Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Purchasing & Supply Management 11 (2005) 83–96
JOURNAL OF PURCHASING AND SUPPLY MANAGEMENT
www.elsevier.com/locate/pursup

Five counterintuitive findings in IT-purchasing

Chris Snijders[a,*], Frits Tazelaar[b]

[a]Dept of Technology Management/DG1.07, Eindhoven University of Technology, PO Box 513, 5600 MB Eindhoven, The Netherlands
[b]Dept of Sociology/ICS, Utrecht University, Heidelberglaan 2, 3584 CS Utrecht,The Netherlands

Received 4 May 2005; received in revised form 4 October 2005; accepted 7 October 2005

Abstract

Since 1995 we have been collecting quantitative data about the purchasing of IT-products and relations between buyers and IT-suppliers in The Netherlands, together with a team of colleagues. The data include the way in which buyers search and select their supplier, the way in which they negotiate with their chosen supplier, the kind and content of the contracting that is used, the kind and number of management staff involved, the importance of the IT-product or service to the buyer and supplier, the performance of the supplier, and the problems that were eventually encountered. Using our database of transactions in IT-purchasing, we present five empirical findings that we believe to be counterintuitive: (1) though the ability to deal with IT-purchases has increased over the years, the amount of problems experienced has not diminished, (2) the types of problems with IT-transactions that are encountered most, are not the ones managers expect to occur most often, (3) large investments in planning and contracting to prevent problems are not useful, (4) current rules and procedures concerning purchasing management within firms lead to larger management investments, while they do not lead to fewer problems, and (5) although large firms are more bureaucratic and deal with more complex transactions, they are not so different from SMEs as one might think.

Keywords: (IT-) purchasing; Supplier relationship management; Governance; Bureaucratic control; Supplier performance; Problems in IT-purchasing

1. Introduction

Since 1995 we have been collecting quantitative data on a large scale about the purchasing of IT-products and relations between buyers and IT-suppliers in The Netherlands, together with a team of colleagues. Our unit of analysis is the transaction: a single purchase of IT-products and/or services of a buyer (mostly a small or medium sized firm) from a seller, in The Netherlands. For each transaction we collected data about the way in which buyers search and select their supplier, the way in which they negotiate with their chosen supplier, the kind and content of the contracting that is used, the kind and number of management staff involved, the importance of the IT-product or service to the buyer and supplier, the performance of the supplier, and the problems that were eventually encountered. Taken together, these data provide a set of more than 2000 "quantitative snapshots" of the actual purchasing management that takes place, collected in three separate surveys in 1995, 1998, and 2003.

Our research is part of a larger research program, initiated at Utrecht University (the "Management of Matches" program, Raub and Tazelaar, 2000; Raub and Weesie, 1992/3). The program considers decentralized mechanisms for cooperative relations on the basis of different kinds of theoretical models: game theoretical models with repeated interaction (Taylor, 1987; Axelrod, 1984), models based on trust and social exchange (Dasgupta, 1988; Coleman, 1990; Kreps, 1990), transaction cost theory (Coase, 1937; Williamson, 1975, 1985), and theories regarding the social embeddedness of economic behavior (Granovetter, 1985). The emphasis of the program is on the integration and application of these theories to different kinds of cooperative undertakings: the governance of households, employment relations, and cooperative relations between organizations (such as joint ventures, R&D alliances, and cooperative relations between buyers and suppliers). Within this larger project, several papers with systematic and rigorous tests of

*Corresponding author.
E-mail address: c.c.p.snijders@tm.tue.nl (C. Snijders).

1478-4092/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.pursup.2005.10.006

theoretically derived hypotheses on buyer–supplier relations have been published (see: Raub and Weesie, 1990; Raub and Snijders, 1997; Rooks et al., 2000; Blumberg, 2000, 2001; Buskens and Raub, 2002; Batenburg et al., 2003; Rooks et al., 2005).

We feel that, especially in the field of management and organization studies, one of the main purposes of quantitative data collection and data analysis is that they can be used to expose ideas about buyer–supplier interaction that have some intuitive or even theoretical appeal, but are in fact wrong. Especially, given the fact that a substantial part of the research in purchasing is based on case studies (Morlacchi et al., 2002), interviews with key informants, participant observation, or other forms of more qualitative data collection, it can be useful and refreshing to see which of the ideas that seemed so plausible and compelling can stand a quantitative comparison with reality. Of course, one can also work the other way around, and this is what we do in this paper. We present five empirical findings related to problems with transactions in IT-purchasing that we believe to be interesting and counterintuitive. The first two findings concern the amount, degree and type of problems that are encountered; the other three findings concern the relationship between the buyer's management, both at the transaction and the organizational level, and the problems encountered. Whenever possible, we try to find reasons for our findings; in any case, we feel that all of them are worthy of further inquiry.

In order to get a feel for what the beliefs and perceptions of managers are with respect to the likelihood and causes of problems in IT-purchasing we used several sources: (a) popular IT-magazines, purchasing magazines, and newspapers, (b) studies with respect to purchasing and with respect to experienced successes and failures in IT-projects (e.g. Riesewijk and Warmerdam, 1988), and (c) discussions with experts in IT (automation managers, consultants). To get a more systematic and less biased insight to managers' perception, we also collected: (d) survey data from our audience when presenting the results of our analysis in non-academic settings (such as at a meeting of a local branch of the Dutch Association for Purchasing Management [NEVI]), (e) experimental data (conjoint analysis) from managers and laymen who were tested on their ability to assess the likelihood of problems, and from these same individuals we also collected data on the perceived relative importance of factors influencing the likelihood of problems occurring in IT-transactions (see Snijders et al., 2003; Tazelaar and Snijders, 2004). Based on these empirical sources we get a clear picture of the beliefs and perceptions managers have concerning not only the probability of problems with purchasing transactions under specific conditions, but also with respect to the relationship between various management mechanisms and this probability. For instance, purchasing managers have strong beliefs about their ability to predict the kind and type of problem that will occur, and have strong beliefs that large investments in planning and contracting help to prevent problems to occur. They also believe that on the organizational level strict internal rules and procedures with respect to the purchasing process do help to prevent problems to occur. Whether these beliefs and perceptions are sound in the field of IT-purchasing will be put to the test here.

2. The data

We report about three waves of survey data collection, called "The external management of automation (MAT)". The first wave was in 1995 (MAT95), the second one in 1998 (MAT98), and the third one in 2003 (MAT03). MAT95 and MAT98 were carried out by the ISCORE-group at the Department of Sociology at Utrecht University; MAT03 was a joint venture of the same group with the Department of Technology and Policy at the Eindhoven University of Technology. In each wave, the unit of analysis is the transaction: one buyer, purchasing IT-products and/or services from a seller. Since the number of managers involved in the purchasing management process may vary (although this variation is much smaller for smaller firms),[1] we always asked for the most knowledgeable manager with regard to IT purchases within the buyer firm. From this respondent, we asked for a list of recent IT-transactions for which the manager had been responsible. After that we randomly determined an IT-transaction from this list that would subsequently be the focus of the survey. The survey consists of questions regarding the whole process of the transaction, ranging from the ex ante management (specification of the need, search, screening, and selection of the supplier), the actual purchasing management (e.g., negotiating and contracting), to the problems experienced after the sale was completed. As much as possible we tried to use survey questions that asked for objective facts rather than perceptions. More details, including the full MAT95 and MAT98 questionnaire, can be found in Buskens and Batenburg (2000; the codebook of MAT03 is in preparation). Details on the construction of variables can be found in Batenburg et al. (2003).

The data collections consider IT-transactions ranging from 1978 to 2003, though the bulk of the data (over 90%) considers transactions after 1990. All in all, the data consist of 2236 IT-transactions, with about 300 items scored per transaction. Through our sampling we made sure that there is ample variation in the kinds of products that were

[1] From a similar research project in which $N = 318$ transactions from 23 firms were investigated (Tazelaar and Snijders, 2000, Chapter 6) we can learn that in firms with less than 200 employees, 50% of the transactions are coordinated by just a single manager, while 33% of the transactions are coordinated by buying teams with two or even more managers from different departments. In larger buyer firms (between 200 and 500 fte) these percentages are 32% and 51%, whereas they are 13% and 69% for the largest firms (>500 fte). In the MAT data analyzed here, 81% of all transactions come from firms with less than 200 employees.

Table 1
Summary statistics on MAT95, MAT98, and MAT03

	MAT95	MAT98	MAT03
Period	1978–1995	1986–1998	2000–2003
Cases	971	281	984
Buyer firm ⩽ SME	95%	95%	68%
Med. size buyer firm	35	40	75
Seller firm < 50	66%	64%	58%
Med. transaction volume[a]	23,000 Euro	20,000 Euro	25,000 Euro
Mean transaction volume[a]	58,000 Euro	110,000 Euro	289,000 Euro

[a]Converted to Euro, rounded to thousands, and controlled for inflation (consumer prices, base year = 2003).

bought (software versus hardware, standard versus complex). The three waves of data collection differ with respect to the kind of data collection method that was used (which is something we must and do take into account in our analyses). Most cases in MAT95 were administered by interviewers, a small part was collected as a mail survey. The sampling frame was a business-to-business database, representative for small- and medium-sized enterprises (SMEs, more than 5 and less than 200 fte) in The Netherlands (Batenburg, 1997). In MAT98 we collected some additional information about some of the MAT95, and collected new cases through a mailed questionnaire after asking for participation by phone. MAT03 was collected completely through the Internet; the sampling frame consisted of the "PanelClix" Internet panel.[2] Response rates are high for this research domain (over 50% for MAT95 and MAT98; for MAT03 we have a 23% response rate to the invitation to participate, from those who passed the screening questions 85% completed the questionnaire).

Table 1 shows some summary statistics on the three waves of data collection. Most findings concern the performance of the supplier, as measured by the amount and degree of problems encountered. For nine different problem categories, respondents could answer whether or not problems occurred on a 5-point Likert scale (1 = not at all, 2 = hardly any problem, 3 = small problems, 4 = large problems, 5 = huge problems). We considered two ways of measurement for the total amount and degree of problems: the average score across the nine items (ranging from 1 to 5), and the number of items with a value of at least 3 (resulting in a variable with a range from 0 to 9). Both variables strongly correlate (Pearson $r = 0.94$), so it does not make much sense to differentiate between the two empirically. Analyses are reported based on the average score on the 9 items. Table 2 gives an overview of the percentage of times the transactions lead to problems, and how many problems that were. This overview shows that when purchasing IT-products or services, problems occurred in the majority of cases. This statement holds across data sets, and across firm sizes.

Table 2
Percentage of transactions with problems for different sizes of buyer firms, and for different data collections (given problems occurring: average number of different problems)[a]

	MAT95	MAT98	MAT03
Size of buyer firm:			
Small (< 50)	55% [3.3] ($N = 591$)	49% [3.1] ($N = 145$)	61% [4.2] ($N = 412$)
Medium (50–199)	60% [3.3] ($N = 305$)	59% [3.2] ($N = 97$)	60% [4.0] ($N = 229$)
Large (> = 200)	66% [3.4] ($N = 64$)	71% [3.8] ($N = 17$)	64% [4.4] ($N = 343$)
Total	57.5% [3.3] ($N = 960$)	54.1% [3.2] ($N = 259$)	61.5% [4.3] ($N = 984$)

[a]A logistic regression analysis on the probability of problems shows neither significant differences between the different waves, nor between the different sizes of firms. A regression analyses on the number of problems for those cases where problems were encountered shows that problems were a bit more likely in MAT03 (+0.2, $p < 0.01$) and less likely for medium size firms (−0.1, $p = 0.03$).

3. Analytic strategy

Almost all of the findings we are about to present either directly concern the amount and degrees of problems encountered, or are at least related to it. This necessitates a specific strategy of analysis, as we will illustrate in this section. First, we show a plot of the amount and degree of problems against the amount of planning.

We could have shown these graphs separately for MAT95, MAT98 and MAT03, but they would convey the same image. Two things are noteworthy in this graph. First, for any given amount of management, there is quite a lot of variance in problems. In fact, for virtually all amounts of planning the amount of problems spans the whole spectrum of problem values. Second, it appears that on an average (see the upward sloping line in the graph) the number and degree of problems *increase* with increasing investment in management. This finding is also consistent across the data sets. It is important to note that this, by itself, is not an anomaly. It makes perfect sense, comparing across different transactions, that smaller transactions go with low levels of management and few problems, whereas larger transactions experience more problems even though

[2]PanelClix (www.panelclix.nl) is a Dutch (commercial) Internet panel consisting of 200,000 members at the time of the research. About 9% of the panel members have a job description that is IT-related; about 8% of the panel members either authorize purchasing, carry out the actual purchasing, or supervise purchasing. If we compare the eventual MAT03 sample with that from MAT95 and MAT98, we find no significant distributional differences (at the 5% level) with respect to firm sizes (under 200, that is), with respect to whether a previous business relation existed, and several other characteristics.

higher levels of management were chosen. Nevertheless, one would expect that, all else being equal, increased levels of management help prevent problems.

This means that a graph such as the one in Fig. 1 would be more meaningful if we adapt it to incorporate two extensions. The first one is the fact that it is likely that the number of problems not only depend on the investment in management, but also on other factors. For instance, the above graph simply stacks the more expensive and risky transactions on top of the cheap and not so risky ones, which can obviously affect the results. The second issue is that the investment in management itself is *also* dependent on other factors (such as the degree of risk involved in the transaction). We can conceive of this as is shown in Fig. 2: a transaction with certain characteristics, carried out by a certain kind of buyer and supplier, will lead to a certain level of transaction management. Together, this leads to a certain amount and degree of problems that materialize.

What we are interested in is the 'net' effect of investments in purchasing management on the amount and degree of problems (i.e., the dashed line in Fig. 2), while taking into account the fact that management itself is also determined by characteristics of the transaction, the buyer, the supplier, etc. This poses a methodological problem: one of the predictors of the amount and degree of problems is itself endogenously determined, and that implies that employing standard regression techniques is not likely to deliver valid inferences.[3] However, such models can be adequately estimated using different variants of "instrumental variable regression" (including 2-stage least-squares and 3-stage least-squares, Zellner and Theil, 1962; Johnston and Dinardo, 1997; Davidson and MacKinnon, 1993). Using this approach, one can graph the amount and degree of problems as a function of the investment in management, while controlling for a considerable number of possibly intervening factors and while controlling for the endogeneity of purchasing management. We control for transaction characteristics (complexity of product, hardware versus software, whether there were any monitoring problems for the buyer, the switching costs involved, etc.), and buyer and supplier characteristics (size and reputation of the supplier, whether buyer and supplier had done business before, degree of dependency on the supplier, etc). See the Appendix A for the details on the used variables and the technicalities.[4]

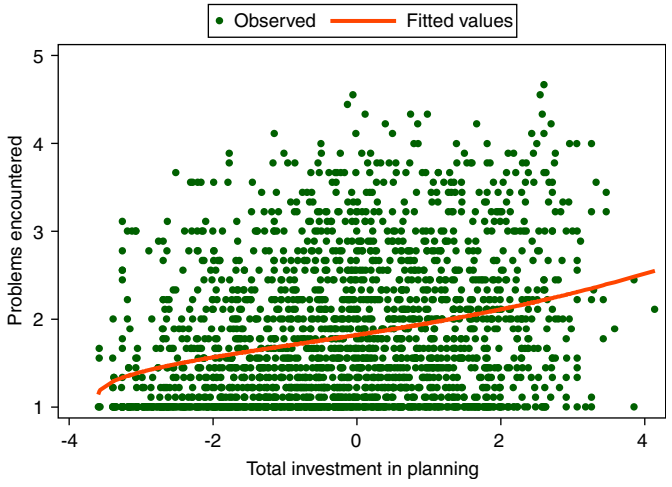

Fig. 1. Amount and degree of problems encountered by investment in management.

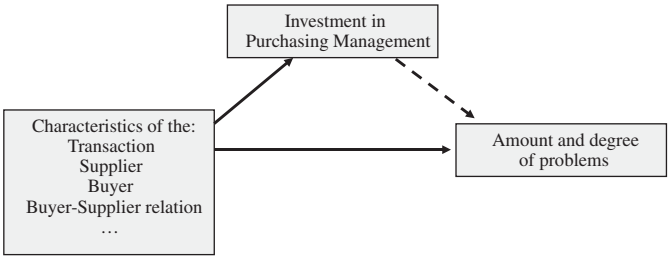

Fig. 2. The amount and degree of experienced problems, as affected by characteristics of the transaction, buyer and supplier, as amended by investments in purchasing management. All arrows represent the assumed relations ("has an effect on") between entities.

3.1. Finding 1: during the last decades, purchasing managers have become more at ease with the purchasing of IT-products and services, but the ability to prevent non-optimal performance of suppliers has not increased over time

The first issue we want to address is the likelihood of problems occurring with IT-transactions between buyers and suppliers. In the late 1980s in The Netherlands, many IT-projects failed and the general consensus was that at least one reason for this was because buyers were too unfamiliar with what they were buying, at least much less familiar than the sellers of IT, so that sellers could get away with selling poor products and services (Riesewijk and Warmerdam, 1988). In our recent experiments, managers also endorse the claim that "over the years experienced purchasing managers can acknowledge better and better in which cases problems are likely to occur" (78% agrees with this statement in our experiments, 76% agreed in our pre-presentation surveys $N = 210$). Our data indeed corroborate that managers have grown more accustomed to buying IT. Over the years, the monitoring capacity of managers

[3]For triangular models such as this one, we could use standard regression techniques only when the residuals in the estimation equation for the investment in management are not related to the residuals in the estimation equation of the amount and degree of problems. Tests show that in this case this assumption is in fact violated.

[4]For all the (graphical displays of the results of) analyses presented below, whenever we mention that we "control for" characteristics of the transaction, the buyer, the supplier, and the transaction management, we report results that are based on instrumental variable regression. Since we wanted to present five findings, space requirements do not permit us to get into the details of all the analyses underlying the graphs. We tried to be as accurate as possible given the space limitations, but chose to emphasize the findings more than the analyses that produced them (of course, all analyses are available on request).

for this kind of transaction has increased, most notably within small and medium sized enterprises: managers' ability to judge the quality of IT-products, to compare and judge tenders, and to weigh their quality and price, has certainly grown over the years. In Fig. 3 we show this increasing ability, controlling for the type and complexity of the IT-products involved, as well as for a large number of other transaction characteristics.

This finding is promising. Given that managers have improved their skills, one could rightfully wonder whether the (number and seriousness of) problems encountered in IT-purchases has diminished over the years. In Fig. 4 we present the amount and degree of problems with IT-transactions (on the vertical axis) against the year of purchasing, for the data collected in 1995, 1998 and 2003.

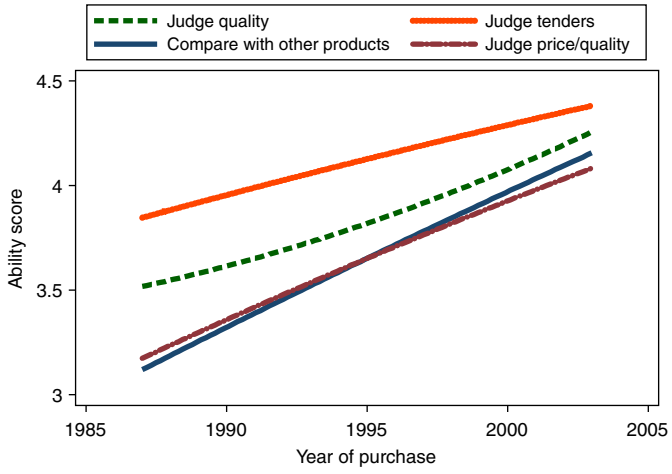

Fig. 3. The increasing perceived ability of purchasing and automation managers to judge the quality of IT-products (line on top), to compare and judge tenders (2nd from top), to compare IT-products (3rd from top on the left), and to weight their quality and price over the years (line below on the left), controlling for the type and complexity of the IT-products involved as well as for a large number of other transaction characteristics.

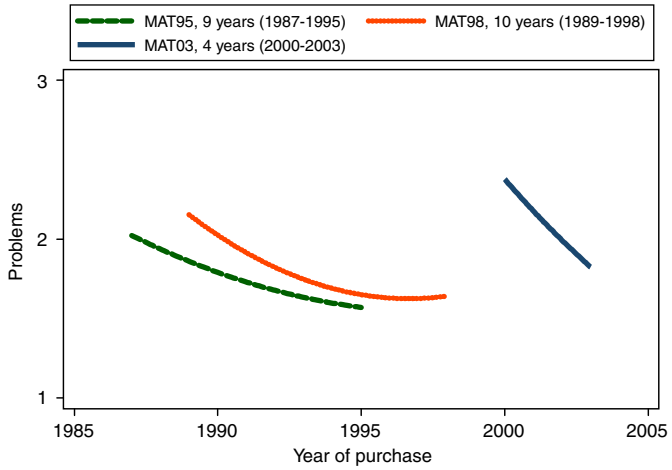

Fig. 4. The amount and degree of problems encountered with IT-transactions (min = 1, max = 5), by year of purchasing.

Given the number of cases we have per year, we restrict ourselves to the cases that occurred after 1986.

Fig. 4 seems to back up the claim that the amount and degree of problems has decreased over the years. Within data collections, there is a notable decrease in the amount and degree of problems (all lines in the graph have a downward slope). However, from Fig. 4 it is hard to draw strong conclusions about the level of problems over the years (and across data collections). Not only may the characteristics of the transactions vary within and between the data collections, but the characteristics of the buyer, the supplier, and the relation between the two may also differ. Moreover, this comparison of amount and degree of problems encountered within IT-transactions over the years may be influenced by differences in the way the data were collected in MAT95, MAT98 and MAT03. In Fig. 5 we again show the amount and degree of problems, but now given that we control for the abovementioned factors.

Our analyses now reveal that, in fact, the average amount and degree of problems encountered in IT-transactions *is stable over the years*. Notwithstanding the increased expertise and monitoring capacity of managers for the kind of transactions over the years, there is no diminished probability of problems with the purchase of these kinds of products. That is, if one controls for the characteristics of the transactions, the characteristics of the buyer, the supplier, the relation between these two, and the amount of management invested, then the net effect of the year of purchase on the amount of problems encountered is not significantly different from zero.

One possible explanation for this finding (that is in fact in accordance with our data, although one cannot see this from the above figures only) is that not only there is an increasing ability among managers to judge and control IT-products and services over the years, but at the same time

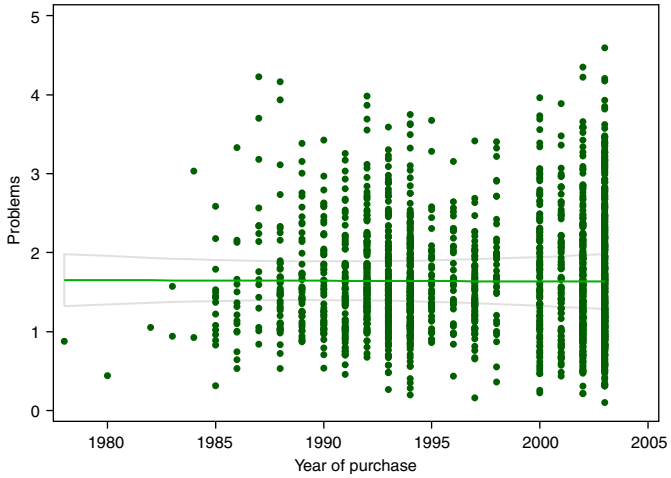

Fig. 5. Number of problems by year of purchasing: The horizontal line shows the (absence of an) effect of the year of purchasing on the likelihood of problems with IT-transactions, controlling for characteristics of the transaction, the buyer, the supplier, the relationship between the buyer and the supplier, for the amount of management invested, and for possible data collection effects.

Table 3
The percentage of IT-transactions with specific types of problems

	SMEs (<200 fte)	large firms all (>200 fte)		All, high price only
	%, rank	%, rank	%, rank	%, rank
Type of problem				
Product: incomplete/too slow/too limited	29 [2]	38 [1]	31 [1]	40 [1]
Service and/or adjustments: too slow/too late	30 [1]	36 [3]	31 [2]	40 [2]
Documentation: incomplete and/or unclear	28 [3]	34 [4]	29 [3]	38 [3]
Guidance and coaching: too limited	26 [4]	30 [5]	26 [4]	31 [5]
Exceeding time of delivery	22 [5]	36 [2]	25 [5]	34 [4]
Deviation(s) from agreed specification	18 [8]	30 [6]	20 [6]	29 [7]
Incompatibility with related automation products	18 [7]	29 [8]	20 [7]	25 [9]
Installation: too quick/inaccurate	19 [6]	23 [9]	20 [8]	26 [8]
Exceeding price/budget	17 [9]	29 [7]	19 [9]	30 [6]

Separate for small and medium sized enterprises (SMEs), for larger firms, for all cases, and for all cases over 100,000 Euro [rank order between brackets].

these managers have been confronted with an increasing complexity of the purchased goods involved. It is noteworthy that the complexity of the purchased IT-products increased not only within the larger business firms, but most conspicuously also within small- and medium-sized enterprises.[5]

3.2. Finding 2: the types of problems with IT-transactions that are encountered most are not the ones managers expect to occur most often

The second issue we want to address is the accuracy of the general impression managers tend to have of the types of problems that are most likely to occur in the purchase of IT-products and services. When one browses popular IT-magazines or newpapers, 'exceeding the budget' and 'incompatibility with related automation products' are problems one encounters very often, although the list of potential problems is seemingly endless (e.g., Computable, October 4 1996, August 19 1999, January 13 2000; Tweakers.net, May 17 2004; Topmanagement & IT, August 16 2001, and many others). Whether these impressions are correct has not often been considered. There are indeed several scientific studies claiming to pinpoint the critical factors that lead to problems in IT-projects (Auer and Harris, 1981; Hornsby et al., 1992; Vadapalli and Mone, 2000) and studies that show that many larger IT-projects fail (Ewusi-Mensah and Przasnyski, 1991; Doherty and King, 1998), but there seems to be much less scientific concern with regard to what precisely these problems are. One of the few studies on this topic is the one by Riesewijk and Warmerdam (1988). They also report, on the basis of survey interviews with over 200 managers, that exceeding the budget and taking too much time are major concerns in IT-projects. Our data show something different. For each IT-purchasing transaction in our data, we know which types of problems have occurred. In Table 3 we give an overview of these types of problems.

In fact, the most frequently occurring types of problems are the problems encountered in *after sales*, such as 'service and/or adjustments too slow or too late', 'documentation incomplete or unclear' and 'guidance and coaching too limited' (see also: Rooks et al., 2005). Together with 'incomplete and/or too slow/limited product' we find these kinds of problems in the top-5 of problems encountered, whether it is in small- and medium-sized firms or in the larger firms. 'Exceeding price' and 'incompatibility' cannot be found in this top-5.

This finding is extremely robust and also surfaces when we only consider IT-projects over 100,000 Euro. Moreover, this finding holds irrespective of the year of purchase and the period and type of data collection, which can be seen in Fig. 6. In this figure four lines are shown, each representing the rank order of the specific problem in the list of encountered problems (higher numbers denote more problems), over the years. We show the data for 'service and/or adjustments too slow or too late' and 'incomplete and/or too slow/limited product', and (below) 'exceeding budget' and 'incompatibility with related automation products'.

A possible explanation, one could argue, for the fact that problems concerning 'exceeding price' and 'incompatibility' stick in our memory most and are the most often mentioned among purchasing and automation experts is that these types of problems have the greatest impact on the discontent of those encountering these specific problems in the purchase of IT products. Perhaps these problems are not the ones most often encountered, but if you do, they are likely to be severe. The data do not support this claim. This can be seen if one compares the grades (0–10) managers gave for the product or service purchased and for the performance of the supplier. If the abovementioned explanation were true, one would expect

[5]Another explanation would be that managers choose a level of investment that (they feel) decreases the level of risk involved below a particular threshold. That is, one invests a lot in risky transactions and much less in the more simple transactions, but in both cases the degree of risk that remains after investments in transaction management is roughly the same. When we also assume that this remaining risk level is stable over time then one would also expect results such as the one presented in Fig. 5.

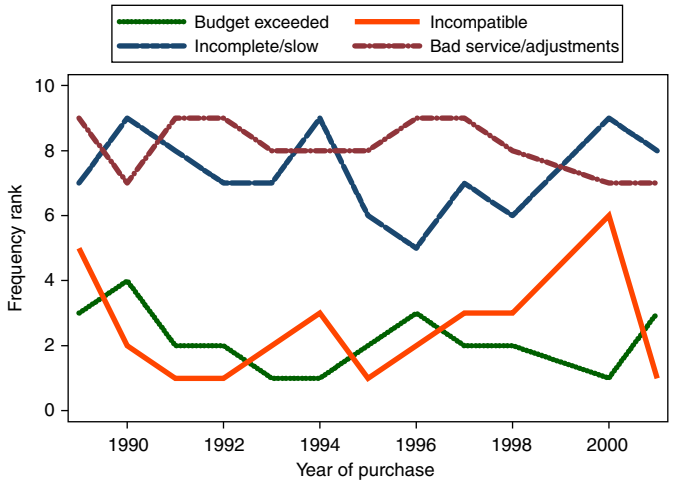

Fig. 6. Frequency rank (higher numbers denote more problems) of different kinds of problems in the total list of problems, across the years. The top two lines represent 'service and/or adjustments too slow or too late' and 'incomplete and/or too slow/limited product'. The bottom two lines represent 'exceeding the budget' and 'incompatibility with related automation products'.

that the difference in awarded grades between transactions with and without these specific types of problems is the largest, in fact larger than in the types of problems that were actually encountered more frequently and are ranked in the top-5 of problems. However, our analyses show that these differences in grades are the *smallest* for 'exceeding price' and 'incompatibility' while substantially larger for every type of problem in the top-5.

One counterargument against these results would be that, because respondents were interviewed after an IT-project had been completed, the respondents simply had a better recollection of the problems that were encountered most recently. Since the problems that occurred most recently are the problems in the after-sales period, these problems get mentioned more often. We do not think this drives our results, for three reasons. First, the respondents were interviewed on the basis of a single purchasing transaction, and had to answer questions regarding this transaction "chronologically". Second, there were questions about the screening and selection, then about the chosen supplier, then about the negotiation and contracting phase, then about the problems that occurred. By the time the respondents had to answer the questions on the problems, it has become less likely that a recollection bias would favor more recent problems. Moreover, after extensive testing in the pilot phase, we came up with what we think is a complete list of potential problems. We could therefore ask this question in "closed form", offering all possible problems explicitly instead of posing an open question. Hence, even if respondents would have forgotten about problems that took place, it is likely that they would remember it when mentioned explicitly. Our third argument is an empirical one. If such a recollection bias exists, it is likely that its disturbing role is less strong in cases where the questions were asked on transactions that had already taken place a longer time ago. However, if we rerun our analyses for sets of transactions that differ with respect to how long ago they took place, we find similar results.

One other and perhaps more likely explanation for the fact that problems concerning 'exceeding price' and 'incompatibility' are the most often mentioned among purchasing and automation experts, irrespective of the fact that they are *not* frequently encountered in IT-transactions in our data, is that those responsible for the purchasing of these goods may somewhat more easily loose sight of problems occurring in the after sales period, such as non optimal 'service', 'guidance and coaching' and 'documentation'. On the basis of our data we cannot test this proposition.

3.3. *Finding 3: large investments in planning and contracting are not useful in preventing problems*

In one of our experiments (Snijders et al., 2003; Tazelaar and Snijders, 2004) we asked managers and laymen to divide 100 points over 14 different case characteristics (contractual planning, reputation of the supplier, number of tenders, etc.) according to the degree to which they thought each characteristic was "important to predict the success or failure of a transaction". Both managers and laymen feel that contractual planning is of major importance. The issue we want to address next is the extent to which careful planning and contracting have an impact on the problems that eventually emerge in a particular purchasing transaction. One basic purpose of investing in planning and contracting—in line with our common sense, the intuition of the managers and many if not all theories on buyer–supplier interaction—is that it is supposed to decrease the number of problems of a purchasing transaction. This probably sounds too logical to even warrant further attention: basically this is why one invests in the management of a purchasing transaction in the first place! The facts turn out to be different.

The investment in transaction management was measured as a factor score, based on the number of person days invested in the management of a transaction, whether or not a tailor-made contract was used, and elaborate measurement of the kind of items that were covered in the contract. Given that it is a factor score, its scale is meaningless; we will give more substantial information later but for now it suffices to know that it is a variable that varies roughly between -4 and $+4$ (with a mean of 0). The higher the value, the larger the investment in management was.

Fig. 7 shows the results of the analysis: even after controlling for endogeneity of planning and many other characteristics, it emerges that the average benefits of larger investments in management are statistically not significant from zero. Again, these results are stable across our data sets, and also hold if we eliminate the larger firms from MAT03, or use other definitions of what precisely is a

Fig. 7. Net effect of (estimated) investment on amount and degree of problems, correcting for the endogeneity problem, and controlling for characteristics of the transaction, the buyer, the supplier, and other characteristics (see the Appendix. A for details). The line shows a best non-linear fit.[7]

problem (for instance, we could have operationalized problems as the number of sizeable problems encountered). This implies the following. For groups of similar transactions in our data, there are firms who invest comparatively little in transaction management, and firms that invest a lot. On an average, the firms who invested more than the minimum amount of management used by other firms are confronted with just as many problems as the ones who invested little. This does not imply that all investments in management are useless (they might be useful for other purposes), and it also does *not* imply that all investments in management are useless to prevent problems. What our findings do show is that for the purpose of decreasing the number problems encountered, one need not invest more in management than any other firm does.[6]

In addition, closer analysis (analysis not reported here) shows that the *variance* in the amount and degree of problems increases with increasing investment in transaction management. Roughly stated, this means that increased investments in management indeed increase the probability that you end up without any problems, but they also increase the probability that you end up with lots of problems. In that sense it would be wise for buyers who are risk averse, to invest less in management.

[6]This shows that firms should have a keen interest in the principles of transaction management *of other firms*. A firm who finds out that another firm generally invests less in transaction management for a specific transaction, would be wise to decrease his own transaction management to that lesser level.

[7]Because the graph is based on 3SLS, we have the *estimated* investment amount in planning on the horizontal axis (estimated on the basis of the transaction, buyer, and supplier characteristics), and the amount and degree of problems, adapted for differences in the transaction, buyer, and supplier characteristics, on the vertical axis. This is the reason that the scatter-plot now shows values smaller than 1.

The practical conclusion is a surprising one. It may very well be that large investments in the management of a transaction are useful (for instance because current investments can be of use in future transactions, or for other reasons), but our data show that this usefulness does *not* show up as a decreased number of problems that one experiences after the transaction is completed. A possible reason for our finding could be that firms tend to "play it safe" and rather invest a little (or a lot) extra in transaction management just to ensure that if something goes wrong later on, they can at least claim within their organization that it was not because of their lack of effort. Our data do not lend itself to test such suggestions, but we can find some evidence related to this issue by looking at the internal rules and procedures that firms use to govern their purchasing transactions.

3.4. Finding 4: current rules and procedures within firms go with larger investments in transaction management, but not with fewer problems

Rules and procedures that govern the investment in transaction management can exist for many reasons, but most theories that base themselves on rational action explain rules as a way to reduce transaction costs and a way to avoid opportunism and mistakes. If in the literature that bases itself on rational considerations to a lesser extent, the general idea is that "a conception of historical efficiency underlies many speculations about rules" (March et al., 2000, p. 4). That is, somehow rules are expected to represent what an organization has learned about dealing with matters, both within the organization itself and in relation to other organizations (cf. Williamson, 1996). In the MAT98 and MAT03 data we asked respondents whether, in their firm, rules or explicit oral instructions existed with regard to several issues. Table 4 gives an overview of the issues we asked about, and the answers of respondents.

As can be seen from Table 4, by and large the firms in MAT03 have more of these rules (see the first two columns of the table), but this difference is due completely to the inclusion of larger firms in the MAT03 design (see the last two columns of the table). Rules and procedures that occur most often are rules concerning the ways of dealing with tendering and judging tenders. Rules and procedures regarding the carrying out of a supplier evaluation occur least often, around 30% of the time.

We now count, for each firm, how many of these seven issues are covered in rules and procedures. Table 5 gives an overview.

Again we see some differences between the MAT98 and MAT03 data. If we do not take the differences in firm size into account, we find that firms in MAT03 have more rules and procedures (a statistically significant difference between an average of 2.7 versus an average of 3.4). If we only take firms with fewer than 200 employees, the difference is negligible (2.9 versus 3.0).

Table 4
Rules and procedures regarding the governance of purchasing transactions

	ALL FIRMS		SMEs	
	281 cases, MAT98 (%)	984 cases, MAT03 (%)	244 cases, MAT98 (%)	641 cases, MAT03 (%)
A	39	44	42	36
B	49	64	53	58
C	33	44	37	37
D	44	54	48	45
E	37	53	39	46
F	27	36	30	30
G	41	49	43	42

A = Departments or hierarchy levels that should be involved during search, screening, and selection of suppliers.
B = Ways of dealing with tendering and judging tenders.
C = Running supplier audits.
D = Departments or hierarchy levels that should be involved during negotiations and contracting.
E = The kind of contract that must be used.
F = Carrying out of a supplier evaluation.
G = Departments or hierarchy levels that should be involved in possible conflict regulation.

Table 5
Number of different rules and procedures (maximum = 7) per firm type and per data collection.

	ALL FIRMS		SMEs	
	281 cases, MAT98 (%)	984 cases, MAT03 (%)	244 cases, MAT98 (%)	641 cases, MAT03 (%)
0	34	21	29	27
1	7	8	8	8
2	10	10	11	11
3	12	12	14	14
4	7	11	7	11
5	7	10	7	8
6	8	7	9	5
7	14	21	15	15
	100	100	100	100

We now repeat the analysis as performed under the previous finding: we predict problems, using the investment in management and characteristics of the transaction and of buyer and supplier, while taking the endogeneity of the investment in management into account. We then see that, with an increasing use of rules and procedures, investments in transaction management increase (Fig. 8).

The picture changes drastically when we consider the direct effect of rules on the amount and degree of *problems*. Having a larger number of rules does not—ceteris paribus—correlate with the amount and degree of problems at all, as can be seen in Fig. 9.

Apparently, rules and procedures do not affect the amount and degree of problems directly. It does increase the management investment, but the management investment itself has a negligible influence on the amount and degree of problems that will be experienced. So here we see

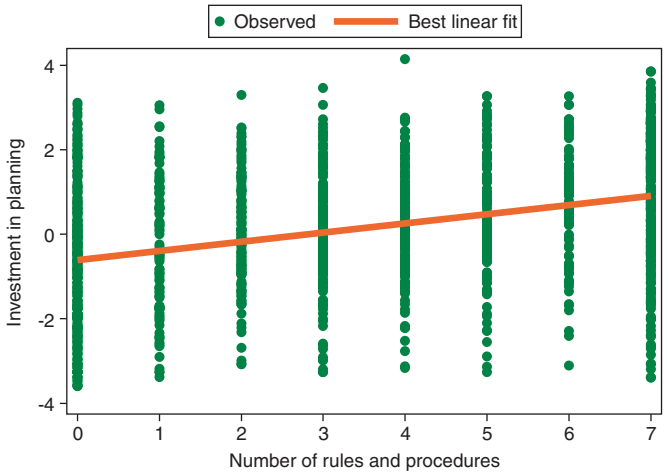

Fig. 8. The investment in planning by number of rules and procedures.

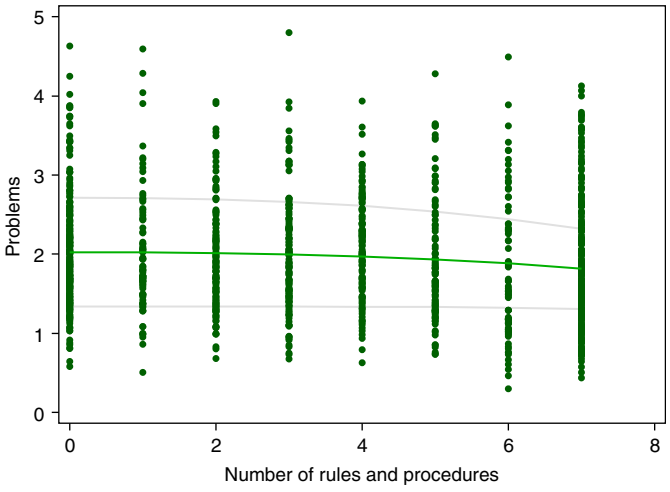

Fig. 9. The amount and degree of problems by number of rules and procedures (based on 3SLS estimation as in the previous section). The line shows that the average impact of the number of rules and procedures on problems is zero.

one possible reason for the tendency for investments in transaction management to be too large: the rules and procedures that govern the behavior of the people involved might lead these people to over-invest. The effect of the rules is not that large, though. One extra rule leads to an increase in the investment in management of 0.1 (on a scale from −4 to +4). Closer examination of the data indicates that especially rules concerning the kind of contract that should be used, lead to an increased investment in management (an effect of size 0.2).

Once again, it should be noted that our finding should not be mistaken to mean "rules and procedures have no use". There may be all kinds of sensible reasons to apply the kind of rules and procedures as mentioned above. For instance, it gives employees a guideline for their behavior without the necessity to consult their supervisor all the time, and creates some consistency within the firm across transactions, which decreases transaction costs. Moreover, one could argue that these decreased transaction costs in

fact allow for higher levels of investment in management (because you can now achieve higher levels of investment at the same costs), so that it makes perfect sense that investments in management are larger when there are more rules and procedures (cf. Batenburg et al., 2003 for a dynamic model including transaction costs). However, the alternative interpretation, that rules and procedures are the focus of control (Cyert and March, 1963) within the firm and represent what has become "known" within the firm to represent a best practice, finds no support in our data.

3.5. Finding 5: large firms are more bureaucratic and deal with more complex transactions, but for any given transaction their level of investment in management and the amount of problems experienced are similar to the levels of investment and the amount of problems experienced by smaller firms

Over the years, researchers using the MAT95 and MAT98 data (Batenburg et al., 2003; Blumberg, 2000, 2001; Rooks and Snijders, 2001; Rooks et al., 2005), including ourselves, have been confronted with a general comment that comes down to "all this is different for large firms; your findings are driven by the fact that you study small and medium sized enterprises. Small firms are not 'little big businesses'" (cf. Welsh and White, 1981). Since firm size is inextricably bound up with complexity and bureaucratic control, this comment is not that peculiar at all: compared to small and medium sized enterprises large firms can be characterized by specific organizational features, such as an increased presence of internal rules and standardized procedures, specialization and division of labor, hierarchy of authority, technically qualified personnel, and an increased presence of written communications and records (which is known at least since Weber, 1947[1922]). Some of these features are related to firm size in our data as well. In Fig. 10 we show that rules and standard procedures which enable organizational activities to be performed in a predictable and routine manner are found more in larger firms, as are specialized duties which enable employees to perform a clear task. In this figure specialization and division of labor are indicated by the likelihood that separate departments (e.g. automation departments, purchasing departments, legal departments) exist within firms. According to Mokken's (1971) criteria both characteristics are measured by strong scales: $H = 0.60$ for rules and procedures, and $H = 0.57$ for specialization and division of labor.

Notwithstanding this variation in organizational features, we were not that convinced we would find different results when one were to consider larger firms, but without any data to back it up, we could do nothing but acknowledge that this is indeed a possibility. With the MAT03 data collection we are able to say something about the extent to which this counterargument makes sense, at least with respect to the problems that firms encounter when purchasing IT-products and/or services.

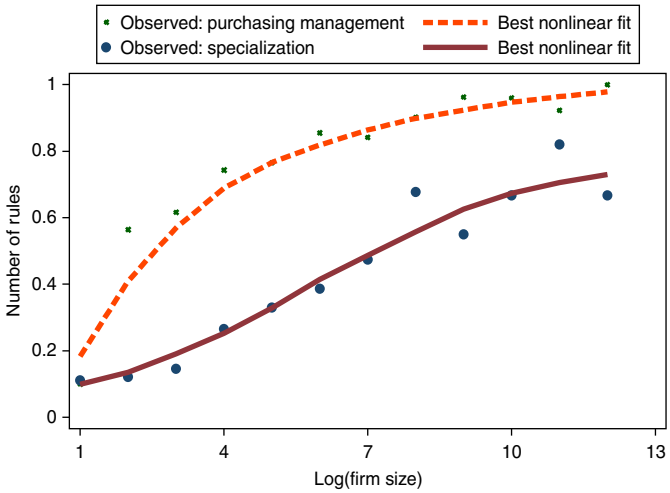

Fig. 10. Rules and standardized procedures concerning purchasing management (upper line) and specialization and division of labor (lower line), by (the natural log of) firm size.

Let us consider what we mean by the size of the (respondent's) firm. All analyses presented here are based on a variable representing the natural log of the number of employees in the firm of the respondent (that is, the buyer's firm). Throughout all three data collections, "firm" was taken to mean "the largest organizational unit for which you and your department carry responsibility".

If we only control for the three different waves of data collection, we indeed see that on average larger firms are confronted with more problems in their IT-purchase. Fig. 11 shows a graph that summarizes this analysis.

By itself, this does not yet mean much, since there can be several reasons why we find such an increase in problems for larger firm sizes. We summarize a few of these possible reasons.

First, it is conceivable that SMEs are in some unspecified sense "structurally different" from larger firms, and more so the larger the firm is. This would mean that if we add a dummy predictor variable equal to '1' if a firm is large, we should find an effect even on top of the linear effect of firm size. Our analysis shows this is not the case ($p = 0.64$). The second possible reason is that larger firms generally invest less in management, or manage their transaction less effectively, than smaller firms, which is why they end up with more problems. We investigate this possibility together with a third explanation, namely, that larger firms purchase IT-products and services that are in general more risky, for instance because they tend to buy more complicated products and services (and in larger quantities).

To explore this issue, we once again ran a 3-SLS regression, trying to predict the amount and degree of problems from a variety of characteristics of the transaction, the buyer and the supplier. Again, we have to take into account that the investment in management of a transaction, a potential predictor of the amount and

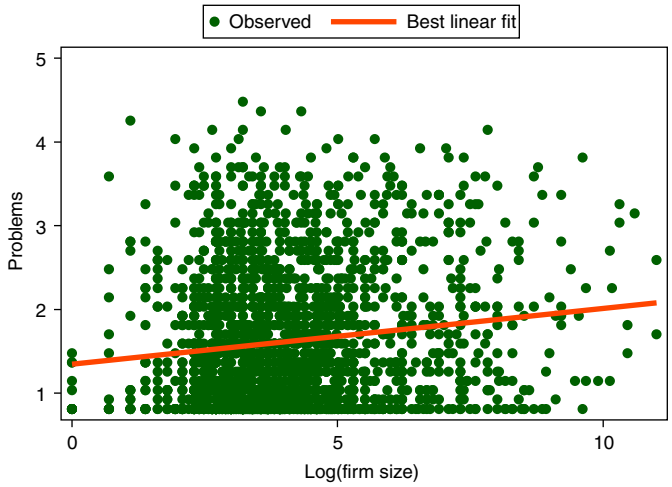

Fig. 11. Relation between (log of) size of respondent's firm and the amount and degree of problems encountered, controlling for different waves of data collection. Firm sizes vary from smaller than 10 to more than 10,000. The problems increase with firm size ($p<0.001$).

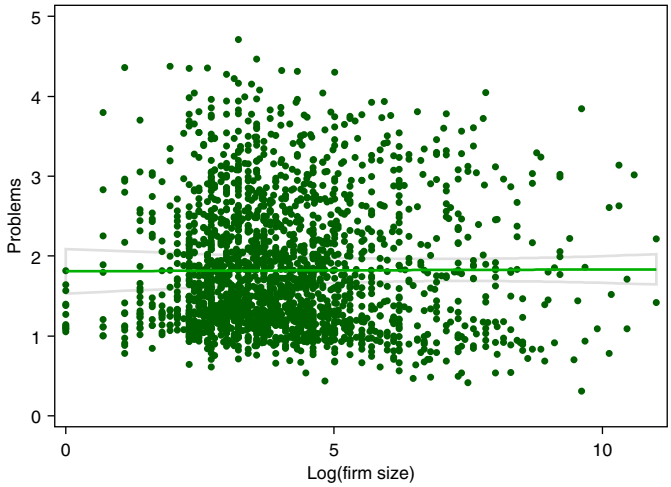

Fig. 12. Estimated effect of (log of) firm size on the amount and degree of problems, controlling for the investment in management, the financial volume of the transaction, and the degree of monitoring problems. The effect of firm size (the horizontal line) is not significantly different from zero ($p = 0.824$).

degree of problems encountered, is itself endogenous and determined by almost the same characteristics. Because of space limitations, we confine ourselves to a graphical representation of the most important results: Fig. 12.

It turns out that our third possible explanation is in concurrence with the data: the alleged effect of firm size has something to do with the kind of purchasing transactions larger firms tend to undertake (at least in our data). We can see this if in our analyses we take into account the financial volume of the transaction, monitoring difficulties, switching costs, and the importance of the product or service for the firm.

The financial volume of the transaction simply refers to the (log of) the amount of money that was involved in the focal transaction. Monitoring difficulties arise when a firm is buying a product or service where, even after delivery, it is hard to judge whether or not the supplier has lived up to its promise. It was measured as a factor score based on questions regarding the degree to which it was easy to judge the quality of the product or service on delivery, regarding the ease with which one could evaluate tenders, regarding the ease with which one could judge the price/quality ratio, and whether there were any employees available with specific expertise in IT. Switching costs is measured as a factor score based on questions regarding the damage to the buyer in case the product or service did not function properly and had to be replaced immediately. The importance of the product or service for the buyer is also calculated as a factor score, based on two questions: one regarding the importance of the product or service for the profit of the firm and one regarding how important it was that delivery was on time. Taken together, the financial volume, monitoring difficulties, switching costs, and the importance of the product or service for the firm, are a good proxy of the general "degree of risk" involved in the purchasing transaction.

As an interesting aside, the analyses bring to light the fact that if one controls for the degree of risk involved, there are no longer any differences with respect to the investment in management. What is more important is the fact that after controlling for the degree of risk of the transaction, there are no longer any differences between smaller and larger firms ($p = 0.824$; or SMEs versus multinationals, $p = 0.33$, for that matter). In other words, the fact that larger firms encounter more problems can be completely "explained away" by the difference with respect to the degree of risk involved in the transactions. The larger firms encounter more problems, but that is because larger firms on average deal with more risky transactions (that is, assuming that our way of sampling transactions does not lead to any systematic differences with respect to the choice of transactions across small and large firms). However, if we compare how firms of different sizes deal with transactions of a similar degree of risk, then smaller and larger firms can no longer be discerned. Small and large firms show similar investments in transaction management *and* similar amounts of problems. Hence, we see that although small and large firms differ with respect to several issues, most notably the kind of transactions they are confronted with, we find no evidence that the underlying mechanisms to deal with purchasing transactions and the problems experienced differ.

4. Conclusion and discussion

We conclude by first summarizing our main findings. First, though the ability to deal with IT-purchases has increased over the years, the amount of problems

experienced has not diminished. IT-managers have become better at judging IT-purchases, but IT-projects have in the meantime also grown more complex, and the net effect on the ability to preclude problems is zero. Second, the types of problems with IT-transactions that are encountered most are not the ones managers expect to occur most often. The ones that occur most often are generally related to after sales issues, and much less related to exceeding the budget, compatibility issues, and time delays. Third, we find no evidence that large investments in planning and contracting are useful in preventing problems, although they might have other benefits (such as improving the relationship with the supplier). A certain minimum investment in planning and contracting is necessary, but after that the extra investments do not—on average—help prevent problems. Fourth, the current rules and procedures within our firms generally lead to larger management investments, but not to fewer problems. Finally, large firms are not so different from small- and medium-sized enterprises (SMEs): with respect to investment in purchasing management and the problems that go with it, our data indicate that the underlying mechanisms are actually similar for small and large firms.

All of these findings warrant further research as to their general validity and implications, but we do want to emphasize that being able to come up with findings that are counterintuitive *and* have a factual basis is only possible given that we have been collecting quantitative data over a larger period of time on a relatively large scale. Without denying the importance of qualitative research, we feel it is curious and unfortunate that so little of the purchasing literature is developed in quantitative ways (note: the MAT95 and MAT98 data are freely available from the Steinmetz archives, www.niwi.knaw.nl/en). An issue that complicates the analysis of the supplier's performance is that, even if quantitative data are available, one needs relatively sophisticated ways of analyzing the data. Our analyses show that if one—inappropriately—applies standard regression models, the conclusions can turn out to be simply wrong.

Of course, large-scale quantitative data collection suffers from its own disadvantages. For instance, because we collected data only from the buyer, this gives us by definition a one-sided view of the transactions under study. Moreover, although we tried hard to find respondents who were involved in the transaction under study and sufficiently aware of its details, the data are collected retrospectively (some more than others), so that recollection biases are a general risk. Nevertheless, we feel that our approach is promising also in a different respect. As our last finding shows, even when one considers purchasing transactions in a relatively small domain (IT-products and services by SMEs), careful and elaborate measurement can add to the general validity of the results. In part, this is because we control for many intervening variables. This implies that if one expects that, for instance, differences exist between SMEs and larger firms with respect to the factors that drive the probability of problems, they must be related to variables other than the ones we already control for. However, as we saw using MAT03, the differences between SMEs and larger firms are in fact negligible with respect to the underlying mechanisms.

That brings us to the scope of our findings. Basically, we see no reason why IT-purchasing in The Netherlands would be different from IT-purchasing in any other developed western country, so we do expect our results to hold for IT-purchasing in general. Our general suspicion is that after controlling for characteristics of transactions, buyers, sellers, and investment in management, not many differences with purchasing of other products in other contexts will remain. This implies that we are quite confident about the validity of our results for purchasing in, say, facility management or consulting. What we can imagine is that differences will exist for purchasing of other products in different contexts when the relative efficiency of management mechanisms differs from that in purchasing. The purchasing of IT is in many ways 'uncertain', especially when the IT is non-standard, and it is hard to make contractual agreements about it. Compared to other products or services, it is difficult to specify concrete targets for software or even hardware in contractual agreements. Moreover, the buyers of IT—especially the SMEs—are not very well connected socially, so that more informal mechanisms of governance are not likely to work. One way to progress that we are currently undertaking (Kamann et al., 2005) is to run a similar study in a context where contracting is easier because products are more standard, and the social network between buyers is more dense, such as contractor–subcontractor relations in the (Dutch) construction industry. In such a context both formal management through contracts and informal management through networks that spread information and reputation should be more efficient. The latter issue is another interesting question for future research. Given that we find relatively little support for the use of formal investment mechanisms such as contracts, one could try to understand better how *in*formal ways of safeguarding a transaction might work (cf Rooks et al., 2005). Finally, our findings about rules and procedures suggest an obvious follow-up question: how can rules and procedures be designed so that they do reduce problems in buyer–supplier relations, or are there other benefits from standardized rules and procedures that compensate for the increased level of management they tend to invoke?

5. Implications for practitioners

Our results suggest five main implications for practitioners:

(1) With growing experience in (IT-)purchasing, managers might be tempted to think that their problems with suppliers will diminish. They should bear in mind that both the complexity of the products and services they

buy and the experience of their supplier may grow at the same or even a faster pace.

(2) It is possible or even likely that the image that one has about the kinds of problems that are most likely to surface is wrong. These problems concentrate on after sales issues much more than one usually thinks.

(3) On average, investment in the management of purchasing transactions of firms is too high. It is likely that a smaller investment would have lead to the same supplier performance, and is worth the risk.

(4) Internal rules and regulations are usually too rigid: they lead to increased investments in management, but not to fewer problems with the purchasing transaction. There can be many reasons to have rules and regulations, but if one of these reasons is that one expects higher satisfaction with the end result (fewer problems), then this is a mistake.

(5) Do not dismiss results that are based on large-scale data analysis too easily as "not appropriate for my firm", simply because your firm is working in another sector, or somewhat larger, or otherwise different from the original study's target population. When the study adequately controls for many factors—as is the case here—it is likely that its conclusions also have an impact on firms in your own sector.

Acknowledgment

We gratefully acknowledge the remarks by the editors and by two anonymous reviewers.

Appendix A

The general issue is this. Suppose we want to predict problems from the investment in management and some other characteristic(s) of product, buyer and/or supplier.

$$\text{PROBS} = \text{c0} + \text{c1 INVEST} + \text{c2 CHAR1} + \text{c3 CHAR2} + \varepsilon. \quad \text{(A.1)}$$

However, we know that the investment itself is determined by similar characteristics.

$$\text{INVEST} = \text{d0} + \text{d1 CHAR1} + \text{d2 CHAR2} + \text{d3 CHAR3} + \delta, \quad \text{(A.2)}$$

where the δ and ε represent the residuals of the equations. If δ and ε are related, one of the assumptions underlying OLS-regression is violated, because INVEST and ε are then related. In general, this will lead to biased results. However, given that we indeed have variables such as CHAR3 in the above equation—a variable that is related to INVEST but not to PROBS—we can solve this issue by applying 2-stage least-squares regression (or: 3-stage least-squares regression). This involves estimating Eq. (A.2), and using the estimated values of INVEST as a predictor in Eq. (A.1), instead of INVEST itself. In the 3-stage least-squares approach we use, we also adapt the standard errors of the coefficients on the basis of the covariance matrix of the residuals. Table A1 shows the results of a representative analysis.

Table A1
Results of the three stage least squares estimation

	MAT98/03 + rules		MAT95/98/03	
	Coef.	$P>\|z\|$	Coef.	$P>\|z\|$
Problems				
Management	0.248	0.506	0.201	0.167
Complexity	0.004	0.946	0.005	0.893
Software (dummy)	−0.046	0.802	0.084	0.188
Hardware (dummy)	0.098	0.205	0.074	0.108
Monitoring problems	0.172	0.000[a]	0.187	0.000[a]
(log of) Financial volume	−0.012	0.785	0.010	0.697
Switching costs	0.074	0.264	0.044	0.079
Importance of durability	−0.043	0.114	−0.043	0.022[a]
Importance of on time	0.013	0.869	0.040	0.214
Did business before (dummy)	0.148	0.177	0.142	0.024[a]
If yes, how satisfied	−0.073	0.009[a]	−0.064	0.000[a]
Future interaction likely	0.028	0.247	0.035	0.023[a]
Reputation of supplier	−0.432	0.000[a]	−0.427	0.000[a]
Dependent on supplier	0.007	0.761	0.020	0.169
Size of buyer firm	0.003	0.892	0.008	0.645
Buyer firm is SME	−0.079	0.393	−0.073	0.303
Size of supplier firm	−0.020	0.311	−0.033	0.010[a]
Year of purchase	−0.027	0.237	−0.000	0.985
(log of) Outdegree	−0.021	0.476	−0.029	0.177
MAT98 data (dummy)	−0.122	0.738	0.087	0.329
MAT03 data (dummy)			0.091	0.552
Number of rules	−0.013	0.743		
Constant	57.914	0.206	3.167	0.871
Management				
Complexity	0.181	0.000[a]	0.257	0.000[a]
Software (dummy)	0.447	0.001[a]	0.221	0.017[a]
Hardware (dummy)	0.115	0.262	0.050	0.510
Monitoring problems	0.097	0.042[a]	0.079	0.017[a]
(log of)Financial volume	0.107	0.001[a]	0.156	0.000[a]
Switching costs	0.172	0.000[a]	0.146	0.000[a]
Importance of durability	0.049	0.147	0.075	0.004[a]
Importance of on time	0.193	0.000[a]	0.171	0.000[a]
Did business before (dummy)	0.177	0.230	0.068	0.507
If yes, how satisfied	−0.047	0.209	−0.037	0.156
Future interaction likely	0.015	0.687	−0.019	0.444
Reputation of supplier	0.217	0.017[a]	0.207	0.018[a]
Dependent on supplier	−0.034	0.314	0.006	0.793
Size of buyer firm	0.033	0.355	0.028	0.323
Buyer firm is SME	0.068	0.643	0.046	0.697
Size of supplier firm	0.039	0.071	0.053	0.003[a]
Year of purchase	−0.023	0.500	−0.018	0.235
(log of) Outdegree	0.059	0.070	0.096	0.000[a]
MAT98 data (dummy)	−0.869	0.000[a]	−0.210	0.134
Number of rules	0.098	0.000[a]		
MAT03 data (dummy)			0.699	0.000[a]
Contract made by supplier	−0.087	0.268	−0.170	0.005[a]
Own legal expertise available	0.175	0.159	0.249	0.002[a]
External legal exp. available	0.113	0.344	0.150	0.044[a]
Constant	42.712	0.534	33.419	0.284

[a]Significant at the 5% level.

References

Auer, J., Harris, C.E., 1981. Computer Contracts Negotiation. Van Nostrand, New York.

Axelrod, R., 1984. The Evolution of Cooperation. Basic Books, New York.

Batenburg, R., 1997. The external management of automation 1995. Codebook of MAT95. ISCORE Paper, no. 58, Utrecht University.

Batenburg, R., Raub, W., Snijders, C., 2003. Contacts and contracts: dyadic embeddedness and the contractual behavior of firms. In: Buskens, V., Raub, W., Snijders, C. (Eds.), The Governance of Relations in Markets and Organizations, Research in the Sociology of Organizations, vol. 20. JAI/Elsevier, Oxford, pp. 135–189.

Blumberg, B.F., 2000. Cooperation contracts between embedded firms. Organization Studies 22, 825–852.

Blumberg, B.F., 2001. Efficient partner search: embedded firms seeking co-operative partners. Journal of Mathematical Sociology 25, 329–354.

Buskens, V., Batenburg, R., 2000. The external management of automation: codebook for the combined data from the Netherlands and Germany. ISCORE Paper, no. 175, Utrecht University.

Buskens, V., Raub, W., 2002. Embedded trust: control and learning. Advances in Group Processes 19, 167–202 (James S. Coleman Award 2003 of the Section on Rationality and Society of the American Sociological Association).

Coase, R., 1937. The nature of the firm. Economica 4, 386–405.

Coleman, J.S., 1990. Foundations of Social Theory. Harvard University Press, Cambridge, MA.

Cyert, R.M., March, J.G., 1963. A Behavioral Theory of the Firm. Prentice-Hall, Englewood Cliffs, NJ.

Dasgupta, P., 1988. Trust as a commodity. In: Gambetta, D. (Ed.), Trust: Making and Breaking Cooparative Relations. Basil Blackwell, Oxford, pp. 49–72.

Davidson, R., MacKinnon, J.G., 1993. Estimation and Inference in Econometrics. Oxford University Press, New York.

Doherty, N.F., King, J.P., DeSanctis, G., Fulk, J. (Eds.), 1998. Shaping Organization Form. Communication, Connection, and Community. Sage Publications, Thousand Oaks, California, pp. 497–502.

Ewusi-Mensah, K., Przasnyski, Z., 1991. On information systems project abandonment: an exploratory study of organization practices. MIS Quarterly 15, 67–85.

Granovetter, M.S., 1985. Economic action and social structure. The problem of embeddedness. American Journal of Sociology 91, 481–510.

Hornsby, P., Clegg, C., Robson, J., MacLaren, C., Richardson, S., O'Brien, P., 1992. Human and organizational issues in information systems development. Behaviour and Information technology 11, 160–174.

Johnston, J., Dinardo, J., 1997. Econometric Methods, fourth ed. McGraw-Hill, New York.

Kamann, D-J.F., Snijders, C., Tazelaar, F., Welling, D.Th., 2005. The ties that bind. Buyer–supplier relations in the construction industry. In: Calvi, R., Merminod, M. (Eds.), Researches in Purchasing and Supply Management. Proceedings of the 14th IPSERA Conference. Archamps, France, pp. 151–172.

Kreps, D.M., 1990. Corporate culture and economic theory. In: Alt, J.E., Shepsle, K.A. (Eds.), Perspectives on Political Economy. Cambridge University Press, Cambridge, pp. 90–143.

March, J.G., Schulz, M., Zhou, X., 2000. The dynamics of rules. Changes in written organizational codes. Stanford University Press, Stanford, CA.

Mokken, R.J., 1971. A Theory and Procedure of Scale Analysis. Mouton, The Hague.

Morlacchi, P., Lamming, R., Wynstra, F., 2002. IPSERA: ten years and beyond. European Journal of Purchasing and Supply Management 8, 63–70.

Raub, W., Snijders, C., 1997. Gains, losses, and cooperation in social dilemmas and collective action: the effects of risk preferences. Journal of Mathematical Sociology 22, 263–302.

Raub, W., Tazelaar, F., 2000. Probleemstelling, theoretische achtergrond en samenhang met een meeromvattend wetenschappelijk onderzoeksprogramma (Formulation of the problem, theoretical background, and relationship with the more general scientific research program). In: Tazelaar, F., Snijders, C. (Eds.), Samenwerking tussen inkoper en leverancier: het management van inkooptransacties (Cooperation between buyer and supplier: The management of purchasing transactions) Zoetermeer, Nederlandse Vereniging voor Inkoopmanagement (www.nevi.nl), pp. 15–32.

Raub, W., Weesie, J., 1990. Reputation and efficiency in social interactions: an example of network effects. American Journal of Sociology 96, 626–654.

Raub, W., Weesie, J., 1992/3. The management of matches. Decentralized mechanisms for cooperative relations, with applications to organizations and households. Revised version. ISCORE Paper, no. 1, Utrecht University.

Riesewijk, B., Warmerdam, J., 1988. Het slagen en falen van automatiseringsprojecten. ITS, Nijmegen.

Rooks, G., Snijders, C., 2001. The purchase of information technology products by Dutch SMEs: problem resolution. The Journal of Supply Chain Management 37, 34–42.

Rooks, G., Raub, W., Selten, R., Tazelaar, F., 2000. How inter-firm cooperation depends on social embeddedness: a vignette study. Acta Sociologica. Journal of the Scandinavian Sociological Association 43, 123–137.

Rooks, G., Raub, W., Tazelaar, F., 2005. Supplier Performance in IT-transactions: Returns on Social Capital. Utrecht University, The Netherlands (Iscore-paper no. 215).

Snijders, C., Tazelaar, F., Batenburg, R., 2003. Electronic decision support for procurement management: evidence on whether computers can make better procurement decisions. Journal of Purchasing and Supply Management 9, 191–198.

Taylor, M., 1987. The Possibility of Cooperation. Cambridge University Press, Cambridge.

Tazelaar, F., Snijders, C. (Eds.), 2000. Samenwerking tussen inkoper en leverancier: het management van inkooptransacties. (Cooperation between buyer and supplier: The management of purchasing transactions). Zoetermeer, Nederlandse Vereniging voor Inkoopmanagement (www.nevi.nl).

Tazelaar, F., Snijders, C., 2004. The myth of purchasing professionals' expertise. More evidence on whether computers can make better procurement decisions. Journal of Purchasing and Supply Management 10, 211–222.

Vadapalli, A., Mone, M., 2000. Information technology project outcomes: user participation structures and the impact of organization behavior and human resource management issues. Journal of engineering and technology management 17, 127–151.

Weber, M., 1947[1922]. Max Weber: The Theory of Social and Economic Organization (translated by A. M. Henderson and Talcott Parsons). The Free Press, NY.

Welsh, J.A., White, J.F., 1981. Converging on the characteristics of entrepreneurs. In: Vesper, K.H. (Ed.), Frontiers of Entrepreneurship Research. Babson College, Wellesley, MA, pp. 504–515.

Williamson, O.E., 1975. Markets and Hierarchies. Analysis and Antitrust Implications. Free Press, New York.

Williamson, O.E., 1985. The Economic Institutions of Capitalism. Free Press, New York.

Williamson, O.E., 1996. The Mechanisms of Governance. Oxford University Press, New York.

Zellner, A., Theil, H., 1962. Three stage least squares: simultaneous estimate of simultaneous equations. Econometrica 29, 63–68.