

## **Collaborative e-Purchasing for Hospitals: IT for Addressing Collaborative Purchasing Impediments**

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### **Abstract**

*The benefits of collaborative purchasing are many, yet in the healthcare sector, in particular at hospitals, it is still uncommon. In this paper we identify major impediments for collaborative purchasing, resulting in a first component of our proposed collaborative e-purchasing model for hospitals; as a second component it contains a collaborative purchasing typology. After analysis of a first validation round with hospital purchasing professionals, the results show four applicable purchasing types and fourteen collaborative purchasing impediments that are perceived as important for hospitals. The model is further extended by possible IT solutions, identified by experts, addressing the specific fourteen impediments. We conclude that the collaborative e-purchasing model can be used by healthcare consortia, branche organizations, partnering healthcare institutes and multi-site healthcare institutes as a means to help identifying strategies to initiate, manage and evaluate collaborative purchasing practices.*

**Keywords:** E-procurement, Collaborative purchasing, Purchasing

### **1 Introduction**

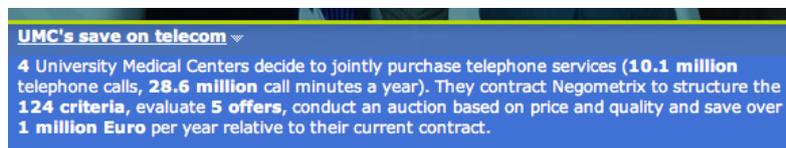
The hospital purchasing environment is highly dynamic. This is reflected in the considerable media attention given to growing healthcare costs and the associated ongoing professionalization of the procurement function (Llewellyn, Eden & Lay, 1999; Puschmann et al., 2005). The consequences of an aging population and the associated healthcare costs are a popular topic of discussion. In the Netherlands for example, healthcare costs per capita have already increased 21.7 percent just over the last four years; the Dutch Ministry of Health, Welfare and Sport (VWS) has calculated that the costs will continue to grow in the years leading up to the aging peak of the 'baby boomer' generation in 2040 (VWS, 2007). This expectation of rising costs combined with the knowledge that a hospital's strategy should be based on maximizing service

quality against cost efficiency (Porter & Olmsted Teisberg, 2006) puts more and more pressure on the procurement function of a hospital.

During the last decades much research has been dedicated to procurement. Various authors like Beall et al. (2003), Ellram and Carr (1994), Morlacchi and Harland (2000), Chadwick and Rajagopal, (1995), and Spekman, Kamauff and Salmond (1994), contributed to the field of electronic procurement and auctions, with a special emphasis on benefits and structure. A relatively new area of study examines the potential for group buying (collaborative purchasing) to contribute to the purchasing function. Collaborative purchasing is the act of multiple firms procuring products and services from a supplier, in cooperation and often as a consortium.

Cooperation in the procurement domain is not new. Decades ago researchers already investigated purchasing collaborations, mainly focusing on the field of vertical relationships between buyer and supplier (Patterson, Forker & Hanna, 1999); focus was on price reductions and improvement of the activities executed within the purchasing department (Ribbers, 1980). This agenda has shifted since the beginning of the 1980's to a more strategic, long-term view with a focus on the purchasing function as a cross-functional chain of purchasing activities (Hahn & Kaufmann, 1999). Since then, many researchers have examined the issues related to the increased strategic importance of the purchasing function and the corresponding shift from the department purchasing view towards a more integrated and strategic function view (Rozemeijer, 2000).

Compared to vertical buyer–seller cooperation, horizontal buyer–buyer cooperation has not been a major research area until recently (Ellram, 1991; Essig, 2000; Nollet & Beaulieu, 2005). Also in practice collaborative purchasing has gained increasing attention and adoption lately. In the early 2000's, major automotive and aerospace firms embarked on collaborative purchasing platforms like Covisint ([www.covisint.com](http://www.covisint.com)) and Exostar ([www.exostar.com](http://www.exostar.com)), and these platforms continue to extend their services. Another example of a particularly successful case comes from four Dutch University Medical Centers (UMC's) that decided to collaboratively purchase all their telecommunication costs (10,1 million phone calls, 28,6 million minutes a year). They asked Negometrix (a consultancy firm specialized in reverse auctioning and procurement solutions) to advise their purchasing departments on how to select, structure and execute this e-purchasing project. In the end this resulted in an overall savings of €1 million euro per year based on existing agreements. See the snapshot retrieved from the Negometrix website on February 15<sup>th</sup>, 2011, in figure 1.



**Figure 1:** Example of savings through collaborative purchasing

Despite literature and practical cases showing that collaborative purchasing provides major advantages such as economies of scale, stronger negotiation position, lower transaction costs, lower supplier risks, and more overall efficiency, in our opinion collaborative purchasing has not been leveraged to its full potential in the healthcare sector in general, and by hospitals in particular. Referring again to the Dutch situation, only a small percentage of hospital purchases are made collaboratively (NVZ, 2009; RVZ, 2008). The Netherlands has 89 hospitals, some of them with multiple offices, but

only a few are really active in collaborative purchasing initiatives (NVZ, 2009). It is for this reason that our research focuses on the healthcare sector.

Additionally, from an IS/IT perspective new approaches and principles such as 'software as a service' (SaaS) and Web 2.0 (O'Reilly, 2007) provide new opportunities for business partner cooperation and the associated communication (e.g. Emaus et al., 2010). The aforementioned elaborations lead us to our research question, namely:

*What are the main impediments of collaborative purchasing among hospitals and how can IT help in addressing them?*

Although Schotanus and Telgen (2007) performed research on impediments within the procurement domain, it was not made specific for the healthcare sector; nor did he include IT in his research. Additionally, Ball and Pye (2000), and Pye and Ball (1999) performed research to identify success and adoption factors of collaborative purchasing but did that in general for the public sector, and yet again without including IT principles. Other authors identified research potential in the field of collaborative purchasing with IT. Tella and Virolainen (2005), and Huber, Sweeney and Smyth (2004) conclude that more academic work needs to be carried out with regards to the use of IT applications and principles to enable and support collaborative purchasing. Also Essig (2000) pointed out that there is still a lot of research to be done examining the success factors of purchasing collaborations in order to come up with practical sourcing tools to support them.

The next section identifies two dimensions relevant for a conceptual model that we develop to address our research question; 1) the collaborative purchasing impediments and 2) the collaborative purchasing types. In section 3 the results of an explanatory survey are presented as well as the framing of the final model; the survey is held in the Dutch healthcare sector (academic, non-academic, public hospitals). Subsequently, within section 4 we operationalize the model by filling out the cells of the conceptual model with IT principles and applications that are identified by another group of experts for addressing the impediment. We end this paper with a section that includes the conclusions and recommendations for future research.

## **2 Literature study**

In a first observation of literature, we found that potential impediments of collaborative purchasing are often situational; they depend on various specific characteristics of the consortium performing the actual buying. Schotanus and Telgen (2007) defined particular collaborative purchasing situations into purchasing types. They explicitly combined and validated identified variables (a- costs and gains for the consortium members, b- influence by all members on the activities of the consortium, c- number of different activities in the consortium, d- organizational structure of the consortium, e- member characteristics, f- size of the consortium, g- lifespan of the consortium) into a typology for purchasing types. They subsequently defined the following purchasing types, with associated characteristics:

1. Piggy-backing: focus on simplicity
2. Third party: focus on scale; third party with specific resources; fair allocation of gains and costs; there is a membership fee
3. Project: one-time event; focus on learning and reducing transaction costs
4. Program: focus on learning, transaction costs and standardization

5. Lead buying: activities for a project are carried out by one party; skill specialization in the consortium; members depend on each other's skills and efforts

As for the individual purchasing impediments of collaborative purchasing we conducted an extensive literature study. We conducted a literature search for relevant papers using keywords (among others: collaboration, consortium buying, collaborative purchasing). A first selection based on abstract reading produced 98 papers, including dissertations. Various scholars were found to have investigated impediments from different perspectives on collaborative purchasing, such as the life span of the group (D'Aunno & Zuckerman, 1987; Johnson, 1999), extent of the costs and size of the group (Nollet & Beaulieu, 2003). We then read through each of these 98 papers and systematically recorded all impediments to collaborative purchasing mentioned, noting the frequency with which impediments were found in the literature, and merging similar concepts together into one impediment. This yielded 34 impediments that were mentioned in anywhere from 14 to 36 papers, and ranged in their perspectives from financial related to social related. For example, "expect high coordination costs" was identified in 29 papers, including Schotanus and Telgen (2007), Huber, Sweeney and Smyth (2004), Nollet and Beaulieu (2003), Essig (2000), Bakker et al. (2008), and Puschmann and Alt (2005). For a full list of the 34 impediments see Figure 2.

### 3 Results and framing of the model

To validate our initial literature findings on the impediments we conducted a survey between February and mid-March 2010. Experienced Dutch hospital buyers and procurement managers were invited to fill out an online questionnaire. The survey consisted of three parts: a) a section with context related questions to establish the background of the respondent, b) a section with (collaborative) purchasing background questions to determine the current situation of a hospital with regards to purchasing and the group typology use, c) a section listing the 34 identified impediments to provide the perceived importance of these impediments.

Respondent participation was solicited through contacts gained from the Nederlandse Vereniging voor Ziekenhuizen (Dutch Association for Hospitals, NVZ) public database as well as through the business network of Negometrix, the previously mentioned consultancy firm specialized in reverse auctioning and procurement solutions. As table 1 depicts, 49 hospital buyers and procurement managers submitted surveys. In the final analysis, five surveys were omitted because of submission by a respondent outside the targeted population.

**Table 1:** Absolute number of respondents per position and per hospital type.

	General hospital	University Medical Center (UMC)	Other	Total
Procurement director	0	0	0	0
Supply chain manager	1	0	0	1
Purchasing manager	5	1	0	6
Senior buyer	22	11	0	33
Junior buyer	4	0	0	4
Other	0	0	5 (Omitted)	0 (5)
<b>Total</b>	<b>32</b>	<b>12</b>	<b>5 (Omitted)</b>	<b>44 (49)</b>

### 4.1 Collaborative purchasing types

A main finding of the survey was that there was much variation in the purchasing types used when purchasing collaboratively. The full breakdown can be seen in table 2. We noted that the results show differences between the UMC’s and general hospitals; yet these will not be elaborated in this paper. For now we decide to leave out program groups as a purchasing type, as no hospital could confirm a single practice of this type.

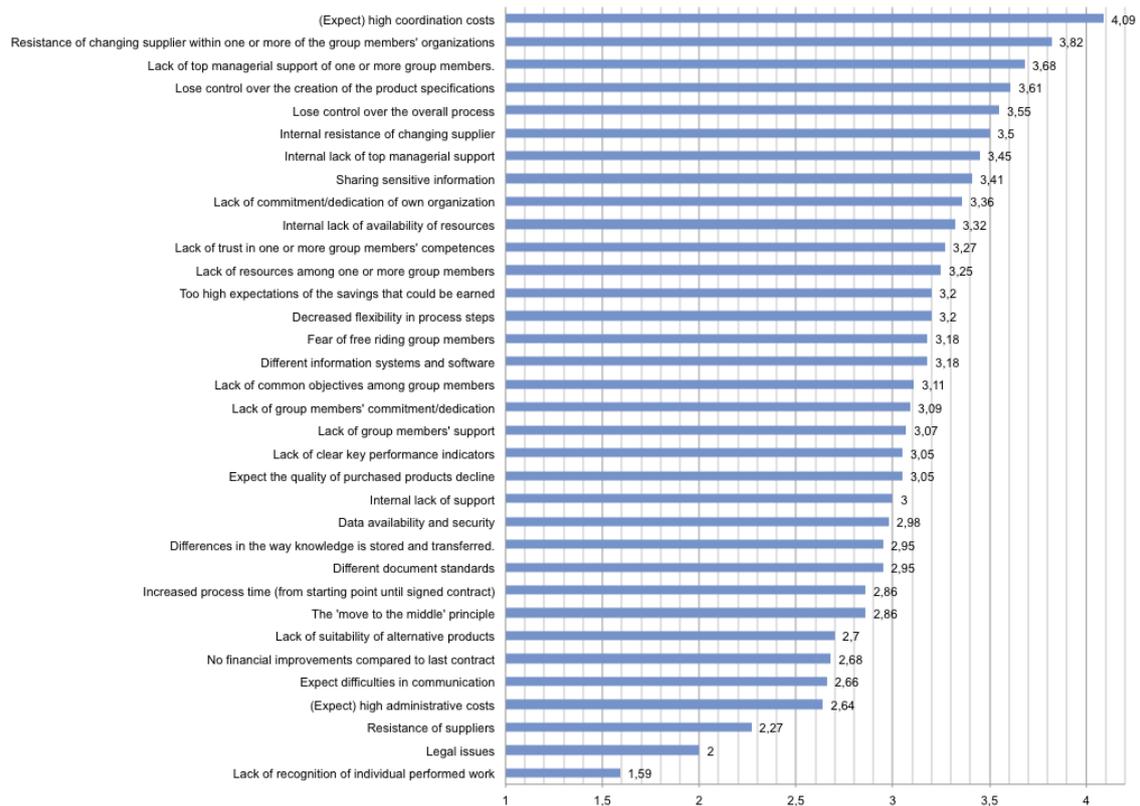
**Table 2:** Absolute numbers of performed collaborative purchasing procedures per type in 2009 (N = 44).

	General Hospitals	Relative percentage	UMC	Relative percentage	Total	Percentage
Piggy-backing groups	291	38,70%	192	44,44%	483	40,79%
Third party groups	225	29,92%	60	13,89%	285	24,07%
Lead buying groups	224	29,79%	159	36,81%	383	32,35%
Project groups	12	1,60%	21	4,86%	33	2,79%
Program groups	0	0,00%	0	0,00%	0	0,00%
<b>Total</b>	<b>752</b>	<b>100,00%</b>	<b>432</b>	<b>100,00%</b>	<b>1184</b>	<b>100,00%</b>

### 4.2 Collaborative procurement impediments

For obtaining a tangible and effective operationalization, we narrowed the 34 impediments down by eliminating those that were perceived as less critical.

In the survey, the structure of all the 34 impediment-related questions was the same, asking, based on the respondent’s knowledge and experiences in the field, to what extent respondents agree that the factor is an impediment to collaborative purchasing. The scale was a 5-points Likert ranging from "Fully disagree" to "Fully agree". The impediments were grouped for readability and user awareness reasons. The correlations between impediments in a group were not determined. Furthermore, the generalization of the impediments into one group to one variable, thereby creating the possibility of comparison on a group level, was not done. Each impediment was analyzed individually. The questions aimed to establish the perceived importance of the listed impediments. Although we have the individual data for UMC’s and general hospitals respectively, we will operationalize them together. The results are generalized in Figure 2.



**Figure 2:** The average result of each impediment (N = 44).

Figure 2 yields some initial findings. First, we see that six of the impediments were rated an average score of 3.5 or higher. Moreover, 22 impediments were on average rated equal to or higher than three indicating a range of impediments that warrant further analysis. Additionally, some other conclusions can be drawn from the lower (average) ranked impediments. For instance, the proposed impediments related to the recognition of individual performed work, the legal issues, and the possible resistance of suppliers, were not perceived as impediments to start or successfully finish a collaborative purchasing initiative because their average rating was far below the neutral value of three. These findings confirm a need for further research and the relevancy of operationalization.

To narrow down and establish the final subset of impediments for a manageable operationalized model, we performed some explorative data analysis. This selection process involved both the perception of overall consensus (i.e. the spread of the responses) and the height and weight of the responses.

Our first step used of univariate analysis techniques based on the inter quartile range (IQR) by means of box plot analysis (Chambers et al., 1983). This revealed only two lower outliers outside the 1.5 IQR. Moreover, we were able to calculate the four quartiles, of which the lower quartile (Q1) was 2.9, the 50<sup>th</sup> percentile (Median/Q2) equated to 3.1, and the upper quartile (Q3) 3.5. Given these values, we observed that half of the impediments in the upper two quartiles were all within 1,5 IQR, moreover all were above the neutral value and therefore confirmed as genuine perceived impediments.

For further validation (and to make the final selection of impediments, we calculated which impediments had the highest absolute responses, making an impediment more

important if more people answered so. It appears that the first seven impediments have the highest (at least two quartiles) of absolute responses within the answer range four and five, which means that at least 22 respondents perceived the impediment at least as important. We find sufficient justification to select the above impediments, among others, for the final model based on the criteria that: they have at least three quartiles of absolute responses either neutral (3) or important (4-5), for which it also holds true that the absolute numbers of important answers (4-5) needs to exceed 40 percent of the total. This resulted in the selection of fourteen impediments all perceived as having the highest importance.

### 4.3 Outline of the conceptual model

All the findings that we arrived at so far culminated in the conceptual model below (Figure 3). This model consists in part of the collaborative purchasing typology of Schotanus and Telgen (2007), which we situationalized for hospitals by eliminating one purchasing type (as discussed in section 4.1) The second component is the explored and situationalized impediments. Of the 34 impediments explored in the survey, only the 14 most salient are included in the model, the selection process of which is detailed in section 4.2.

Conceptual model		Collaborative purchasing group structures			
		Piggy backing	Third party	Lead buying	Project group
Collaborative purchasing impediments	(Expect) high coordination costs				
	Resistance of changing supplier within one or more of the group members' organizations				
	Lack of top managerial support of one or more group members.				
	Lose control over the creation of the product specifications				
	Lose control over the overall process				
	Internal resistance of changing supplier				
	Internal lack of top managerial support				
	Trust related obstacles - Sharing sensitive information				
	Lack of commitment/dedication of own organization				
	Internal lack of availability of resources				
	Lack of trust in one or more group members' competences				
	Lack of resources among one or more group members				
	Decreased flexibility in process steps (e.g. planning/deadlines)				
	Different information systems and software				

Figure 3: The frame of the resulting model

## 5 Operationalization of the model

To operationalize our model we determined IT systems, principles and features that could overcome or address the specific impediments listed in the outlined conceptual model. The data used to operationalize (i.e. fill the cells) was attained through semi-

structured explorative interviews with five experts (two heads of purchasing of two major Dutch universities, one head of purchasing of an e-procurement consultancy firm, one head of purchasing of a large Dutch hospital, and the program manager of a major health care research institute) in the field of purchasing with profound knowledge on (developments in) IT.

We used an open-ended format for our expert interviews as it ensured that respondents were not forced to provide their views and experiences through pre-established response categories but could rather provide their input in their own words and terminology, which we found appropriate for our purposes (Myers, 1997). We analyzed the interview findings with an open coding data technique, which entailed labeling the interview results to the corresponding IT principles and applications (Kaplan & Maxwell, 2005).

In the interviews respondents were asked, where possible and applicable, to assign potential IT items to purchasing impediment/types combinations of collaborative purchasing. IT solutions were discussed in detail and identified for all fourteen impediments. In the flow of this paper, and for spatial reasons, we only highlight the results of the four impediments related to costs, control and flexibility. The full list of impediments can be downloaded separately<sup>1</sup>.

The first impediment concerned coordination costs. All the experts identified that IT can help to lower the actual coordination costs by optimizing the collaborative process and communication streams. Physical meetings can be replaced with virtual videoconferencing and wiki's, which can reduce the need for physical meetings, thereby reducing costs. The experts mentioned web based platforms that can be used off-the-shelf, 24/7 data availability and automatic status updates that will save the members time. Additionally, coupling techniques like web services, EDI/XML and translation middleware can tie the e-procurement system to other e-business applications saving time, people, and correspondingly money.

Moreover, the experts mentioned that the concerns about losing control of the process could be addressed with IT programs that show real time progress. Furthermore, if the e-procurement system is able to embed some user management structure, it will contribute to the (perceived) level of control, since one can allocate user rights (e.g. read only, write) based on the specific group type one uses. As a demonstration of such a software program, one expert noted that "If the partners are all equally involved in the creation of important documents, groupware, real time monitoring and version control principles like they can be found in Google Docs or some collaborative package can help structure and guide the process, ultimately helping in gaining a greater degree of overall control". At any time, any of the group members can get the status quo. If all partners are not equally involved (third party or lead buying group structure) it is essential to make the progress visible. Transparency can help the ones that are not the (lead) buyer to still feel involved and somewhat in control. Additionally, it is useful to incorporate business intelligence, decision support systems and monitoring systems to track key performance indicators in order to gain a higher perceived feeling of authority.

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<sup>1</sup>The entire collaborative e-purchasing model can be downloaded from [http://www.cs.uu.nl/groups/OI/Bled/Collaborative\\_epurchasing\\_model.pdf](http://www.cs.uu.nl/groups/OI/Bled/Collaborative_epurchasing_model.pdf)

In response to the question of what IT can do for the ‘flexibility in process steps’-impediment, one expert respondent indicated MS Project like applications. “Those applications can merge all planning of the group members together and can automate and recalculate the planning in cases where some milestones are not met on time”. With such tools you make the consequences and the corresponding effect on the milestones of other members visible. Two respondents pointed out during the interview that a tool that shows the critical path based on the deadlines and current status of the project would really help the group in managing the planning.

Below, in table 3, you can find the overview of the operationalization of a number of rows of the collaborative e-purchasing model, that focus on impediments dealing with costs, control and flexibility.

**Table 3:** Costs, control and flexibility operationalized impediments of the collaborative e-purchasing model

Impediments	Collaborative purchasing types			
	Piggy backing	Third party	Lead buyer	Project group
<b>Coordination costs</b>	<ul style="list-style-type: none"> <li>• Web based</li> <li>• Digital files</li> <li>• Knowledge repository</li> </ul>	<ul style="list-style-type: none"> <li>• Social Referrals</li> <li>• Videoconference, wiki’s, social media</li> </ul>	<ul style="list-style-type: none"> <li>• Social Referrals</li> <li>• Web based</li> <li>• Videoconference, wiki’s, social media</li> </ul>	<ul style="list-style-type: none"> <li>• Social Referrals</li> <li>• Videoconference, wiki’s, social media</li> </ul>
<b>Lose control over creation of product specifications</b>	<ul style="list-style-type: none"> <li>• Digital files with version control</li> <li>• Knowledge repository</li> <li>• Track &amp; trace</li> <li>• Wiki’s</li> </ul>	<ul style="list-style-type: none"> <li>• Real time monitoring of planning</li> <li>• Groupware</li> </ul>	<ul style="list-style-type: none"> <li>• Process anchor and efficiency</li> <li>• Real time monitoring - traceability</li> <li>• User management structure</li> <li>• Groupware</li> <li>• Version control</li> <li>• Google Docs</li> <li>• Software as a Service</li> <li>• Knowledge gathering tool</li> <li>• Web portal 24/7 data availability</li> </ul>	<ul style="list-style-type: none"> <li>• Decision support tools</li> <li>• Process anchor and efficiency</li> <li>• Real time monitoring - traceability</li> <li>• User management structure</li> <li>• Groupware</li> <li>• Version control</li> <li>• Google Docs</li> <li>• Software as a Service</li> <li>• Knowledge gathering tool</li> <li>• Web portal 24/7 data availability</li> <li>• Decision support tools</li> </ul>
<b>Lose control over the overall process</b>	<ul style="list-style-type: none"> <li>• Digital files</li> <li>• Knowledge repository</li> <li>• Track &amp; trace</li> </ul>	<ul style="list-style-type: none"> <li>• Real time monitoring of planning</li> <li>• Groupware</li> <li>• Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Process anchoring</li> <li>• Web services</li> <li>• Real time monitoring - traceability</li> <li>• User management structure</li> <li>• Groupware</li> <li>• Google Docs</li> <li>• Social planning networks</li> <li>• Web portal</li> <li>• Countdown of tasks</li> <li>• EDI</li> <li>• Interoperability with other business processes.</li> <li>• Decision support tools</li> <li>• KPI monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Process anchoring</li> <li>• Web services</li> <li>• Real time monitoring - traceability</li> <li>• User management structure</li> <li>• Groupware</li> <li>• Google Docs</li> <li>• Social planning networks</li> <li>• Web portal</li> <li>• Countdown of tasks</li> <li>• EDI</li> <li>• Interoperability with other business processes.</li> </ul>
<b>Decreased flexibility in process steps</b>	<ul style="list-style-type: none"> <li>• The experts deemed cell as not applicable.</li> </ul>	<ul style="list-style-type: none"> <li>• The experts deemed cell as not applicable.</li> </ul>	<ul style="list-style-type: none"> <li>• MS Project</li> <li>• Critical path</li> <li>• Monitoring and guarding</li> <li>• Social planning networks</li> <li>• Meta search engines- to increase pool of alternative</li> </ul>	<ul style="list-style-type: none"> <li>• MS Project</li> <li>• Critical path</li> <li>• Monitoring and guarding</li> <li>• Social planning networks</li> <li>• Meta search engines- to increase pool of alternative</li> </ul>

The primary finding is that experts unanimously agree that IT can address all of the impediments, yet not all purchasing types will benefit. Additionally, experts expressed that for the more cost, process and control related impediments IT could serve as the primary support solution for overcoming these impediments. Whereas for social related impediments, other domains are possibly needed in addition to IT to overcome them.

## **6 Conclusion**

This study explored the current status and main impediments of horizontal buyer-buyer collaborative purchasing initiatives in the Dutch healthcare sector and matched them with IT solutions. Despite the many perceived benefits of this so-called collaborative purchasing, more benefits could be gained from collaborative purchasing.

From our survey we constructed a conceptual model to explain and address the lack of collaborative purchasing with IT. One part of the model consisted of the typology of collaborative purchasing types. We confirmed the applicability of this typology to Dutch hospitals, with the exceptional finding that one type, program group, was not used by hospitals and therefore was excluded from our final model.

Our survey also revealed that there were many perceived impediments to collaboration. Using univariate analyses we identified the 14 most important impediments for inclusion in the model. Having established the perceived barriers to collaborating, we then sought to find IT solutions for them by operationalizing our model through expert interviews.

This finding relates to our first suggestion for further research. Future studies could examine collaborative e-purchasing and our identified impediments from other domains. Moreover, it would be valuable to empirically test each of the impediments and associated IT solutions.

With the findings in this paper, we are positive that the collaborative e-purchasing model can be used by healthcare consortia, branche organizations, partnering healthcare institutes and multi-site healthcare institutes as a means to identify strategies to initiate, manage and evaluate collaborative purchasing practices.

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