An integrated approach in healthcare e-procurement: the case-study of the ASL of Viterbo

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Abstract. The size and growth of Italian healthcare spending for goods and services ask for prompt rationalization programs, with novel purchasing approaches (e-procurement), capable to provide significant reductions in purchasing and administration costs. If several interventions have not yet delivered the expected results, that's due to lack of problem segmentation and resistance to change of public structures. Health-related purchases require a segmented approach, to take into account the specific needs of different spending items and foster coherent organizational changes. It is therefore of interest to examine the e-procurement project undertaken by the ASL of Viterbo, for its scope, consistence and brilliant results.[1]

1 Size and peculiarities of healthcare spending for goods and services

A 20% share of public healthcare spending (2002, source ASSR[2]) is for the "purchasing of goods and services" (frequently named "intermediate healthcare consumptions"). Sizeable in percent, this component reaches huge absolute dimensions when referred to the whole Italian public healthcare sector. In one year (2002) the *National Healthcare System* spends about 17,5 €b for goods and services, a sum of money which is increasing both in absolute terms (it almost doubled from 1997 to 2002) and in percent (21,39%; in 1998, 21,68% in 1999, 22,46% in 2000).

The spending for goods and services largely varies in percent among the various Italian regions [5] and the market is further influenced by other complexity factors:

– about 350 diverse healthcare structures (ASL, AO and IRCSS[3]) with different procurement needs (thereby asking for a complex and strongly personalized offering);
– about 500 thousand, highly differentiated suppliers (multinationals, mid-size national Companies and local SME's).

[1] The gist of this paper is somehow similar to that of a recent article in bibliography [16].
[2] Agenzia per i Servizi Sanitari Regionali (Regional Healthcare Services Agency).
[3] ASL - "Azienda Sanitaria Locale" (local health authority), AO - "Azienda Ospedaliera" (hospital authority) and IRCCS - "Istituto di Ricovero and Cura a Carattere Scientifico" (shelter-and-care institute with also scientific purposes).

The main issue, however, is the composite structure of the spending, which includes standard supplies for the whole Public Administration (PA), together with highly specific purchases. Introducing e-procurement tools in the healthcare sector asks for a detailed analysis of spending variety, in order to match each purchase type with the appropriate electronic procurement tool, by clearly defining the nature of the need (e.g. operating room specific devices) and planning purchases without inconsistency, thereby supporting both healthcare performance and economy of procurement.

Healthcare spending for goods and services can be classified into three[4] items:

- *common* for the whole PA, independent from the type of buying Administration (e.g.: phone services, office materials). In 2002, this cost item for the Italian healthcare sector reached 4.2 €b (Consip, 2002), 23% of total (18 €b);
- *common-but-differentiated* (25% of total), existing for all the Administrations but highly differentiated by buying sector (e.g. in healthcare sector: hospitals building maintenance or cleaning);
- *healthcare-specific* (more than 50% of total), composed by drugs and medical devices[5].

This diversity – as well as the complexity factors indicated above – must be taken into account to devise innovative ways to manage procurement in order to rationalize and reduce spending, before choosing the most appropriate IT solutions.

2 e-Procurement tools

The term "e-procurement" indicates the organizational solutions, as well as the supporting information and communication technologies, which offer on-line forms of procurement, more effective and efficient than traditional ones, to industrial, commercial and service Companies [15]. An e-procurement system, when correctly conceived, deals with the whole procurement process and not only its purchasing phase. It requires an overall redesign of the process, taking into account the whole life-time of a product or service [18]. When useful, logistic / *Supply Chain Management (SCM)* solutions might also be integrated, connecting IT systems of suppliers and clients.

e-Procurement solutions include widely different tools, in three areas: *e-sourcing*; *e-requisitioning* and *e-logistics* (the first two are alternative ways to deal with the purchasing phase, while the third one is a complement to both of them, to streamline the whole procurement process).

e-Sourcing, preferably applied to with medium / low-frequency purchases, includes web-based models and tools, which allow to perform on-line tenders and contracts, analyze spending and measure supplier performance, in order to optimize supplier, product ad service mix. It refers to both *e-auctions*, which allow to define a purchase price by accepting competitive on-line price reductions, and various types of electronic tenders, which reproduce the administrative procedures on the web. Auctions are particularly indicated to buy "well defined" supplies in terms of requirements, not

[4] This classification, formerly used to identify the economic aggregations of healthcare spending for goods and services, is very useful to single out the most suitable e-procurement tool.

[5] Appliances and materials that, separately or jointly, are used in case of injury, disease, handicap, or during a physiological application.

requiring to provide and evaluate a specific project. For them, the criterion of lowest price is suitable, without risk of adverse consequences in supply quality. On-line tenders, instead, are more suitable for non standard purchases, which ask to balance quality and price.

e-Requisitioning, yields its best results in term of savings when dealing with high-frequency supplies, with limited individual costs, and standardized non-strategic goods, with low consolidated technology [10]. It fully manages orders (from the issuing of purchase requests to the authorization of spending, to monitoring the order progress, up to the payment of supply), with the tool of *marketplace*. This collects and show the offers of goods and services proposed by admitted, even competing suppliers – with details on characteristics, prices and supply / payment term – to an audience of enabled buyers. With a single IT platform, it performs the whole purchasing cycle (from the choice of good and producer to the issuing of order, to the notification of the order to the supplier). For Italian PAs, this tool became – alternatively in *tying* and *untying* mode [1] – the *Electronic catalogue* of the goods and services which can be purchased at predefined conditions through the *Frame contracts ("Convenzioni Quadro")* negotiated by Consip and, more recently, in an experiment of true *Marketplace* [19], new tool for on-line negotiation useful for purchases of amounts lower than the threshold set by the European Union for public tenders.

e-Logistics is the optimized management of inventories (in healthcare structures, those of pharmacy and supply office) and of internal flows of purchased goods, based on Intranet/Extranet technologies, capable to directly link both internal and external players. Independently from purchase process, e-logistics can bring large advantages to the whole procurement cycle, particularly for repetitive supplies / continuous stock replenishment. It's an innovation closely linked to process redesign and supplier integration, the absence of which might severely reduce the scope of the benefits [12] coming from adopting e-sourcing or e-requisitioning innovative tools.

3 Correlation between tools and spending items

In the healthcare sector (more than in others) is paramount to safeguard – together with economy and timeliness of purchases, transparency of deeds and conformance to competition principles among Companies – high quality standards for many products and services purchased [21]. The large differences among spending items indicated above *(common, common-but-differentiated, healthcare-specific)* and the availability of diverse electronic solutions enforce a profound reflection on which solution suits most which type of good / service, according to a segmented approach.

Goods and services within the *common* spending can be standardized for the whole PA (large utilization, wide offering, repetitive purchasing quantities) and are perfectly compatible with *e-requisitioning* tools. The best opportunity – in terms of purchase price reduction, administrative costs and delivery time – is to link into a public marketplace, based on contracts negotiated by a single entity (at national, regional or local level). This would aggregate fractions of public demand, knock-down standard supply contracts of large overall amount, perform unified tender procedures for a number of "client" entities [14] and – in the end –lower the final price.

The *common-but-differentiated* spending consists of supplies which must absolutely guarantee to the healthcare buyer the fulfillment of specific needs. It requires the presentation and evaluation of (even complex) projects, for which it's difficult to define criteria for automatic score attribution. The traditional procedure can be substituted by a tender partially performed on-line, moving onto the web the call, presentation, intermediate and final communications phases – with clear benefits in terms of administrative time and cost reduction – while keeping the offers evaluation phase off-line.

To reduce the *healthcare-specific* spending, a wider e-procurement approach must be used: looking just for the lowest price [12] can be counterproductive, since the requested goods and services are highly specific, and high quality levels are required as well. The maximum benefit can be obtained by reengineering the internal processes, merging several e-procurement methodologies and tools together – healthcare e-logistics, on-line tenders, evolved forms of marketplace – as well as providing adequate IT supports to the healthcare cost centers (e.g. hospital wards).

4 Case study: ASL of Viterbo

The use of e-procurement tools in healthcare environments is based mostly on solutions pre-defined by external subjects, like the above indicated *Frame contracts* negotiated by Consip, which – as discussed – do not fully respond to the specific needs of a relevant share of healthcare purchases.

An interesting case – for its scope, early start and brilliant results – is the experience of the "Azienda Sanitaria Locale" (ASL) of Viterbo, which introduced well targeted and effective organization and IT solutions for e-procurement within a wider plan to more comprehensively rethink the procurement processes, set-up into various projects driven by the Procurement and Logistics (P&L) Department.

The ASL of Viterbo is organized in three areas: hospital services; territory services; administration services. With about 3.200 administrative and healthcare employees, it provides healthcare to the province of Viterbo (859 hospital beds), with a production value of about 350 €m, determined according to the individual spending allocated for each citizen of the province (297.686 as of December 31, 2001).

4.1 Activated projects approach

The e-procurement project of the ASL of Viterbo is characterized by a diversified and systematic approach, as well as a direct and decisive role assigned to the hospital wards: they actually deliver the health care and are the main final users of the new tools. The whole procurement cycle was resized, starting from a detailed analysis of the need for goods and services. Specific purchase characteristics were made explicit, spending was mapped in detail – divided among: *common, common-but-differentiated, healthcare-specific* – and an organic plan to link procurement needs and e-procurement solutions (according to theory).

The ASL relied heavily on the specialized competences of individual hospital wards and involved them in the definition of the new procurement processes, as a

necessary complement to the cooperation with external Companies, capable to transfer their technology and management know-how. In the new process model, the wards, in their healthcare duty, assume a driving role, but not the responsibility to decide how to purchase each specific good. Working within a highly integrated procurement process (IT supported), they are informed of their overall consumptions and related stock levels[6] and can address the purchasing system directly, to signal specific emerging needs and issue very accurate orders in a very short time. According to experiences, about 2/3 of hospital stocks do not reside in hospital pharmacies (which essentially intermediate the order flow), but directly at wards: without adequate monitoring tools, it is difficult to know ward consumptions in a timely way and the chances of error increase when planning procurements centrally.

The use of public and private electronic catalogues for the *common* spending soon delivered the expected economic benefits, in line with the rationalization program promoted by Consip, with which the ASL of Viterbo instituted a reciprocal cooperation relationship, both to utilize the negotiated contracts for *common* goods and to test innovative initiatives like the *Marketplace*, to which the ASL of Viterbo took active part together with other 19 Italian PA's.

In order to improve the procurement and internal management of the *healthcare-specific* and *common* goods, from ward requests up to the purchasing channels, the ASL of Viterbo designed a fully IT-supported process, with procurement flows designed along two distinct routes, according to the type of goods to supply:

- for non-specific Medical Devices (MD), normally used in hospital wards for the routine healthcare activity, and office products (e.g.: ink, paper) the steps are:
  - *on-line tenders*, for products not in the hospital (never purchased or fully consumed), by transferring most phases of traditional tender onto the web – with minimal technological adjustments – while guaranteeing conformance to awarding criteria;
  - *e-logistics*, to automate the whole replenishment route of the product supplies awarded by tender, between pharmacy or supply office inventories and wards;
- for the Specific Medical Devices (SMD), used in surgical operations, the route activated is the *operating room e-procurement*, for materials which require an ad-hoc procedure, by designing a new on-line procurement process which optimizes the replenishment time and reduces the ward and inventory stock levels.

The wards activate the procurement process, which proceeds through the routes defined by the P&L Dept., according to the nature, availability and peculiarities of the requested devices. In this way, many management problems – related to the mutual understanding and coordination between specialized beneficiaries (ward personnel) and administration (Purchasing Department) – are overcome and do not slow down the performance of the healthcare delivery machine any longer.

The indicated distinction into two routes must be considered just a first experimental step. In the future, while continuing to pay attention on the differences among goods characteristics, the distinction could be overcome by extending the scope of the *operating room e-procurement* route that simplifies the process, as it integrates together supply and outsourcing of logistics.

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[6] To correctly evaluate this innovation, consider that 99% of Italian hospital wards do not reach the level of IT support needed for this kind of activities.

4.2 Testing methods

After characterizing spending categories, designing new processes and matching spending items with e-procurement tools, application tests were performed in internal pilots. The sharing of results with involved professionals then preceded the implementation phase, which is still ongoing in the interested structures.

The test phase performed by the ASL of Viterbo on e-procurement solutions were conceived in order to track results in terms of innovation effectiveness and time and costs reduction, by producing:

- a detailed map of the existing process, with identification of micro-activities and number and type of human resources engaged, and quantification of working and elapsed time through interviews;
- a design of the new process flows, with embedded methods to automatically track the time spent in each activity;
- a comparison of volumes of goods, time spent and purchase costs between the existing and the new process.

The pilot phase performed an even more detailed analysis on cost elements for the *operating room e-procurement* (this is the main reason why only its data are exposed here), by identifying:

- the direct costs of the existing and the new process, quantified according to cost accounting (e.g. hourly pay per job position) and also by means of field surveys (e.g. squared meters actually occupied in the warehouses) or estimates, when precise measurements was not considered useful (e.g. costs of obsolete products);
- relevant indirect costs (e.g. general costs), estimated on the basis of fair criterion.

Time and cost savings reported are therefore actual, as results of an accurate analysis. Based on these data only, the ASL decided to implement the tested solutions fully.

4.3 On-line tenders

The implementation of on-line tenders originates form a first experience with a private web portal in 2000 [2], which represented the starting point for the organization and technology innovation promoted within the ASL, aiming at reducing spending in constant growth with the introduction of novel tools, by that time rarely used in the public sector [17].

The electronic request for goods is satisfied by the hospital inventory, if the requested item is available; otherwise, the opportunity of a new purchase is evaluated by the specific Commission for that product typology. After approval, in case of non-specific MD's for example, the hospital pharmacy requests the opening of a tender to the Purchasing Department, according to the total hospital needs. The on-line tender route is reduced to a minimum vis-à-vis a traditional procedure [8]; it includes:

- *invitation*: when the tender is opened with related supply contract terms (goods / services characteristics and knock-down specifications), the ASL invites potential suppliers via e-mail and sends them an identifier and an access key to the system;
- *competitive price reductions and knock-down*: once invitation terms are expired, in the day and at time indicated, the offers received are filtered by the system according to products, technical specifications and price, and – after a further price reduc-

tion offer by participants – the supply is awarded;
– *award notification*: it is sent directly to the winner of the tender, with the related supply order approved by the ASL.

The ASL benefits from reduced time[7] and costs in carrying out the purchasing procedures and a database of all offers becomes available, to analyze the suppliers participation and winning patterns, the evolution of healthcare prices and the purchasing performance over time [22].

4.4 e-logistics

The new e-logistics process outsources the management functions of hospital and supply office inventories to an external Logistics Service Provider (LSP), with significant reduction of the operating and economic burden on the ASL. After extending the IT support to all the hospitals of the ASL, the wards will be provided with an easy accessible product inventory, divided by categories, and a daily loading / unloading procedure with indication of actual stock levels.

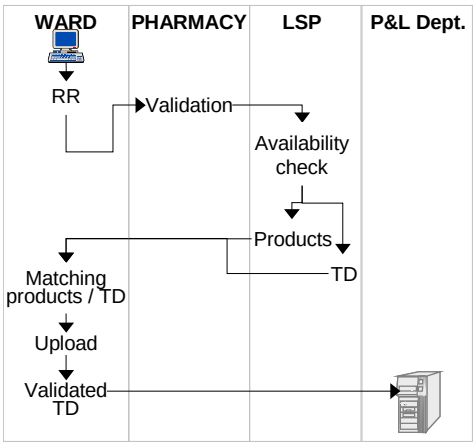


Fig. 1. Replenishment request internal flow.

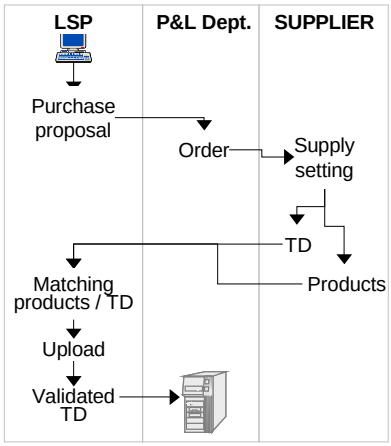


Fig. 2. Supply order flow.

The process is activated by a ward need (see Fig. 1). Every day the hospital ward – in its healthcare duty – unloads the consumed goods from its inventory and issues a replenishment request (RR) when some good is beyond its minimum stock level. The RR of medical devices or supply office goods, through a software application linked to the hospital management information system, is sent to the LSP periodically (once or twice a week) by the ward sister, after validation by the hospital pharmacy. The LSP, if the good is available, replenishes the requesting ward inventory from its warehouse by sending the good together with electronic and paper transport docu-

[7] The invitation procedure is based on a supplier database; catalogued by technical specifications; the e-mail communication provides benefits already in the first phase, by reducing the invitation times by 50% (15 days vs. 30 in the traditional procedure).

ments (TD). The ward sister checks the conformity – in quality and quantity – of the received good with the TD and loads its electronic inventory. In this way, the P&L Dept. is informed centrally in real time about the stock levels of both the LSP and of the individual wards.

The LSP is the sole procurement intermediary, but it cannot make any decision for new supplies, on behalf of the ASL, when a good is not available in its warehouse. The ASL outsources the management of central inventory and delegates the unloading of ward inventories, but does not externalize the purchasing function, which for obvious reasons remains exclusively in its hands. In case of stock-outs, the LSP sends a purchase order proposal to the ASL:

- when the goods are part of a still open supply agreement, after the validation by the P&L Dept., the order is sent to the awarded supplier (see Fig. 2), which sends the goods and related TD to the LSP, which will load its electronic inventory;
- when the supply agreement is closed (o for new goods), the P&L Dept. can decide to open a new (traditional or on-line) tender, at the end of which the illustrated route between awarded supplier and LSP is activated.

After the pilot experiment at Civita Castellana, the ASL of Viterbo planned a full roll-out of the system. With the technical support of Consip, the ASL is thus modeling a solution (centralization and outsourcing of the warehouse function) which might be extended to other ASL's. The initiative supports the thesis that savings in healthcare should be pursued through the IT support of the procurement processes of the wards and a profound review and integration of the logistics management [7].

4.5 Operating room e-procurement

The traditional planning of operating room provisioning is performed by hospital responsible and pharmacists, who manage the hospital inventories by periodically sending types and quantity estimates of goods to be purchased to the Purchasing Department, according to past consumption and future consumption forecast. This management approach, based on assumptions, generates problems in purchase planning when the hospital wards are not provided with adequate IT supports: the pharmacist unloads the goods allocated to a ward from the inventory, as if it were consumed at once; the good might remain instead unused in the ward for an unpredictable period of time, with no indication to the pharmacist and, least of all, to the Purchasing Department.

The pilot experience of "operating room e-procurement" has been carried out since 2001 at the hospital of Civita Castellana. The operating and technical staff of the General Surgery Department was directly involved in rethinking and redesigning the SMD procurement process from scratch. The model conceived is based on:

- a novel approach to provide the SMD's to the operating room, based on the type of surgical operation performed (actual data immediately available), and no longer on the SMD stock level that requires a huge administrative work;
- the definition of surgical protocols (SP) which indicate the type and quantity of the medical devices needed for each type of operation and allow to determine, after it has been performed, the quantities actually consumed to be reordered;
- the contractual allocation – with innovative paying terms – of the products supply and management to a single player.

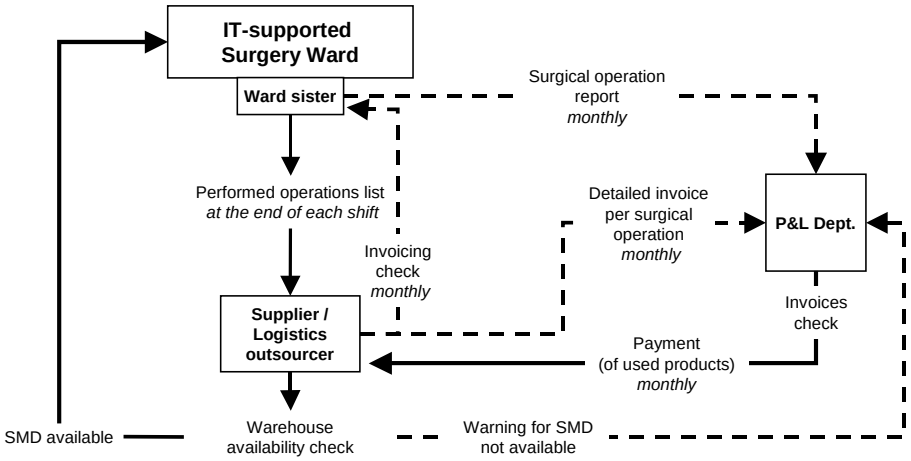


Fig. 3. Flow diagram of Operating room e-procurement process.

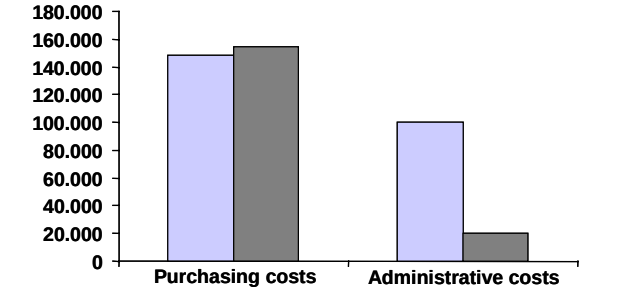
The new procurement process (see Fig. 3) is supported by a shared application platform. At the end of each shift, the ward sister sends the list of the operations performed to the supplier. The supplier, according to the product quantities indicated by the corresponding SP's, knows product consumptions in real time and can thus replenish them. The goods are delivered directly to the ward which requested them and thus covers actual needs, with no intermediate steps, cost / time increase or stock-out risks.

The process ends monthly when the supplier, after a quick cross-check with the ward sister, issues a detailed invoice per surgical operation, which allows the P&L Dept. to activate the payment after a brief check and at the same time provides data for an effective periodical comparative analysis of ward needs.

The analysis performed at the end of the first semester of experimentation indicated that, to reduce spending, it is necessary to consider the whole supply cost and not only the purchase price, on which the procedure was focused before, in order to negotiate the lowest one.

Actually, the economic advantages were mostly concentrated in the administrative costs, which decreased from 100 €k per semester to only 20 (see Fig. 4).On the contrary, the purchase price of the operating room devices slightly increased (by 4%, due to their increase in market price); this witnesses that the project was aimed at not sacrificing the quality of supply at all[8]. With savings on the *total* final cost of the SMD supply of more than 73 €k per semester (30% less than the traditional approach), the experimentation of the ASL of Viterbo demonstrated that the e-procurement per surgical operation can provide substantial cost savings, not to be pursued by reducing the purchase costs (in order not to dangerously penalize the supply quality) but by redesigning the procurement process and thus reducing the administrative costs.

[8] Particular attention was dedicated to both the supply range (purchased products increased from 92 to 141) and quality (by ordering the best products available on the market).



Approach	TRADITIONAL	INNOVATIVE	Difference	Diff. %
Purchasing costs	148.678,03	154.767,01	-6.088,98	-4,1
Administrative costs	99.927,29	20.232,60	79.694,69	79,8
Total	**248.605,32**	**174.999,61**	**73.605,71**	**29,6**

Fig. 4. Comparison between traditional and innovative procedure in Operating room e-procurement (1st semester 2001).

It may be of interest to examine the savings breakdown among the various cost items:

– 42% of savings came from reducing the fixed and financial inventory costs[9], by outsourcing logistics and shifting the payment terms after consumption. Stock-related costs were eliminated, as well as the losses from obsolete products; savings were then widened by end-of-the-month payments, after the goods were used;
– 26% of savings came from reducing personnel costs (of Hospital Pharmacy and Operating Room), for the fraction linked to inventory management[10], by outsourcing these activities to the LSP;
– 24% of savings came from reducing the administrative cost for purchasing and supply monitoring, by unifying sets of diverse medical devices into SP kits (instead of using a separate procedure for each type of device) and by being provided with detailed information directly, from the invoices per surgical operations;
— 8% of savings came from reduced order management and invoicing costs.

The objective of the experimentation was to verify the operating-economic impact that a specific supply system, based on on-line methodologies and provisioning *per surgical operation*, would provide vis-à-vis the traditional procedure [6]. According to the positive economic results achieved, together with a high level of healthcare performance (due to the reduction of stock-out risk in the hospital inventories), the ASL of Viterbo is now (end of 2004) opening a tender for the supply – through e-procurement – of the operating room specific devices for all the hospitals of the ASL. At the end of the project all the hospital wards will be provided with IT supports to directly perform the management of MD's (through e-logistics) and the procurement

[9] As regards the pharmacy and the operating room inventories were measured: the *management cost per squared meter* of inventory premises; the *financial costs of the capital locked into stocks* (according to industry statistics, they were estimated at about 8% of average stock value) and the *cost of obsolete products* (estimated at 0,05% of purchases).

[10] For comparison, personnel costs incurred for the following activities were considered: Book-keeping; Product replenishment; Incoming goods inspection; Order / delivery expediting.

functions for SMD's (through the operating room e-procurement).

5 Conclusions

From the composite experience of the ASL of Viterbo, regarding the healthcare e-procurement, the following considerations can be derived or confirmed:

- healthcare structures (ASL and AO) provide critical and specialized services (vs. the rest of PA). The goods and services they need are frequently very specific and can have an impact on the service quality. Therefore, cost reductions should not be pursued on purchase prices [12], but on the whole procurement, logistics and administrative cycle;
- the goods and services needed are very diverse in terms of purchased quantities / number of suppliers, technical characteristics and peculiarities. Therefore, the e-procurement solutions must be segmented to properly respond to this variety;
- in order to obtain valid results when introducing e-procurement practices, a comprehensive perspective of the problem is needed, from which to proceed in order to design brand new purchase, logistics and administration processes and to integrate the various technical solutions available;
- for the most specific supplies it is paramount to involve wards doctors and technicians, as experts in the design phase and primary players of the redesigned process, since they only can define protocols and device characteristics on which depend the healthcare performances they are responsible of;
- on the technical level, it is necessary to provide a shared IT platform, linking the administrative offices, wards and external providers (when needed);
- a sound e-procurement introduction can provide significant savings for *common*, *common-but-differentiated*, and *healthcare-specific* spending items*;* as regards the last one (more than 50% of total), savings are mostly linked to administrative and financial costs [7].

The personnel seemed to positively participate in new e-procurement process. The main risk for a full implementation are therefore linked to the outsourcing of the logistics function (the core of the change) and could be minimized with the usual precautions used to grant a global service assignment (precise tender, accurate supplier selection, well defined contract terms, continuous performance monitoring).

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