supporting public procurement processes, particularly considering the possibility to manage tendering procedures and auctions online (e-tendering, e-auctioning). This paper analyzes the impacts that e-procurement could produce in Public supply chains, the main goal is to define a model to measure the performances of public procurement activities, by quantifying organizational benefits deriving from introducing this innovation.

Literature about IT based innovations has been reviewed to identify the critical success factors (CSF) to achieve the benefits related to the use of electronic instruments in procurement. Thus, a definition of six impact dimensions on organizational performances is provided: *efficiency*, *effectiveness*, *transparency*, *competitiveness*, *governance* and *dematerialization.*

Each of the six impact dimensions is part of the performance measurement model herewith proposed; they are described by a set of indicators. Specialized literature lacks a similar model, therefore the paper identifies both its characteristics and its usage modalities. The results of the first survey based on this methodology are given, the survey has been conducted on Lombardia Public Healthcare Service. The data will highlight the interesting benefits that the healthcare sector is already experiencing, thanks to the usage of e-Procurement web platforms, although the implementation of this instruments has been carried out only recently.

2. E-PROCUREMENT AND ORGANIZATIONAL RENEWAL

Literature and specific research contributions on e-Procurement and the implementation of these instruments begun to develop only during the last decade, especially considering Public Services. The first papers dedicated to these issues date back the end of the 90s, the authors stressed the importance of employing IT in procurement activities and handling the benefits.

It has been highlighted that e-Procurement has to be evaluated in its complexity, which encompasses numerous goals: to rationalize expenditure, to reduce “administrative confusion” and costs, to foster operational efficiency, to strengthen organizations’ network vision and technological collaboration with business partners, even to completely automate certain procurement activities (Croom, 2000; Gamble, 1999; Greenemeier, 2000 and Murray, 2001). In order to achieve these goals, the implementation of e-Procurement has to be carried out alongside a complete revision of procurement processes,

which would include an accurate selection of suppliers, strategic bargaining of contracts, monitoring of performance, both of buyers and suppliers. Moreover, it is necessary to move towards a systemic usage of this technological innovation, with a continuous flux of electronic purchasing activities affecting important volumes of expenditure (Ramayah, Zbib, Jantan e Koh, 2006).

The pros and cons of IT based innovations in complex organizations have encouraged a plethora of studies that investigated these impacts under a variety of points of view. The contributions of Davenport and Andersen have been particularly considered to develop the procurement performance measurement model presented in this paper.

T. H. Davenport (1994) defines 9 principal groups of specific effects of IT on organizational processes: *automating* (eliminating or reducing drastically the effort of human resources), *informative* (generating more information and allow a better understanding of it), *sequential* (modifying the sequence of the process and the activities that are part of them), *of control* (improving monitoring), *analytical* (improving the understanding of the phenomena), *geographical* (improving the ability to coordinate remote processes), *integrative* (assuring coordination among tasks and processes), *intellectual* (getting and spreading knowledge), *disintermediation* (reducing redundancy and intermediate activities).

In *e-Government in action*, Andersen analyzes the subject in a broader perspective: Information Technology produces direct effects on *organizational skills*, as far as effectiveness and efficiency of the processes are concerned. On the other hand, IT indirectly affects organizational interactions, coordination and cooperation, interaction models, internal control and organizational power.

Particularly regarding the Italian healthcare sector (herewith analyzed), Nasi (2005) took up the paradigm *people – process – technology* (PPT) to define the CSF to effectively achieve an organizational improvement through IT. *Technology*: such as web sites, ERP, system security, digital signature. *Process*: a thorough business process re-engineering is needed along with the adoption of standards and coding acknowledged internationally. *People*: it is necessary to raise awareness and train the employees on themes such as sharing knowledge through IT, networking and change management. On the basis of this contribution, the CSF to successfully employ e-procurement (and get the positive effects) are shown in TAB. 1. Extra-organizational relevant factors (*environment*) have been added to the classic PPT paradigm.

TAB. 1 – *Critical success factors to successfully employ e-Procurement and get the positive effects*

Technology	Availability of a suitable and capillary **IT infrastructure**
	Integration among the applications (i.e. e-procurement web platform and ERP)
	An e-procurement **web platform**, which has to be complete, user-friendly and free
Process	**Business process re-engineering** on the basis of shared organizational models
	Adoption of standard **commodity categorizations** (i.e. CPV coding)
	Adjustment of internal rules
	Shared logics and methodology for **measuring, reporting** and **publicize** the results
People	**Raising awareness** towards the use of new technologies, training, networking and management techniques.
	Training on e-procurement tools
	Technical, legal and strategic consultancy for the first tendering procedures online.
Environment	Political definition of goals related to the effective **use of e-procurement**
	A **comprehensive and unique normative** discipline
	Creation and development of public "**centers of excellence**" whose goal has to be the diffusion of knowledge and innovative tools.
	Facilitations to involve suppliers, often tied to the "traditional" *modus operandi*

2.1 E-Procurement Impacts

Precise definitions of e-procurement positive effects ("impacts") will be given in the present chapter, starting from those defined by Davenport and Andersen and applying them to the case of e-procurement. The results are shown in TAB. 2 and 3.

TAB. 2 - *e-procurement impacts on organizations (Regional Procurement Agency 2009, Davenport, 1997)*

Automating *Eliminate or reduce drastically the effort of human resources*	→ **Automation or reduction of the duration of the phases of the process**
	Sending of the invitations to the suppliers and publishing of the tendering procedure documentation.
	Technical / qualitative evaluation of the offers (only when non-discretionary parameters are defined).
	Anomalous offers evaluation.
	Use of e-auctions.
	Final and intermediate report production, archiving of the documents received.
Informative *Generate more information and allow a better understanding of it*	→ **Quality and availability of information**
	Tender documents are available from more sources.
	Tendering procedure documentation is more accurate, as the employees can spend more time in its preparation.
	Documents produced by every user of the platform are shared and available for consultation (spreading of the best practices).
Sequential *Modify the sequence of the process and the acitivity that compone them*	→ **Standardizing, expediting and innovating**
	The tendering procedure is clearly divided in phases, with no possibility of overlap (or "forget") activities.
	Automation liberates time to be used in activities generating an higher value-added.
	Creation of standardized tendering procedure "template" using the platform.
	Using of new IT instruments (i.e. digital signature, certified email, e-invoicing).

Of control *Improve monitoring*	→ **Better organization and archiving of the offers**
	Offers, documents and answers to eligibility requirements, are automatically organized by the platform, in the same way for each supplier. Thus, it's faster and easier to compare the offers and access them in every phase of the process.
	There is no risk of losing documents or confusing them with those presented by other suppliers, or even regarding a different tendering procedure.
	Every event or activity regarding a procedure is tracked and available to every stakeholder, anytime.
	Email alerts notice new events real-time.
Analytical *Improve the knowledge of phenomena*	→ **Administrative simplification**
	Standardization of phases and activities allows employees to master the dynamics of a tendering procedure.
	Every registered user can access to a tendering procedure and check its status
Geographical *Improve the ability to coordinate remote processes*	→ **Better communication**
	Easier collaboration and knowledge sharing with other Public Boards (exchange of documents, messages and contact lists).
	More effective managing of bundled tendering procedures, like framework contracts.
	Possibility of working from remote locations.
	Managers can coordinate many tendering procedures more effectively.
Integrative *Assure coordination among tasks and processes*	→ **Univocal attribution of responsibilities**
	The attribution of specific roles and delegations on the platform permit every employee to carry out only the activities within his competence.
Intellectuals *Capture and diffuse knowledge*	→ **Increased transparency**
	Information about current tendering procedures and their rules.
	Information about the volume of public expenditure.
	Information about the markets (which supplier for which commodities and where).
Disintermediating *Reduce redundancy and intermediate activities*	→ **Streamlining, reduction of bureaucratic procedures**
	The tendering procedure is linear, clearly divided in phases.
	Reduction of procedural burdenings.
	Reduced error-risk.

"Triggering" the nine effects of the effective Davenport's model (applied to e-procurement) could represent a change of great relevance for the public sector. Nevertheless, the positive impacts are not directly activated by introducing this new technology: achieving the benefits requires a complete process re-engineering. This can be initiated with the implementation of an e-procurement platform, but has to be based on human resources empowerment and improved information flows.

TAB. 3 - *Direct effects of e-Procurement on an organization (Regional Procurement Agency, 2009, Andersen, 2005)*

Effects on **organizational capabilities**	→ **Effectiveness and HR empowerment**
	Improved management and control of the tendering procedures, their results and of the quality of the expenditure.
	Improved transparency of the tendering procedures.
	Increased knowledge of the procurement processes.
	More time available for activity generating an higher value-added.
	Improved mastery of IT instruments.
Effects on **organizational interactions**	→ **Efficiency**
	New interaction, collaboration and sharing opportunities both within and outside the organization.
	The course of the procedures is simplified and expedited.
	Reduction of "administrative / bureaucratic" activities and redundancies.

Andersen's approach can easily be traced to the efficiency/effectiveness dimensions. Thus, the "trajectories" of the innovation in the procurement processes can be better appreciated when applying this model to e-procurement.

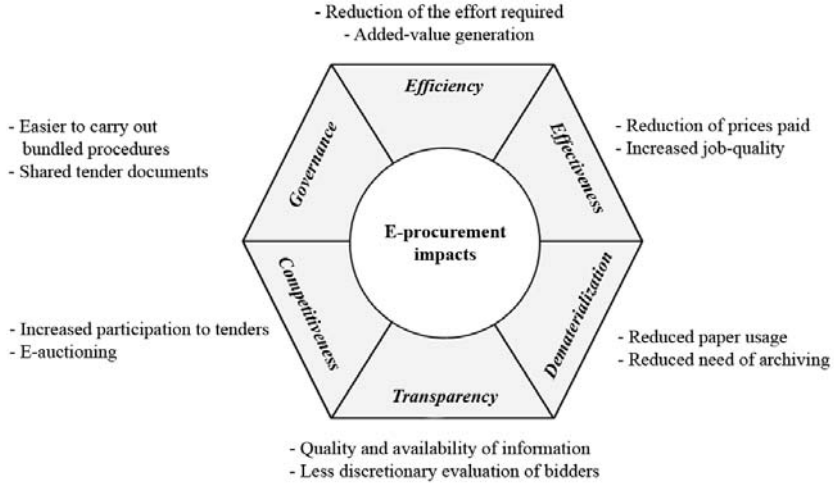
Both the models cannot sufficiently describe real procurement processes, even if they are perfectly able to show the entity and multi-dimensionality of e-procurement impacts. Evidences are not easy to measure, therefore they can hardly be used to tailor a framework of indicators, in order to gather data and report results. Moreover, certain effects, clearly acknowledgeable in e-procurement use experiences, cannot fit properly in the above mentioned models.

Dematerialization (reduced consumption of paper and materials) and *competitiveness* are two of these cases. The latter regards both the competiveness of the Public Boards and that of the market players; it encourages price reductions and increases in the quality of the offers.

Considering the real experiences of the users these two "dimensions of impact" are very important to describe the real impact of e-procurement. Once the effects shown in tables 2 and 3 are taken into account and are encompassed, a more precise definition of the impact is given on the basis of the criteria of measurability and exhaustiveness.

Six dimensions of impact are hereby exposed; they enable us to catch the complexity of the phenomena likely to be affected and changed by e-procurement: *efficiency, effectiveness, transparency, dematerialization, competitiveness, governance*. The indicators of the model presented in this chapter stem from a *subset* of measurement variables set for each of the abovementioned dimensions. A graphical representation of these six impact dimensions is given in FIG. 1.

FIG. 1 - *E-procurement impact dimensions (Regional Procurement Agency)*



A suitable model to study the impacts of new technologies applied to public purchasing processes is so far missing in specialized literature. Public e-procurement has been considered in existing studies mostly in terms of economic volumes exchanged per year through web platforms. The positive and negative impacts of buying online as operational standard are not precisely defined, nor measured by the researcher.

Nevertheless, a clear perception of the organizational benefits of renewing procurement through IT is spreading among public management. The importance of achieving these benefits and identify a tool to control and optimize them are widely recognized today by institutional stakeholders, as stated below.

At political level – to steer the strategic planning of the procedures, especially taking into account: the definition of management goals; the need for public expenditure reduction and optimization.

At management level – to improve the way procurement areas are managed, through: constant monitoring of group and single employee performances; control of expenditure levels and obtained discounts for current procedures; easier definition of a clear road-map for the team (programming of procurement activities).

At operational level – to increase the productivity and have the results objectively reported, increased visibility over the process phases and interaction opportunities. Moreover, a clear perception of personally contributing to innovate the organization could give more pleasure in working.

3 PERFORMANCE MEASUREMENT MODEL

In the present chapter, the *purchase* process is considered to pinpoint e-procurement impacts. The purchase process starts from requirements rationalization to the signature of the contract. A description of the impact dimensions and the related measurement frameworks is given below.

3.1 Efficiency

Efficiency measures the usage of resources during a process. E-procurement impacts this dimension allowing employees to achieve (at least) the same results of a traditional "paper-based" procedure, but using less time, thanks to the automation of certain phases (cf. Tab. 2, "automating effects").

Thus, the reduction of the full time equivalents (FTE) employed for the activities composing the process is the driver to measure efficiency. Moreover, a reduction of the elapsed time to complete a tendering procedure is expected, as e-procurement should affect the "wasted" time (cf. for example Tab. 2, "disintermediating effects" or "integration effects").

TAB. 3.1 - *Efficiency measurement framework*

Efficiency	→ **Measurement framework**
Reduction of the effort required; added-value generation	1. FTE saved by a manager
	2. FTE saved by an employee
	3. FTE saved by all the human resources involved in each phase
	4. FTE saved by all the human resources for the whole of the process
	5. Bids evaluation phase elapsed time

3.2 Effectiveness

To measure effectiveness simply means comparing goals and results. Among the various goals of the Public Healthcare Boards procurement areas, it is important the need to achieve good purchasing prices, while granting the respect of qualitative standards. Average discount on the reserve price is a good proxy to evaluate e-procurement impact on this dimension, given that e-tenders should at least grant compliance with qualitative standards. E-procurement should allow increased discounts, because larger markets are made accessible and it should be easy to use advanced instruments for the negotiations, such as e-auctions.

Furthermore, minimizing disputes, appeals and clarification requests from the suppliers is very important, as they are sure signals of a mismatch between goals and quality of results. A benefit to these themes is also expected to originate from e-procurement (cf. for example TAB. 3, "Organizational skills").

TAB. 3.2 - *Effectiveness measurement framework*

Effectiveness	→	**Measurement framework**
Reduction of prices paid; increased job-quality	1.	Average discount on the reserve price
	2.	Average number of appeals per year
	3.	Average number of clarification requests per procedure

3.3 Dematerialization

On the one hand, the amount of discount achieved is probably the first variable observed to evaluate the outcome of a tendering procedure; on the other hand, the number of printed pages is rarely considered relevant. Nevertheless, an enormous volume of documents and bundles piles up in the administrative areas of each Italian Public Board and archiving costs are consequently very high. Using e-procurement as an operational standard could trigger a dramatic turnaround in paper consumption, given a favorable normative framework. This is supposed to happen for different reasons like: the substitutive document retention in e-procurement platforms; the value of digital signatures, which have the same value as the autograph; the use of email instead of fax; the reduced or eliminated need to print hard copies. Thus, dematerialization has an environmental value and a financial one.

TAB. 3.3 – *Dematerialization measurement framework*

	→	**Measurement framework**
Dematerialization *Reduced paper usage; reduced need of archiving*	1.	Average number of produced/received pages per procedure
	2.	Total number of produced/received pages per year
	3.	Tons of paper consumed per year
	4.	Average number of trees consumed per year
	5.	Total number of trees consumed per year

3.4 Transparency

Administrative transparency consists -in its broader sense- in ensuring the highest circulation of information, both inside and outside an organization. E-procurement could improve transparency, as shown in TAB. 2, intellectual and informative effects. As an example, tender documentation and outcomes of the procedures (winning suppliers, rankings, final offers) are automatically posted online, and available to all.

To carry out technical/qualitative evaluations using "tabular format" (technical parameters are accurately defined during the preparation of the procedure, and a score is given to every possible alternative) requires Public Boards to increase the organizational effort, but it's another very important transparency index. In fact, when using the tabular format, suppliers can clearly understand in advance how they will be evaluated, this leads to an increased strategic accuracy of the offers.

TAB. 3.4 - *Transparency measurement framework*

Transparency *Quality and availability of information; less discriminatory evaluation of bidders*	→	**Measurement framework**
	1.	Percentage of tendering procedure whose documentation is available online
	2.	Percentage of tendering procedure whose outcome (winner, price, ranking) is available online
	3.	Percentage of tendering procedure that uses technical evaluation in tabular format

3.5 Competitiveness

Competitiveness is an analysis dimension that generally seems more suitable to private companies than Public Boards. Yet, public organizations can stimulate the highest levels of market competition. Moreover, a procurement unit could be competing with other Public Boards, promoting the mutual achievement of operational excellence. High level of suppliers' participation in tendering procedures and the use of e-auctions are considered good competitiveness indexes. Also, strategic activities such as reserve price definition and scouting of the markets are relevant to pinpoint how a Public Board promotes competitiveness.

TAB. 3.5 – *Competitiveness measurement framework*

	→ **Measurement framework**
Competitiveness *Increased participation to tenders; e-auctioning*	1. Average number of suppliers participating to a tendering procedure
	2. Percentage of procedures preceded by market scouting
	3. Percentage of procedures that use e-auctions
	4. Reserve price: definition modalities
	5. Market scouting modalities

3.6 Governance

"Public governance" represents a rather new technique to take care of public interest, through coordination and involvement of every relevant stakeholder. A process of "opening" the organizational boundaries and spreading the decision making power is considered the mean to realize an effective governance. E-procurement could improve public governance, as it lets geographically remote organization to actively cooperate, for example in the realization of a bundled tendering procedure, such as framework agreements. Moreover, it's easier to share best practices, thanks to the availability of information and documents online. This impact dimension can be read in TAB. 3, organizational interactions, and in TAB. 2, geographical effects.

TAB. 3.6 - *Governance measurement framework*

	→ **Measurement framework**
Governance *Easier to carry out bundled procedures; shared tender documents*	1. Total number of bundled tendering procedures
	2. Percentage of tendering procedure whose outcome (winner, price, ranking) is available online
	3. Percentage of tendering procedures that make use of standard documents, shared with other Public Boards

3.7 Method

The syntax of the model is very simple and intuitive. The model is used to compare the current situation (t_0) with an hypothetical situation (*baseline*) preceding the employment of e-procurement, and a future situation (t_n) that is shaped on the basis of the intended achievements.

The model measures the variations happened in the six impact dimensions, when moving from the baseline to t_0. A positive variation means that the organization achieved a benefit, while a negative variation represents an unintended impact, that could have worsened after employing e-procurement. At the same time, the model measures the gap from the desired future situation t_n. Thus, the syntax of the model can be defined as: AS WAS $\rightarrow$ AS IS $\rightarrow$ TO BE.

When measuring the impacts, it is necessary to gather the data of both e-procurement tendering procedures and traditional ones; the cognizant and advanced use of e-procurement is supposed to be the leverage triggering positive impacts. This is done by changing the composition of the mix "e-procurement tendering procedures / traditional ones" that defines the current situation. As an example, when firstly applying the model, Lombardia Healthcare authorities carried out 6% of the total tendering procedures online (below the 2008 EU threshold -206.000 €-). Using the model, it would also be possible to make generic forecasts as to achievable benefits if more procedures were carried out online, or even if *only* e-procurement were used.

It is not easy to monitor all of the indicators composing the model at the same time. For this reason, the surveyor can compose a personalized cockpit, choosing one or more key-indicators for each impact dimension. The cockpit is used to provide a graphical representation which allows the surveyor to appreciate the situation at a glance.

For the first survey it is sufficient to have accurate data for the current situation t_0. In fact, having data for a traditional procedure carried out nowadays, it is possible to estimate the situation in which every procedure was a traditional one. That situation is the *baseline*. The baseline will be the touchstone for the following surveys, but it could be replaced with a more challenging one, when necessary.

The indicators require different data types and levels of bonding -as to, for example, the total number of trees consumed per year, is an indicator which is more significant when applied to the whole of Lombardia Public Healthcare system, rather than a single hospital. Having different units of measure do not represent a problem, as the model measures *percentage* variations, which can be compared.

Using the model is very easy. The most of the data required are indeed available and accessible within an organization, but there is a need to systematize and survey them periodically. Some types of data need to be firstly assessed then precisely measured. For example, a manager should at first provide a realistic estimate of the required FTE for a certain phase of a tendering procedure. Then, he should define a system to measure it systematically. However, surveying this data has the intrinsic value of increasing employees' awareness on their daily activities and performances.

It is a *flexible* model: it measures e-procurement impacts and positive results can generally represent "symptoms" of good performance. It can be used referring to a single organization or to a certain public system, such as the Healthcare sector. It can also be adapted to other processes, for example the whole procurement cycle, which encompasses also logistics and consumption of the goods purchased. Moreover, it can be applied to other technological innovations.

It is a *customizable* model, as the set of indicators composing it can be chosen by the surveyor. It is also possible to give a different weight to each indicator, to emphasize the importance of a certain goal.

Moreover, the human surveyor could not be needed at all. In fact, the most of the Public Boards use nowadays ERP systems, which can manage every kind of data, generating information automatically. These systems could be customized with specific modules, to be used to collect the data needed for the model.

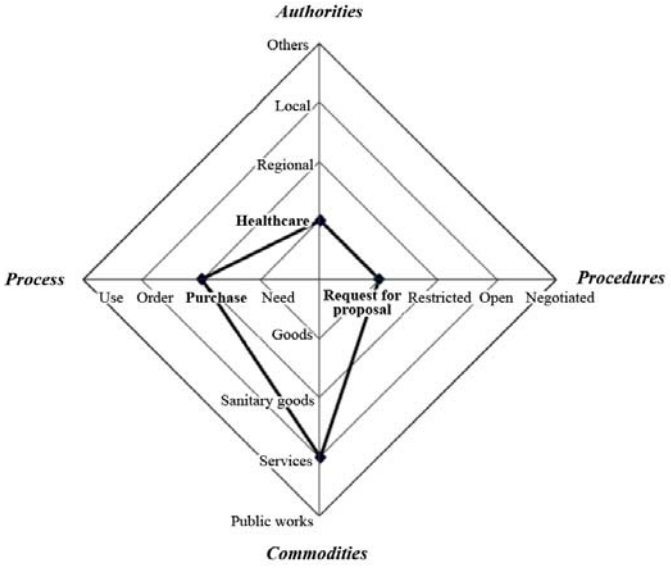
4 SURVEY CONDUCTED ON LOMBARDIA PUBLIC HEALTHCARE SERVICE

The first survey, based on the measurement framework presented in the previous chapter 4, has been conducted on Lombardia Public Healthcare Service, during fall 2008, by the means of questionnaires and interview.

Only *requests for proposals* for goods and services, below the 2008 EU threshold of € 206.000, have been covered in the survey. Tendering procedures for public works haven't been considered, as they require an effort not easily comparable with those for goods or services. Among the procurement cycle, only the purchasing process has been taken into account, thus excluding orders, logistics and consumption.

The scope of the analysis, as exposed above and in the following FIG. 2, has been chosen for simplicity reasons, in order to easily gather and compare the required data and test the quality of the model. However, the measurement framework could be applied considering a much broader scope, with the necessary adjustments.

FIG.2 - *Scope of the survey conducted on Lombardia Public Healthcare Service (Regional Procurement Agency, December 2008)*



4.1 Why Surveying Lombardia Public Healthcare Service

Healthcare Boards have been the most active in employing e-procurement, among the public sector in Lombardia. Seven hospitals have been e-procuring at least since 2003, they represent the *avant-garde* at national level. During 2008 each of these healthcare authorities autonomously managed more than 20 tendering procedures online, one of them even used e-procurement for almost 100% of its procedures.

Healthcare authorities are the sector that affect the most of Lombardia public expenditure, having an aggregate expenditure (for purchases of goods and services only) of about € 2,5 billion per year (2006). Lombardia healthcare authorities provide sanitary services to 9.5 million people, counting more than 100 hospital facilities and about 42.000 sleeping accommodations, also comprehending private structures.

A precise political will to have the healthcare sector use e-procurement exist in Lombardia. In fact, since 2007, the Regional Procurement Agency has been established, by the means of the Regional Law 33/07: one of the primary goals of this organization is to develop and diffuse the use of an e-procurement public web platform, “Sintel”. Moreover, Region Lombardia central authority set as a target for the 48 public healthcare Entities to carry out at least 5 tendering procedures online in 2008, and 8 in 2009. Furthermore, the

healthcare authorities are very involved in innovation themes, both regarding the administrative units and the four sanitary ambits. Indeed, prevention, diagnosis, therapy and rehabilitation are strongly influenced by technology (cf. electronic clinical records, telemedicine and surveillance, electro medical equipments)

4.2 Findings of the Survey

14 out of 48 healthcare authorities have not been surveyed. They are referred to as "hesitant authorities", in fact, at the beginning of the survey process (October 2008) they were not using e-procurement yet. TAB. 4 shows the distribution of the answering authorities.

TAB. 4 – *Distribution of answering authorities, excluding the "hesitant" ones.*

Healthcare authority	Answering	Surveyed	%
Hospitals	16	21	76%
Local sanitary agencies	8	10	80%
Healthcare research and scientific Entities	1	3	33%
Total	25	34	74%

The findings of the survey show that the healthcare sector is beginning to use e-procurement with discrete convincement, to carry out online the tendering procedures among the scope of the analysis. A part from the 7 authorities cited above, that are referred to as "evolved", the rest of the authorities began using e-sourcing web-platforms in 2008, consequently to the implementation of Sintel. The following TAB. 5 shows the 2008 situation of the mix "e-procurement tendering procedures / traditional ones", using the AS WAS (*baseline*) → AS IS (t_0) → TO BE (t_1) logic. The hypothetical situation in which every procedure is carried out online is also given (t_n).

TAB. 5 – Healthcare Service (48 Boards) mix "traditional tendering procedures / e-procurement" (2008)

Period	*Traditional procedures*	*e-Procurement*
baseline	5128	0
t_0	4827	301
t_1	x	y
t_n	0	5128

The final scores of the indicators (cf. chapter 4.1) are exposed below in TAB. 6. The score of each indicator (grey column) is the percentage variation between the result of a traditional tendering procedure and that of an e-procurement one. The results are average data collected during the survey, thus these indicators measure the "average" e-procurement impacts.

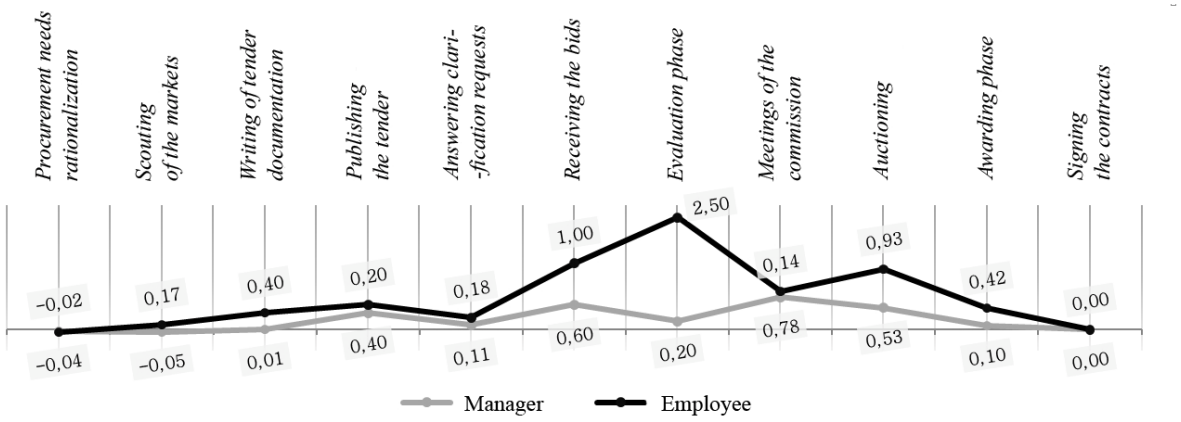
TAB. 6 – *Scores of the indicators*

Impact dimension	→ *Indicators*	*Traditional procedure*	*e-Procurement*	Δ	*% Δ (final score)*
Efficiency	FTE saved by a manager	2,1	1,6	0,5	**25,7%**
	FTE saved by an employee	14,1	7,1	7,0	**49,9%**
	FTE saved by HR involved *procedure preparation*	3,0	2,1	0,9	**29,1%**
	FTE saved by HR involved *negotiation, evaluation and awarding*	13,2	6,5	6,7	**50,8%**
	FTE saved by HR involved *whole procedure*	16,2	8,6	7,6	**46,8%**
	Average elapsed time reduction *offers evaluation phase*	25,5	12,8	12,7	**49,8%**
Effectiveness	Average discount on the reserve price increase	6,97%	10,23%	n/a	**3,26%**
	Average number of appeals per year reduction	0,29	0,03	-0,26	**-89,7%**
	Average clarification requests per procedure reduction	1,65	2,92	1,27	**77,0%**
Transparency	Percentage of tendering procedures whose documentation is available online increase	64%	97%	n/a	**33%**
	Percentage of tendering procedures whose outcome (winner, price, ranking) is available online increase	93%	98%	n/a	**5%**
	Percentage of tendering procedures that use technical evaluation in tabular format increase	44%	20%	n/a	**-24%**
Dematerialization	Average number of produced/received pages per procedure reduction	98	12	86	**-87,8%**
	Total number of produced/received pages per year	470.681	3.612	n/a	n/a
	Tons of paper consumed per year	37,65	0,29	n/a	n/a
	Average number of trees consumed per year	18,8	0,1	n/a	n/a
	Total number of trees consumed per year	639	5	n/a	n/a
Competitiveness	Average number of suppliers participating to a tendering procedure	5,75	8,19	2,44	**42%**
	Market scouting modality	n/a	n/a	n/a	n/a
	Reserve price definition modality	n/a	n/a	n/a	n/a
	Percentage of procedures that use e-auction	24%	71%	n/a	**47%**
	Percentage of procedures preceded by market scouting	89%	91%	n/a	**2%**
Governance	Total number of bundled tendering procedures	28%	7%	n/a	**-75%**
	Percentage of tendering procedures that make use of standard documents, shared with other Public Boards.	48%	68%	n/a	**42%**

Efficiency reports the most encouraging results, in fact, both the FTE dedicated to a tendering procedure and the elapsed time, greatly decrease. E-procuring requires about half the organizational effort of

traditional procurement. FIG. 3 is a graphical representation of "saved" FTE for each phase of a tendering procedure (both for managers and employees).

FIG. 3 – *Saved FTE for each phase of a tendering procedure (December 2008)*



The bids evaluation phase shows the most significant benefits, thanks to the automation of some activities and the simplification of others. For example, with e-procurement it is not necessary anymore to invite all of the bidders to the "opening" of the offers. The aim of these meeting is to guarantee that the phases of the procedure are carried out respecting their chronological order and that no mistakes or misplacing of documents happen. All of these risks are avoided using an e-procurement web platform, and it is always possible to get information about every single activity regarding a tendering procedure (through system log consultation).

The results of the survey should be analyzed considering that e-procurement have been used mostly for small transactions, with awarding criteria of "the lowest price" (Art. 55, Directive 2004/17/EC). On the other hand, traditional procedures are usually more complex, as Public Entities still feel "safer" to carry out strategic procedures using paper. However, even if online procedures are only 6% of the total, e-procurement affected positively the yearly required effort of procurement areas, reducing it by 2,75% (cf. TAB. 7).

Dematerialization and competitiveness impact dimensions have also been positively affected by e-procurement. An online procedure consumes 87,8% less paper than a traditional one (86 pages less per

procedure), and reports a 42% average increase of bidders' participation (2,5 more in e-procurement procedures).

Effectiveness impact dimension shows a 3,3% average discount increase, probably due to the higher suppliers' participation. No significant evidence is reported by the decreasing of the appeals. On the other hand, requests for clarification have increased by 77% in e-procurement procedures, when compared to traditional ones. That could likely happen because of suppliers' lack of experience in e-tendering.

Transparency and governance impact dimensions display discordant evidences. Some indicators among the least challenging show "easy wins", like the increased online availability of tendering documentation, or the slight increase of shared procedures outcomes. They are "easy wins" as e-procurement platforms carry out these operations semi-autonomously, and don't really require an effort from the users. Technical evaluation using tabular format should be much easier in an e-procurement procedure (scores are automatically calculated by e-procurement platforms), as it should be to realize bundled procedures (easier sharing of needs, documents and control over the procedure). However these indicators display negative evidences, meaning that traditional procedures are still preferred both for using the tabular format of evaluation and to realize bundled procedures. That is primarily due to the use of e-procurement by Lombardia Healthcare Public Entities, which is very "basic". E-procuring complex procedures (with technical/qualitative evaluation and/or bundled ones), is still a rare phenomenon. Therefore, it has still to be demonstrated whether e-procurement could affect positively these (high added-value) dimensions or not.

4.3 "Cockpit" of Key Indicators

After discussing the results of the survey, a cockpit has been composed, selecting a set of key indicators. Aim of the cockpit is to provide a graphical representation of the e-procurement impacts measurement framework herewith proposed.

TAB. 7 presents a list of the key indicators which have been selected to compose the cockpit, it also shows the results of each indicator for the three considered periods (*baseline*, t_0, t_n). The most challenging indicators have been chosen, so that it would be possible to clearly understand the gaps to fully disclose the benefits in each impact dimension. The hypothetical period t_n (when all of the procedures will be carried out by electronic means) has been described only referring to the indicators whose results are expected to become trends. The scores for *baseline*, t_0 and t_n have been measured at system-level, aggregating the information provided by single Entities. Thus, the cockpit measures e-procurement impacts on the whole Lombardia Healthcare Sector.

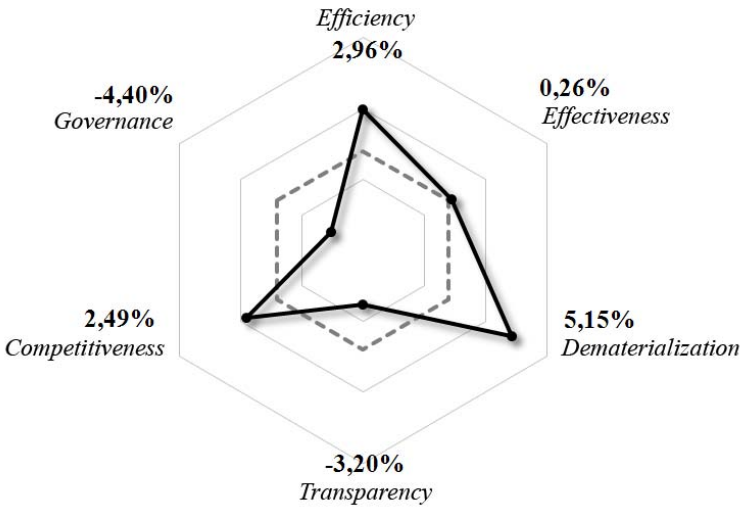
TAB. 7 – *Cockpit used to measure e-procurement impacts on Lombardia Healthcare Sector (December 2008)*

Key indicators	*baseline*	t_0	t_n	Δ	Δ % *(final score)*
Efficiency					
FTE saved by HR involved *whole procedure*	82.997	80.717		2.280	**2,75%**
FTE "savable" by HR involved *whole procedure*		*80.717*	*44.152*	*36.565*	*45,3%*
Effectiveness					
Average expenditure per year reduction *(based on average discount on the reserve price increase)*	€ 144.403.063	€ 144.034.502		€ 368.562	**0,26%**
Average savings achievable		€ 144.034.502	€ 139.353.745	€ 4.680.757	3,26%
Transparency					
Percentage of tendering procedures that use technical evaluation in tabular format increase	2.256	2.184		-72	**-3,2%**
Dematerialization					
Saved trees per year	679	644		34	**4,98%**
"Savable" trees per year		644	85	554	86,8%
Competitiveness					
Average number of suppliers participating to a tendering procedure	29.491	30.224		733	**2,49%**

Governance					
Total number of bundled tendering procedures	1.436	1.373		-63	**-4%**

FIG. 4 displays a graphical representation of the cockpit exposed above. Good results are shown by some dimensions, although the impacts are only moderate. That is due to the total number of online procedures carried out (313), which is too little to produce a decisive impact at system-level.

FIG. 4 – *Graphical representation of the cockpit (December 2008)*



5 CONCLUSIONS

This work proposed a new methodology to measure and continuously control the performances of public procurement organizational units. The cognizant and advanced use of e-procurement is seen as the leverage to improve these performances, especially considering the impact dimensions of efficiency, effectiveness, dematerialization, transparency, competitiveness and governance.

The first empirical evidences of the measurement framework already show positive results, particularly in the dimensions of efficiency, dematerialization and competitiveness. Moreover, the results of this survey prove the importance of buying online as a leverage to trigger a continuous improvement in procurement areas' performances.

Using new IT solutions, such as e-procurement, represents a strong stimulation to move from a bureaucratic model of administration (based on standard procedures, only committed to rules respect), to the virtual bureaucracy (Nohria, Berkley, 1994, Fountain, 2001) in which communication is informal and electronic; employees are cross-functional; jobs are enriched in content and "limited" not only by the expertise of the employees, but also by the extension and sophistication of the mediation offered by technologies.

Therefore, e-procurement seems to have the capability to change old standard practices and affirm new and more efficient dynamic processes. However, even if the theme has been discussed for years, e-procurement has not become an operational standard yet. Using a measurement framework to quantify e-procurement benefits should be the right approach to motivate a conscious adoption and promote the continuous development of this and other IT innovations. Thus, the model herewith exposed represents a contribution to redesign public processes strategically, by encouraging focused improvements. This change process has to be guided by empowered HR, freed from bureaucratic activities, they should be able to work more effectively, generating added-value, and *measuring* it.

In order to really move towards the "future of procurement", it is therefore necessary that every involved stakeholder has the right commitment to the importance of using new technological tools, track performances and results and constantly renew the organizational processes.

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