Collaborative purchasing in healthcare system

Chiara Gobbi (Email: cg.om@cbs.dk)
Copenhagen Business School, Dept. of Operations Management, Solbjerg Plads 3, DK-2000 Frederiksberg, Denmark,

Juliana Hsuan
Copenhagen Business School, Dept. of Operations Management, Solbjerg Plads 3, DK-2000 Frederiksberg, Denmark

Abstract

The paper represents an exploratory study aimed at developing a theoretical framework that supports the elaboration of efficient collaborative purchasing (CP) strategies in the healthcare system. We identify prerequisites for developing an efficient CP approach in the healthcare system. A case study of Danish National Healthcare system is presented. The case indicates that trust and stakeholders' commitment are key elements for successful CP initiatives. Moreover, simplifying procedures for collaborative sourcing and service management is crucial in sourcing of complex medical equipment.

Keywords: Collaborative purchasing, Healthcare, Technology sourcing and service.

Introduction

Collaborative Purchasing (CP) is an arrangement where two or more independent organizations join together, either formally, informally or through an independent third party, in order to combine individual requirements for purchased materials, services and capital goods. The purpose of CP is to gain higher value of added pricing, service and technology from external suppliers than it could be obtained if each organization purchased goods and services alone (Hendrick, 1997). CP aggregates and consolidates activities among various stakeholders in order to gain synergistic effects in the supply chain. Although it is recognized that research in CP is rather limited (Bakker et al., 2009), an increasing interest in CP arrangements has been proven in the public sector since strategies that promote grouping purchasing solutions can improve efficiency, therefore providing consistent savings in public organizations' budgets (Mazzola and Perrone, 2009). The issue becomes particularly relevant in the healthcare sector, where the public spending is constantly increasing and represents a significant part of the GDP of many European countries, especially in a period characterized by weak economic conditions. The purpose of the paper is to elaborate a theoretical framework that can support national/regional authorities in framing CP strategies in the healthcare sector with the goal of rationalizing the public healthcare expenditure without deteriorating the healthcare services provided to the citizens.

Most of the literature focuses on the CP of services and commodities. As pointed out by Rozemeijer (2000), there are very little publications that illustrate how certain practices are implemented or under which conditions a certain condition will be successful. In this paper, we attempt to address this gap. More specifically, we would

like to gain a better understanding about the role of CP on procurement of complex technologies. This paper focuses on technology sourcing in healthcare systems, mainly from the perspective of collaborative purchasing. The study has been conducted in order to identify the key elements for efficient collaborative sourcing of complex medical equipment, where many different stakeholders are involved but the specific knowledge of the technology to purchase and utilize is only in one of the involved stakeholders (hospitals) and requirements vary from hospital to hospital. The main research questions are: What are the mechanisms for success CP? Why is it so challenging to manage CP? How can healthcare systems ease the tendering of complex technologies?

Literature Review

Technology sourcing

There is an extensive literature in supply chain management on supplier-buyer purchasing and collaboration (e.g., Squire et al., 2009; Spekman and Carraway, 2006; Dubois and Pedersen, 2002; Olen and Ellram, 1997; Cousins, 2002). A firm's decision on its sourcing strategy is typically based on its current supplier base and the criticality of the technology in terms of innovation and asset specificity. Sourcing strategies basically vary from multiple to single. Multiple sourcing means that the buyer has many sources for the purchasing of components. The supplier base is also extensive, where the suppliers are encouraged to compete with each other, often on price. The buyer, then, can drive the price down by competitive tendering. Multiple sourcing strategies also allow the buyer to switch sources in case of supply failure as well as to tap into wide sources of knowledge and expertise. However, it might become more difficult to encourage commitment from suppliers. Suppliers are also less willing to invest in new technologies and processes.

In order to reduce the risks related to multiple sourcing, firms tend to reduce the number of suppliers, and often into single sourcing. Single sourcing means that the buyer relies on one source for the supply of a component. The relationship shared between the partners strives for partnership. Price is not necessarily the most important criteria. The product or service sourced tends to be complex and specialized. Single sourcing also has its disadvantages. The buyer might be more vulnerable to disruption if a failure to supply occurs. This happens, for instance, when the supplier files for bankruptcy and has no means to fulfill the contract. Too much dependency on a particular supplier also makes the firm vulnerable to price demands (Slack et al., 2004).

When sourcing complex technologies, especially in the service industries, there are two closely interlinked elements that firms should consider: product platform/modularity and service operations management (Figure 1). Together they define how a service system can be best organized and configured to deliver the desired service for the customers.

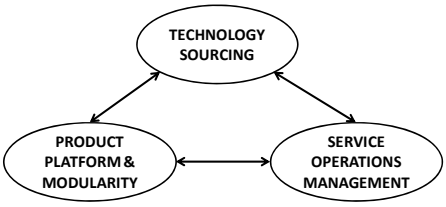

Figure 1. Key decisions in technology sourcing for service systems.

Product platform and modularity

Studies have shown that technology sourcing is closely related to product platform strategies (Mikkola, 2003; Mikkola and Skjøtt-Larsen, 2006). Product platform is (Meyer and Lehnerd, 1997, p. vii) "a set of subsystems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced." It encompasses the design and components shared by a set of products. A robust platform is the heart of a successful product family, serving as the foundation for a series of closely related products (Meyer and Utterback, 1993). Platforms enable the integration of the core technologies and processes in order to provide product variety and customization required by the customers. How platform is planned and configured, in terms of technology composition contained in the subsystems and respective interfaces linking these subsystems, has significant impact on tradeoffs between the degree of standardization and customization offered to the customers. The process of standardization is referred to as modularization. Modularization permits components to be produced separately and used interchangeably in different product configurations without compromising system integrity. It intentionally creates a high degree of independence between component designs by standardizing component interface specifications.

Service operations management

Recently, the notion of modularity is getting increasing attention in the services operations management. Voss and Hsuan (2009) illuminates on why understanding of the nature of service architecture and modularity is crucial to service design and innovation. There are three areas that can contribute to the competitiveness of a service system: the possession of unique service modules that are not easily copied by the competitors in the short term; the ability to exploit these through replication across multiple services and/or sites; and, the presence of a degree of modularity, which in turn supports both customization and rapid new product development. In their study of the Dutch healthcare for the elderly, De Blok et al. (2010) describe how modularity can be extended to investigate service systems, as to how different modules can be mixed and matched to provide the desired care service of individual patients.

Collaborative purchasing (CP) in healthcare systems

When sourcing for complex technologies, selection of suppliers becomes crucial. Most of the medical technologies used in hospitals, such as MRI (magnetic resonance imaging), CT (computed tomography), PET (position emission tomography) and SPETS (single photon emission computed tomography) are extremely expensive have long product life cycles (as long as 10-15 year). No single public institution has the capital or knowledge to purchase these technologies alone. It is a common practice, that in order to save costs, healthcare institutions seek partnership with other institutions or stakeholders. Hence, one of the tasks of CP is to procure the best technology/product platform that would satisfy the infrastructure and policies of the national healthcare system. We define CP as an arrangement where two or more independent organizations join together, either formally, informally or through an independent third party, in order to combine individual requirements for purchased materials, services and capital goods. CP is also referred to as 'cooperative purchasing' (Rozemeijer, 2000), 'consortium purchasing' or 'purchasing consortium' (Hendrick, 1997; Macie, 1996), 'consortium sourcing' (Essig, 2000), and 'group purchasing' (Essig, 2000).

According to Rozemeijer (2000) the driver behind these partnerships is to create business synergies. He mentions six forms: 1) Pooled negotiation power; 2) Sharing

intangible resources, such as knowledge and information; 3) Shared tangible resources; 4) Vertical integration; 5) Coordinated strategies; and, 6) Combined business creation.

The most cited motivation behind CP is cost savings. CP also provides better information exchange and supports risk sharing among the stakeholders. However, CP incurs high coordination costs as a result of standardizing processes, and many stakeholders may end up losing their financial control of their investments. Table 1 lists some advantages and disadvantages of CP (Nollet and Beaulieu, 2003; Rozemeijer, 2000; Johnson, 2000; Hendrick, 1997).

Table 1. Advantages and disadvantages of collaborative purchasing.

Advantages of CP	**Disadvantages of CP**
• Cost savings • Better internal exchange of information • Improved market negotiation strategy • More impact on monopolistic supply markets • Improved insight in market cost structure • Ability of attract new suppliers • Support organizations of staff • Provide suppliers with resources and management capabilities • Potential violations of anti-trust laws are avoided • Access to confidential and proprietary information • Risk sharing among the stakeholders • High degree of trust and professionalism among stakeholders	• High coordination costs • Uncertainty with cost savings • Uncertainty with customer service implementation • Difficulties in compliance of unique specifications • Great effort to facilitate standardization of products and services • Loss of financial control • Free riding • Declining effect of cost savings • Diminishing opportunities for improvement • Government agencies might induce sellers to practice anti-competitive price discrimination • Disclosure of sensitive and competitive confidential information • Strong suppliers might resist participation

Research Methodology

Our current study is exploratory aimed at developing a theoretical framework that supports the elaboration of efficient CP strategies in the healthcare system. We apply case study as a research methodology. Case studies can be used for (Voss 2009): exploration, theory building, theory testing, and theory extension/refinement. As many strategic implications of sourcing of complex technologies with respect to purchasing decisions in the healthcare systems are not very well covered in the literature, our paper seeks to explore the questions of *why*, *what* and *how* in the collaborative purchasing process of the Danish healthcare system.

The research design of our investigation is structured in the following way. We started with an extensive literature review on supplier-buyer purchasing and collaboration from two streams of literatures: supply chain management/OM and healthcare. We identified prerequisites for developing an efficient CP approach for sourcing of complex medical technologies. Empirically, a case study on the tendering and largest purchase of medical equipment in Danish National Healthcare system is conducted.

Semi-structured and structured interviews have been carried out with healthcare practitioners and managers in order to identify the prerequisites, pro and cons of using CP on the basis of their experience. All interviews have been performed following an interview guide, which has been only slightly modified according to the type of interviewed actor. The interviews were transcribed and coded. Table 2 lists the names and positions of the interviewees, duration of the interviews, and areas of expertise.

Table 2. Overview of conducted interviews.

Interviewee	Duration	Area of Expertise
Michel Strauss, Regional Sales Manager Siemens Healthcare	2.5 hr	Responsible for medical equipment business in Scandinavian Countries
Carsten Hinsch, Finance Manager Siemens Healthcare	1.0 hr	Head of Siemens Healthcare, Denmark
Olaf B. Paulson, Professor at Copenhagen University, Head of the Magnetic Resonance Center, Hvidovre Hospital	1.5 hr	One of the most eminent neuroscientists in Scandinavia
Markus Nowak Lonsdale, Physicist Dept. of Clinical Physiology and Nuclear Medicine, Bispebjerg Hospital	1.5 hr	Expert on MRI, CT, PET and SPECT scanning
Karsten Vrangbæk, Director of Research Danish Institute of Governmental Research	1.0 hr	Expert on Nordic Health Systems

Case: The Danish healthcare system and the national tender

The Danish healthcare system has been reorganized after the reform that took place in Denmark in 2007, reducing the number of the regions from 15 to 5. The main objective was to gain from economies of scale and increase the quality of the services provided to the citizens. While the national government is responsible for setting the general framework, most of the planning and monitoring tasks are at the regional level. Regions also have the responsibility for all the curative services from hospitals, clinics, and general practitioners. Municipalities are responsible for rehabilitation, prevention, and health promotion. The main goal is to have the hospitals specialize in the diagnosis and treatment of different diseases, and standardize service packages offered to the patients on the type and acuteness of the diagnosed disease.

How the healthcare system is financed is strongly related to how the national government allocates resources. The Danish taxation system imposes that taxes are collected centrally by the national taxation authority. A part of the taxes is transferred to the regions as block grants or activity based funding. Yearly, the hospitals have to submit budgets to the regions. The regional budgets have to be approved at the national level before the funds are allocated to the hospitals. For the hospitals, the main cost incurred is related to personnel followed by pharmaceuticals and medical equipment. Although CP is largely applied for the purchasing of generic pharmaceuticals, in this paper we concentrate on the national tender of medical equipment.

The purchase of medical equipment

The purchasing process for medical equipment is very specific. Hospitals have to gather their internal needs for new equipment (either to increase the diagnosis capacity or to replace old equipment). Although most of the purchasing decisions take place at the regional level, equipment in excess of one billion DKK (154 million Euros) has to be coordinated across regions and at the national level. The information and fund allocation flows are illustrated in Figure 2.

1. Hospital departments express their needs for new medical equipment to the central hospital administration.
2. The central hospital administration reports the needs to the purchasing group in the region. Each region has around 20 purchasing consultants that coordinate, monitor, and evaluate the needs of the hospitals.
3. The regions report the request for new equipment to the national government that has the final say for approval.

Once the equipment purchase is approved, the hospitals receive the funds and directly sign the contract with the vendor. CP only takes place when different purchases are combined between hospitals and/or regions, through regional and national tenders.

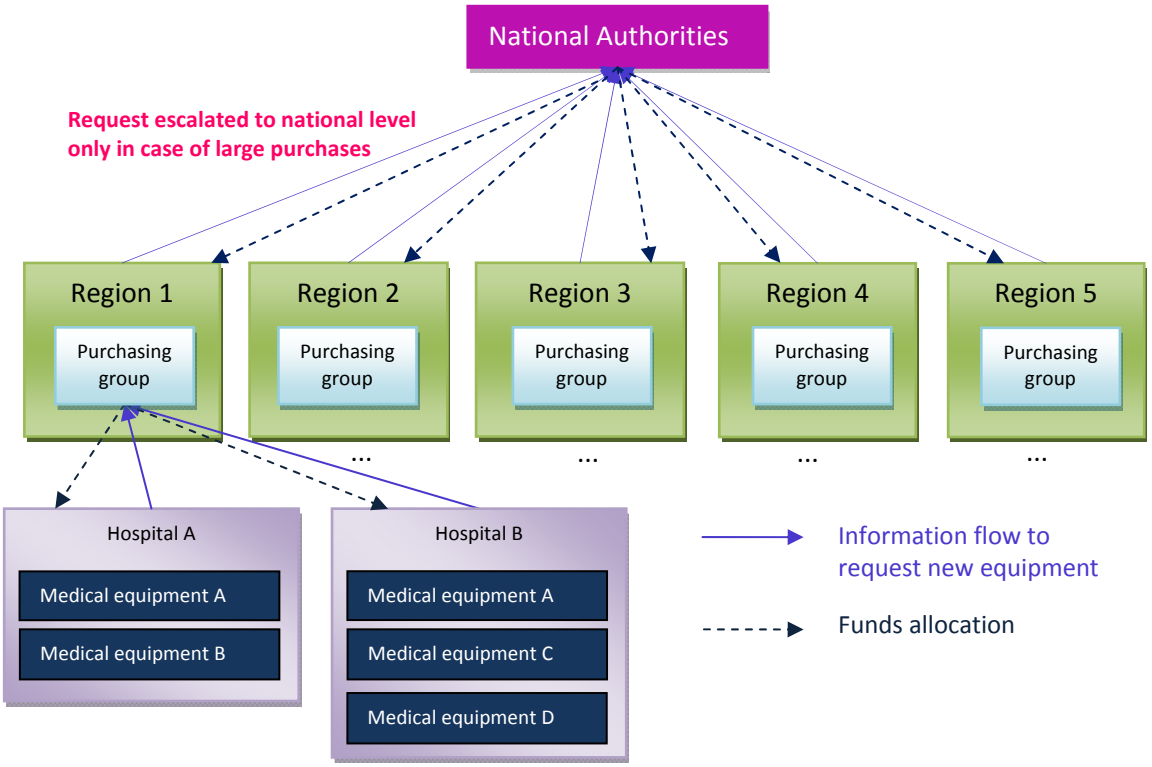

Figure 2. The request for new medical equipment and funds allocation

The case of the national tender for MRI, CT, PET and SPECT scanners

In May 2008 Denmark issued the first national tender for acquiring MRI, CT, PET and SPECT scanners. Due to budget restrictions, the tender was divided in two phases: 2008 and 2009. The tender was organized by the regional administrations in coordination with the national government, and planned according to four different modalities (Table 3). Region 1 (Capital region) acted as the leading region for the all tender.

Table 3. Distribution of modalities within regions

		Group size
Region 1 (Capital region)	MRI scanners	80
Region 2	CT scanners	100
Region 3	PET scanners	40
Region 4 and 5	SPECT scanners	40

Each region invited users (e.g., medical doctors, physicists, physicians, clinical radiologists, etc.) and decision makers (e.g., politicians and purchase consultants) to participate in the evaluation. Each group had to collect the demand for its specific modality from all hospitals. One of the main tasks was to write the technical specifications, within approximately 3 months. In order to make the tender a success and simplify the evaluation process of the vendors' offers, the specifications had to be standardized as much as possible. The price of the equipment in relation to quantity and vendors awarded is listed in Table 4. Some purchases in 2008 were postponed to 2009. From the vendors' side, they had to reply to the offer, present the offers, and arrange for site visits. They were also asked to give a price for maintenance over a certain time

frame and different service levels. After receiving the offer, the final installation and testing took place during the summer 2009.

Table 4. Average price per machine typology, quantity purchases and vendors involved

	Average price (millions Euros)	**Quantity purchased in 2008**	**Vendors that won the tender**
MRI	1.5	17	Siemens
CT	0.8	14	Philips and GE
PET	1.4	3 (option for 10 more)	Siemens, Philips and GE
SPECT	0.7	4 (option for 12 more)	Siemens, Philips and GE
TOTAL (2008)	**43.7**	**38**	
		Quantity purchased in 2009	
MRI	1.5	5	Siemens and Philips
CT	0.8	1	Philips
PET	1.4	3	Siemens, Philips and GE
SPECT	0.7	3	Siemens, Philips and GE
TOTAL (2009)	**14.6**	**12**	
TOTAL	**58.3**	**50**	

Implications for technology sourcing

The complex technology embedded in the equipments determines a high level of complexity in the sourcing process. Even if the hospitals were invited to create pools inside the groups according to similarities in the use of the machine and required features, the specification process was very complicated and not very successful. Creating pools and elaborating specifications for common standard equipment was the main idea of the national tender issued in order to achieve better service and price conditions from the vendors by avoiding the splitting of equipment purchases over several vendors. Unfortunately, hospitals could not find easily an agreement on one single vendor for many different reasons. Hospitals can have many motivations to prefer one vendor over the others:

1. They know the vendor from previous purchases and they have a preferred relationship with the sales representatives.
2. They already have equipments installed from a certain vendor and they do not want to shift to another one. This is maybe the strongest reason why hospital departments are very reluctant to shift to a different vendor. In effect, the switching costs for training personnel to get use to a different interface and to make installed ICT system communicating with a different machine brand can be very high. Only training personnel can take up to 6 months. Vendors are quite equivalent in terms of technology offered but they do not provide common interfaces.
3. They want a technology that only one vendor can provide.

In order to be sure that all hospitals got in the specifications what they required, the final specification documents included more than 1000 pages for modality and only for the MRI modality, 64 different combinations of modules. Another major problem was that the groups were far too large and everybody wanted to have a say in the specifications.

Implications for service operation management

The complex technology embedded in the machines requires regular service in order to guarantee proper functioning. Complexity is related to software and hardware. Both need regular maintenance; in particular, software uploading is executed regularly for bug fixing and to add functionalities. Maintenance costs are usually included in the

equipment price at least during the warranty period; afterwards the hospitals can sign maintenance contract with the vendor in order to have full or partial coverage. Vendors offer different service packages with different levels of coverage (spare parts, field engineers' intervention, software upgrades). Some hospitals have their own technicians that can provide first line service and gave remote access to the vendor, which means that maintenance costs can be significantly reduced. Remote access allows the vendor to control, monitor, perform software upgrade and in some cases, errors fixing without the direct intervention of field service engineers. Machines are provided with automatic diagnosis systems which can facilitate maintenance and error fixing. Automatic diagnosis systems can indicate in which part of the machine the error occurred, error type and the kind of intervention needed. These systems can also detect the status of some critical parts of the machine and suggest preventative maintenance before the error occurs. The breakdowns of this kind of equipments are very costly both for capital allowances and for lost service to patients. In order to minimize time breakdowns, vendors have developed very reactive logistics systems capable of providing spare parts and error fixing within 24 hours. Since parts replacement is crucial to keep the machine alive along the entire life cycle (on average 10 years), vendors usually guarantee to keep spare parts for 10 years after the production of a certain machine stops.

These machines need to work in open systems, be connected to the ICT system of the hospital departments, and to communicate with other devices to perform the examination and data elaboration. Machine installation and testing then becomes crucial to assure that the equipment can work properly in conjunction with the surrounding infrastructure.

Implications for product platform and modularity

CP is mainly applied in the logic of bundling different purchases in order to acquire a better position in the marketplace and therefore gains benefits related to economies of scale. However many different issues have to be taken into account: the level of commitment of the different stakeholders, the costs of issuing a tender and evaluate the offers, the level of satisfaction of the ultimate users of the purchased good, how to redeem contrasts and opposing interests, how to select the appropriate experts to evaluate the offers. Many of these issues emerge clearly in the case presented as well as others related to the specificity of the medical equipments, characterized by a high level of complexity in relation to the embedded technology and modality of use, with a low purchasing frequency and a long life cycle.

Regardless of the vendors, all four types of scanners are built with the principles of modularity: optional modules can be added to the basic equipment in order to add features and functionalities. Modularity allows planning an upgrading path that the machine can go through during its life cycle in order to maintain performances unchanged at least for three quarters of the life cycle. The upgrading path involves substituting hardware and software. Modularity is fundamental to avoid that evolution in technology makes these machines obsolete. It can also be seen as an enabling factor, since process specifications could be simplified by having the hospitals finding an agreement on a basic product which can be enhanced in terms of features and functionalities by adding modules.

Discussion

Of course combining purchases in one tender and make use of the CP concept give to the buyer a stronger negotiation power towards the vendors. However, in order to make the tender a success, it is necessary to balance the needs and interests of all the

stakeholders involved in the process. Furthermore, in order to avoid extra costs of customizing the equipment at a later stage, the specification process has to be precise and as standardized as possible with the use of the modularity concept. This ensures that the tender can include the basic equipment and the extra modules required to comply with the specific hospitals' needs. Simplification through modularity gives advantages to both vendors and buyers: vendors can easily identify the hospitals' needs and elaborate a proper offer in a short time; and buyers can have a much easier evaluation process to decide which offer to accept.

In general, specialists from hospitals valued the tender as a good tool to negotiate with the vendors, but most complained that the process of creating pools was enforced by the regions with no explanation. However, they valued positively the experience of elaborating and writing the specifications with knowledgeable colleagues. Some authors claim that the administrative costs of applying CP can ruin the benefits of having better prices and service conditions from the vendors. On the other hand, there are learning affects that, over time, reduce costs, as happened with the second tender issued in 2009 for CT scanners. All in all, the case study shows that the overall process can gain strong benefits when all stakeholders have a common understanding of the advantages of combining purchases.

Conclusion

CP has direct implications for policy makers and managers in the health care system. We took a closer look at the procurement/purchasing practices that can potentially reduce costs. Procurement represents a considerable part of the total healthcare expenditure, therefore reducing procurement costs can release resources to guarantee or even improve the quality of the healthcare services provided to patients. In addition, CP forces different healthcare organizations to improve collaboration and information sharing, hence to "learn from the best in class".

Our exploratory study of the first national tender issued in Denmark in 2008 for the acquisition of large scale medical equipment describes the strategic and critical issues related to CP. It also provides insights to validate the advantages and disadvantages of CP presented in the literature. We finally identify some key issues for collaborative purchasing (CP) as a viable option to provide savings, promote transparency and simplification: 1) develop mutual trust and reach consensus agreement; 2) apply the principles of modularity on technology sourcing; 3) aim to simplicity both in the specification process and the evaluation process; and, 4) promote communication between the different stakeholders.

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