

The effects of ERP-implementations on organizational benefits in small and medium-sized enterprises in the Netherlands

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Abstract

In this paper we try to assess the impact of ERP-implementations on the development of organizational benefits, as described by Shang and Seddon (2002) and Eckartz *et al.* (2009). We assess this impact for Dutch small and medium-sized enterprises, using a small but unique dataset. Several types of organizational benefits (concerning, among others, employee morale and the creation of a common vision among employees) are compared before and after the introduction of an ERP-system in a variety of organizations, taking into account a three-year period, and correcting/controlling for several possibly influential factors in the process (like organizational size, financial health and sectoral differences).

We conclude that by and large, organizational benefits did not increase significantly more for organizations that implemented an ERP-system in the last three years than for organizations that did not implement such a system. We can also conclude that organizations that recently implemented an ERP-system did not have significantly lower organizational benefits three years ago than organizations that did not implement such a system. Albeit limited to Dutch SMEs, these results contradict some of the views expressed in the ERP-related literature on the subject.

Key words: ERP systems, organizational performance, organizational benefits, SME, surveys

1. Introduction

“In essence, ERP deployment in itself saves nothing and does not improve anything, it’s the people and processes that create benefits” (Kumar et al., 2002, p. 170)

Ever since their introduction in the 1990s, Enterprise Resource Planning (ERP) systems have been widely used by organizations wishing to work with integrated information systems in the hopes to increase their market agility (Grabski and Leech, 2007; Keller, 1999). Many researchers have tried to assess the impact of the introduction of ERP systems on organizational conduct, often focusing on a system’s performance effects. Examples include Hunton *et al.* (2003), Kallunki *et al.* (2011), Liu *et al.* (2008), Poston and Grabski (2001), Nicolaou (2004) and Nicolaou and Bhattacharya (2006). One of the main questions in this type of research seems to be whether the (chiefly) financial performance of organizations adopting an ERP-system has deteriorated or improved during the post-implementation period.

In this study we define an ERP-system as a business support system that maintains the data needed for various business functions such as manufacturing, financials and supply chain management in a single database, so that transactions only need to be processed once (Kumar and van Hillegersberg, 2000).

The implementation of an ERP-system in an organization is often accompanied by substantial changes in organizational structure and ways of working (Bernroider, 2008; Grabski and Leech, 2007; Kallunki *et al.*, 2011). Such implementations seem to be set apart by their complexity, and more specifically, by the difficulties involved in implementing large-scale changes in an organization together with a transition to new systems, whilst legacy systems may be in place (Kumar *et al.*, 2002; Jones *et al.*, 2006). Eckartz *et al.* (2009) even state that ERP-systems have a “(...) decisive impact on almost all aspects of an organization” (p. 2). Partly, the impact of these effects seems to be influenced by whether or not an ERP-system is tailored to fit an organization before it is actually implemented (Hong and Kim, 2002; Kumar *et al.*, 2002).

In general, organizations (and consultancy firms alike) seem to think that the introduction of ERP-systems allows for more efficiency in organizational work, and therefore, for better (financial) performance vis-à-vis non-adopting organizations, because of the fact that best practices are embraced (Bernroider, 2008; Davenport, 1998; Sneller, 2010). It is also expected that in conjunction to this, ERP-implementations invoke more reliable information recording and exchanges in an organization (Shang and Seddon, 2002). However, is the situation always that simple?

Markus and Tanis (2000) developed a framework to describe the ‘typical’ phases involved in the adoption and implementation of ERP-systems. After a chartering phase, comprising the decisions leading to the approval of the implementation of a specific system, the communication in the organization about this, and the system’s funding, a project phase is entered, in which a system is set up and executed in one or more organizational (business) units, ultimately resulting in its rollout and start-up across the

organization ('going live'). Thereafter, a shakedown phase is usually witnessed, which takes up the period of time between the aforementioned 'go live' date up until 'normal operations' have been achieved. In that case, user acceptance has occurred, bugs have been fixed, system training has been accommodated, and a system has been 'finetuned' to fit an organization. Finally, Markus and Tanis discern an onward and upward phase. This phase generally occurs between 1-3 years after a system's 'go live' date, and entails the period from 'normal operations' until a system is replaced completely by another system or is upgraded. Alas, all of these phases are fraught with problems that can affect an organization's productivity and profitability. For instance, Kumar *et al.* (2002) found that in many Canadian governmental organizations, project schedules tended to be revised as organizations underestimated the amount of work involved in implementing an ERP-system, inadequate training in the new system occurred, and difficulties in assuring the quality of the data entered in the system were paramount. Other studies have reported similar problems: implementation costs may rise exponentially, employees may refuse to work with the new system, and data integration processes between new and old (legacy) systems may be more troublesome than expected (Botta-Genoulaz and Millet, 2005; Hunton *et al.*, 2003; Ross and Vitale, 2000; Nicolaou, 2004; Scott, 1999; Sneller, 2010). It may therefore not come as a surprise that more than 70% of ERP-introductions do not reach their intended effects, and may even be regarded as complete failures (Al-Mashari *et al.*, 2006; Buckhout *et al.*, 1999; Hong and Kim, 2002; Stefanou, 2001).

All of this suggests that ERP-implementations do not end when a system 'goes live', but can yield substantial performance gains and losses as a result of (discrete) changes that happen after the 'go live' date (Nicolaou and Bhattacharya, 2006). This paper wants to tap into some of these changes and effects. We look at organizations that have implemented an ERP-system between one to three years ago, and compare their self-assessed organizational benefits with a set of comparable organizations that did not implement such systems in the same period. The period of three years has been chosen for Nicolaou and Bhattacharya (*ibid.*) concluded that organizations adopting an ERP-system needed at least two years to generate positive financial performance. The authors term this the "(...) lag-led re-emergence of performance gains (...)" (*ibid.*, p. 20) (also see Wah, 2000). Contrary to their research, however, we decide to look at non-financial performance (Shang and Seddon, 2002), this being an area where so far, little research seems to have been done (Eckartz *et al.*, 2009). On top of this, we follow up on Esteves and Bohorquez's (2007) call for more research on the benefits of ERP-implementations in small and medium-sized enterprises, this being the market where ERP-systems are nowadays implemented most often (Adam and O'Doherty, 2003). Our data stem from a unique dataset that we collected ourselves of nearly 100 Dutch organizations, many of them small and medium-sized enterprises, whose head(s) of finance or production were asked to fill in a lengthy questionnaire on the situation of their organization across a three year period. As ERP-systems as such have been said to have their roots in Europe (Pairat and Jungthirapanich, 2005), and, apparently, few studies have been conducted in the Netherlands (Bernroider and Tang, 2003), the focus on this country is interesting as well.

This paper will proceed as follows. We start by setting out the types of benefits that may be expected from an ERP-system, working our way towards the organizational benefits we would like to focus on and the hypotheses we would like to test. Thereafter, our research approach and method will be discussed in detail and related to previous literature. The main results will be presented and discussed. Finally, a concluding section will put forward the conclusions that we think can be distilled from this research. We will also describe some of its drawbacks, and point out what we see as viable avenues for further research.

2. ERP benefits

Eckartz *et al.* (2009) present the results of an extensive literature review on ERP benefits. They aim to determine all potential benefits that may be achieved during and after an implementation, both tangible and intangible. Their intention is to come up with an integrative framework containing all of these benefits, focusing in particular on cross-organizational ERP-implementations, or ERP II-systems (Bond *et al.*, 2000). A major problem they see in the literature is that studies sketching possible benefits often do not discuss how they may be realized, and vice versa. Their literature search, which is conducted according to guidelines set out by Webster and Watson (2002), and also includes concept mapping (Trochim, 1989), not only covers the ERP-related literature, but also literature stemming from logistics and organization theory on inter-company associations. They end up with 30 articles that help to create their integrative framework of ERP (II) benefits. They call the latter the '3-dimensional benefit framework'. It is largely based on the classification of ERP benefits of Shang and Seddon (2002), which the authors find the most comprehensive classification to date (at least, in 2009). The three dimensions Eckartz *et al.* (2009) distinguish are:

- Operational, managerial and strategic benefits (Anthony, 1965; Shang and Seddon, 2002);
- Process, customer, financial and innovation benefits, following the four perspectives of the balanced scorecard (Kaplan and Norton, 1993). Also included is a fifth perspective to assess employee resistance or willingness to change (Eckartz *et al.*, 2009);
- Benefits falling into IT infrastructure and organizational categories (Shang and Seddon, 2002). These are often intangible and hard to identify (such as organizational learning and improvement in communications), and are, consequently, not researched very much (Eckartz *et al.*, 2009).

Eckartz *et al.* explicate ask researchers to validate their framework in a variety of ways, among others by determining how the various dimensions and categories of ERP benefits impact on one another. Our own goal with their framework is, however, more modest. We wish to zoom in on organizational benefits in particular, and try to validate that aspect of their framework, as these benefits apparently have not been researched as often as more tangible ERP benefits like financial performance outcomes (Eckartz *et al.*, *ibid.*; Hunton *et al.*, 2003; Nicolaou and Bhattacharya, 2006).

Shang and Seddon (2002) argue that the organizational benefits of ERP-implementations evolve around the following six issues, which are all taken along in our analysis (see appendix 1 of their paper):

- Changing work patterns with shifted focus: the harmonization of interdepartmental processes and interdisciplinary matters
- Facilitating business learning and broadening of employee skills: greater possibilities to enhance employee learning
- Employee empowerment: more pro-active, perhaps even entrepreneurial, employee behavior and involvement in business management
- Building common visions: departments work as a unit, and not as separate entities, sustaining a shared image on organizational work across different levels of the organization
- Shifting work focus: concentration on core work
- Increased employee morale and satisfaction: increased work efficiency and (more) content users, who are provided with better quality service.

The authors also present a more extensive framework to assess the benefits that may be reaped in the years after the introduction of enterprise systems (ES) in an organization, with special attention to ERP-systems. They call this framework the 'enterprise systems benefit framework'. It intends to help managers to make sound evaluations of the perceived success of an ERP-system some years after its 'go live' date (no specific time period is given though). After having answered seven questions on how to frame organizational effectiveness measurement in their particular setting (Cameron and Whetten, 1983), they apply a self-developed four-step procedure to conduct a literature and Internet search. They come up with five categories and 25 sub-dimensions of ERP benefits, organizational benefits being one of the five main categories. Organizational benefits "(...) arise when the use of an ES benefits an organization in terms of focus, cohesion, learning and execution of its chosen strategies" (Shang and Seddon, 2002, p. 279). Other categories include managerial and strategic benefits (just like the Eckartz *et al.* [2009] framework), while the various sub-dimensions pertain to issues like IT cost reduction, cycle time reduction, and the worldwide expansion of business activities. As stated, these categories and sub-dimensions partly overlap with the Eckartz *et al.* (2009) framework, which uses the Shang and Seddon (2002) framework as one of its cornerstones. The organizational benefits overlap completely.

There are many articles trying to assess the performance effects of ERP-system introductions in an organization (Hunton *et al.*, 2003, Kallunki *et al.*, 2011; Liu *et al.*, 2008; Nicolaou, 2004; Nicolaou and Bhattacharya, 2006; Poston and Grabski, 2001). Although the focus of these papers is chiefly on financial performance effects (the Kallunki *et al.* [2011] paper being one of the few exceptions), the way most of these authors conceptualize their research is also followed here, even though we focus on specific non-financial benefits: the six dimensions of organizational benefits, as set out by Shang and Seddon (2002).

Nicolaou and Bhattacharya (2006) report on their analysis of the long-term financial performance effects of ERP-system revisions for ERP-adopters. They find that changes in ERP-systems often offset implementation issues that at first, negatively affect the financial performance of an organization. The sooner adaptations are made, the better organizational performance may become later. However, adapting a system too late may result in a deterioration of financial performance. Following Nicolaou (2004), they also find that taking into account an (at least) two year time lag may be useful to assess the performance impact of ERP-systems, as this lag seems to be necessary for positive differential financial performance in adopting vis-à-vis non-adopting organizations to start materializing.

Poston and Grabski (2001) examine the post-implementation financial performance of a small group of ERP-adopting firms over a period of three years after the system's adoption, whilst controlling for pre-implementation performance. They note that organizations that have implemented an ERP-system seem to show efficiency gains in some areas, but increased costs elsewhere mostly counterbalance such gains. Perhaps consequently, they find no significant improvement in several financial measures of these organizations across a three year period.

The financial performance effects of ERP-implementations in Chinese chemical firms were assessed by Liu *et al.* (2008). They find no significant performance improvement during the implementation period and during the first three years after implementation. At first, a decline in performance is witnessed, which is in line with the Markus and Tanis (2000) framework and previous studies by Nicolaou and Bhattacharya (2006) among others. However, a slight performance improvement in the third year after implementation occurs, which may indicate that the financial benefits of ERP-implementations may only manifest themselves after more extensive ERP-use. This corroborates similar findings by Hunton *et al.* (2003) and Nicolaou and Bhattacharya (2006), and will be a valuable precondition for our own research as well (see below).

The impact of ERP-system adoption on the financial performance of over 60 organizations that were matched, on the basis of their 2-digit SIC-code as well as their size, with organizations that had not adopted such a system, was the focus of a study conducted by Hunton *et al.* (2003). Although the financial performance of ERP-adopting organizations was generally better over a three year period than for non-adopters, no improvement in the financial performance of adopting organizations could be witnessed before and after the implementation of a system. Nevertheless, the financial performance of non-adopters decreased over time.

Kallunki *et al.* (2011) explore the effects of ERP-implementations on both the financial and non-financial performance of 70 Finnish business-units. They try to assess the joint roles that ERP-systems and management control systems can play in potential performance improvements. Again, it is concluded that ERP-systems can improve both financial and non-financial performance (of, in this case, business-units), chiefly in the long run, and that using specific forms of management control may help to achieve this.

Esteves and Bohorquez (2007) have stressed the importance of more research on the benefits of ERP-implementations in small and medium-sized enterprises. This call is followed up on here. We will compare differences in organizational benefits as defined by Shang and Seddon (2002) in their enterprise system benefit framework, which are also contained in the 3-dimensional benefit framework prepared by Eckartz *et al.* (2009), before and after the implementation of an ERP-system in small and medium-sized enterprises in the Netherlands. Bernroider and Tang (2003), albeit indirectly, seem to suggest that although many studies have been conducted on ERP-system implementation effects in Europe, few studies have been conducted in the Netherlands. As ERP-systems as such have been said to have their roots in Europe (Pairat and Jungthirapanich, 2005), the lack of focus on this country is striking, and will be 'redeemed' here.

A period (lag time) of three years will be taken into account to assess the changes in organizational benefits, following the Hunton *et al.* (2003) and Liu *et al.* (2008) studies. We will control/correct our results for possible sectoral effects and effects related to organizational size. Like in Hunton *et al.* (2003), sectoral effects are taken into account by looking at an organization's 2-digit SIC-code (see also Barber and Lyon, 1996), so as to create matched pairs of organizations whose organizational benefits can be compared. Size is expressed in this study as the natural logarithm of the sales of an organization, which is one of the ways in which Hunton *et al.* (2003) operationalized this item. In addition, we control/correct our results for the financial health of an organization through a self-assessment exercise (Berchet and Habchi, 2005, Hunton *et al.*, 2003)¹, and for perceived environmental uncertainty (PEU), so as to include a measure for the turbulence in the surroundings of an organization (Vluggen, 2006). Finally, we take into account the 'go live' date of a system, as ERP benefits may only be reaped after a certain period of time when the aforementioned date has passed (Nicolaou and Bhattacharya, 2006; Wah, 2000). Regression analysis is used to accommodate the aforementioned corrections, after which several Wilcoxon paired-sample tests are carried out to assess the impact of ERP-implementations on the development of organizational benefits. More details on the actual methods used will be provided in the next section.

As this is one of the first studies examining the performance effects of ERP-implementations in terms of (the organizational benefits contained in) the Eckartz *et al.* (2009) and Shang and Seddon (2002) frameworks, we assert that it is mainly exploratory in nature (Smith, 2003). Nevertheless, in line with previous research on the financial performance of ERP-adopting organizations, we believe that the following two hypotheses may be put forward that are interesting to test in the current setting:

H1: Organizational benefits are significantly larger for organizations that have implemented an ERP-system in the last three years than for organizations that do not have such a system (for reference, see our description of the Hunton *et al.* [2003], Kallunki *et al.* [2011] and Liu *et al.* [2008] studies).

¹ Refer to the following section for more details about this self-assessment.

H2: Organizations that implemented an ERP-system in the last three years had significantly better organizational benefits three years ago than organizations that did not implement such a system (for reference, see our description of the Hunton *et al.* [2003] study).

We will now continue with our research approach. Our analysis protocol will be described subsequently, together with our research findings.

3. Research approach and results

There is little information available on ERP-implementations in SMEs (Esteves and Bohorquez, 2007), let alone that there are specific databases about this subject that can easily be accessed in the Netherlands (Bernroider and Tang, 2003).

The data used in this analysis have, therefore, been obtained via a self-developed survey that was almost entirely based on validated concepts taken from the ERP- (and related) literature (Bradley, 2008; Eckartz *et al.*, 2009, Grabski and Leech, 2007; Hong and Kim, 2002; Shang and Seddon, 2002; Soja and Poliwoda-Pekosz, 2009; Vluggen, 2006). Through the survey, we wanted to assess the performance and circumstances in which a variety of Dutch organizations (many of them SMEs) operated in the period 2007-2009. Two surveys were developed: one for organizations that had implemented an ERP-system somewhere in the last three years (and had no such system before), and a highly similar survey for organizations that did not have an ERP-system - the main difference being that the latter survey came without the questions on ERP.

As part of the preparation for their master of science thesis, part-time master of science students in accountancy from Nyenrode Business University were asked to select and approach top-level managers who were knowledgeable about an organization's primary processes (CFOs, CIOs, etc.) in four organizations: two organizations with and two organizations without an ERP-system. Preferably, these organizations had to come from the same sector (expressed in 2-digit SIC-codes) and from within their own network, in order to permit relatively easy data access and analysis. The data were collected in November and December 2010. Exactly 100 surveys were completed. The data were returned both on paper and in a pre-prepared Excel-sheet. As names and contact persons of the organizations that had been approached had to be handed in as well, this enabled us to check, in individual cases, whether the organizations in question had indeed been approached, and an appropriate interviewee had been selected. Also, several checks were carried out to safeguard that the data had been entered correctly in Excel (for instance, by checking several surveys in their entirety or by checking specific variables across surveys)². Examples of survey questions can be found in Appendix 1.

First, the SMEs in the dataset were set apart. The mean number of employees (expressed in FTEs) and mean annual turnover for the 2007-2009 period were

² Both surveys can be obtained from the corresponding author on request.

calculated, so as to accommodate the definition of SMEs according to EC guideline 2003/361/EC³. Organizations that had, on average, between 10 and 249 employees, and a yearly turnover larger than 2 billion Euros, but less than or equal to 50 billion Euros, were labeled 'SMEs' in this study. As a consequence, the number of observations that could be used in the analysis decreased from 100 to 41.

At the time that the surveys were prepared, we had no access to previous operationalizations of the six dimensions of organizational benefits mentioned by Shang and Seddon (2002). Consequently, we had to operationalize them ourselves, and decided to use ten aspects that we believed captured what Shang and Seddon (2002) wanted to indicate by these dimensions. To assess the validity of our operationalization, Cronbach alpha analyses were carried out before further analysis was started (Nunnally, 1978). As can be inferred from Appendix 1, respondents were asked to indicate how they judged the performance of their organization on (among others) the abovementioned ten aspects, both currently and three years ago. A Likert 1-7 scale was employed to assess this (Grabski and Leech, 2007). A low score indicated that they thought their organization performed poorly on a particular aspect, whereas a high score indicated very good performance.

Below it is shown how the six dimensions of organizational benefits distilled by Shang and Seddon (2002) can be linked with the ten aspects contained in our questionnaire (which are depicted in italics):

- Changing work patterns with shifted focus: the harmonization of interdepartmental processes and interdisciplinary matters⁴
Internal communication
Standardization of work processes
Quality of internal reports
- Facilitating business learning and broadening of employee skills: greater possibilities to enhance employee learning
The size of budgets available for internal and external courses
- Employee empowerment: more pro-active, perhaps even entrepreneurial, employee behavior and involvement in business management
The degree to which work activities and decision power has been relegated to other employees than managers
Flexibility of work processes
- Building common visions: departments work as a unit, and not as separate entities, sustaining a shared image on organizational work across different levels of the organization

³ Refer to http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm for details.

⁴ It may be argued that internal communication and the quality of internal reports, which have now been placed under the 'changing work patterns with shifting focus' header, could also have been placed under 'increased employee morale and satisfaction', given the latter's definition. However, since we are studying organizational benefits *in toto*, the exact dissection of these benefits in subcategories is not important to us.

Building a common, organization-wide vision

- Shifting work focus: concentration on core work

Focus on core tasks

- Increased employee morale and satisfaction: increased work efficiency and (more) content users, who are provided with better quality service.

Employee satisfaction

Mutual behavior of employees

As it turned out, all ten aspects could be grouped under the same header – in this particular case, ‘organizational benefits’. The Cronbach alpha values were over 0.70, both in case the current data and the data stemming from three years ago were used (Nunnally, 1978). For the current data, the Cronbach alpha value was 0.77, for the data stemming from three years ago it was 0.84. This validated our conception of organizational benefits, in both situations.

The main part of the analysis then proceeded as follows. To accommodate both H1 and H2, we first ran the following regression for every organization that had implemented an ERP-system in the last three years:

$$\text{LOGMSALES} = \beta_0 + \beta_1 \text{FINHEALTH}_t + \beta_2 \text{PEU}_t + \beta_3 \text{GOLIVE} + \epsilon_t$$

where:

LOGMSALES = the natural logarithm of the mean of organizational sales for the 2007-2009 period (our size measure)

FINHEALTH = financial health of an organization

PEU = perceived environmental uncertainty

GOLIVE = dummy indicating whether the ‘go live’ date of a system occurred in 2007 (‘0’), 2008 (‘1’), or 2009 (‘2’)⁵.

We ran a regression, for contrary to previous studies like Hunton *et al.* (2003), we believe that organizational size is dependent on a number of factors, the influence of which has to be purged before matching can occur. We chose to correct our measure of organizational size for effects occurring both in- and outside organizations. The reason for including the ‘go live’ date of a system has already been set out in the previous section: it generally takes time before the fruits of an ERP-implementation can be reaped (Markus and Tanis, 2000; Nicolaou and Bhattacharya, 2006).

The PEU variable has been incorporated to accommodate effects occurring in the environment of an organization. It has been taken from Vluggen (2006). He uses six items, on a Likert scale ranging from 1-6 (where ‘1’ indicates ‘high stability’ and ‘6’ ‘high instability’), to assess the turbulence of the surroundings an organization operates in. The six items cover issues like the predictability of consumer tastes, the rate of change

⁵ One organization had a ‘go live’ date that occurred in 2010. Since the size variable had been calculated as a mean for the 2007-2009 period, we removed this observation from the dataset, so that we ended up with 40 observations instead of the previously mentioned 41 to be used.

in the portfolio of products and services offered, the rate of change in production technologies, etc. Also here, a Cronbach alpha analysis was carried out to see whether the six items could be grouped under the 'PEU' header. Alas, the Cronbach alpha value was only 0.58, but could be increased to 0.65 by deleting an item on the speed with which an organization generally responded to market changes. Although below the commonly used 0.70 threshold, the value of 0.65 is still deemed acceptable in exploratory studies like this (Nunnally, 1978). Thus, the scores for the five remaining items Vluggen (2006) distinguishes were added to come up with the value of the PEU-variable used in the regression analyses.

The financial health variable, taken from a single question on the survey measured on a Likert scale ranging from 1-6 (where '1' indicates 'completely disagree' and '6' 'completely agree'), tried to put the respondent's view on whether he or she thinks their organization is in a healthy financial state. This can affect the benefits ultimately obtained from an ERP-system, as has previously been indicated by Berchet and Habchi (2005) and Hunton *et al.* (2003) among others. On top of this, we feel that the recent financial crisis, which occurred in the period of study, exacerbated the relevance to include this variable in our analysis.

The standardized residuals of the abovementioned regression were used to facilitate the matching of organizations whose organizational benefits are to be compared to one another. A similar regression was run for organizations without an ERP-system, albeit without the 'go live' variable.

By and large, the regression results were not impressive. The regression for ERP-related organizations had an R^2 of 0.074 (with 21 observations), with no statistically significant variables at either the 5% or 10% significance level except for the constant term (although both LOGMSALES and the standardized residuals of the regression were normally distributed according to a Kolmogorov-Smirnov test at both of the aforementioned levels of significance, with p -values equal to 0.877 and 0.851 respectively) (Hair *et al.*, 2010). Roughly the same conclusion held for the regression within the group of non-ERP adopting organizations (with 19 observations), which yielded an R^2 of 0.043 and similarly statistically insignificant and normally distributed variables (p -values of the Kolmogorov-Smirnov test for the LOGMSALES variable and the standardized residuals were now 0.612 and 0.789 respectively)⁶.

Thereafter, we tried to match organizations based on their 2-digit SIC-code (Barber and Lyon, 1996; Hunton *et al.*, 2003) and the standardized residuals from the two regressions⁷. In Table 1 it can be seen in which sectors the sample organizations with and without an ERP-system primarily operated.

⁶ In both regressions, the residuals were homoscedastic according to the (visual inspection) procedures described by Hair *et al.* (2010).

⁷ As the regression results were largely unimpressive, one may wonder what would have happened if we had used the LOGMSALES variable besides the 2-digit SIC-codes in our matching procedure, instead of standardized residuals. As it turns out, two different matches would have been made, but the overall results would have remained the same.

Table 1 Sample overview by sector and ERP- and non-ERP adopting organizations (as indicated by the number of standardized regression residuals). Stars (“*”) signify the maximum of number of matches possible per sector using 2-digit SIC-codes. Crosses (“+”) indicate further matches possible for 1-digit SIC-codes. Also see the text below.

<i>SIC-code</i>	<i>Number of ERP-adopting organizations</i>	<i>Number of non-ERP adopting organizations</i>
20	0	1
25*	1*	1
26	0	1
28	5	2*
29*	1*	1
31	1	0
35	2	0
45*	1*	4
50	0	1
52	0	1
60	0	2
65*	2	1*
70 ⁺	0	3 ⁺
71 ⁺	1	0
72 ⁺	3	0
74 ⁺	2	0
85	1*	1
93	1	0
Total	21	19

From Table 1, it is immediately clear that we could not match all organizations for the presence of a sometimes dissimilar number of observations (standardized residuals) per sector. For instance, there were five organizations in the dataset with SIC-code 28 (producers of metal products) among the organizations with an ERP-system, but only two among the non-adopting organizations. Therefore, at best, two organizations could be matched for this particular sector. On top of this, there were several sectors that had at least one ERP-adopting firm, but none non-adopting firm, and vice versa (for example the sectors with SIC-code 35 and 52). In the end, we could match only 7 of the 20 organizations, in a total of 6 sectors (spread among SIC-code 25 to 85). These are indicated by a star (“*”) in Table 1.

This number we deemed too low to conduct any further statistical analysis. However, when we look at the 1-digit SIC-codes in Table 1, we see that three other organizations may be matched within SIC-code 7, as there are 6 observations in SIC-codes 71, 72 and 74 of ERP-adopting firms, and 3 observations, all in SIC-code 70, among non-adopting firms. This we indicated by a cross (“+”) in Table 1. We decided to add these matches to our sample, yielding a total of 10 matched pairs of organizations.

As a consequence of the relatively low number of observations left after the matching had been done, we decided to apply a Wilcoxon paired-sample test, this being a non-parametric counterpart of the perhaps more commonly used independent sample t-test

(Hair *et al.*, 2010). This happens to be the same test that has been used in similar studies on the subject (see, for instance, Hunton *et al.*, 2003), and it can accommodate samples sizes less than ten and still yield sufficient statistical power (Noether, 1987).

Two Wilcoxon paired-sample tests were carried out, for H1 and H2. In both cases, we could not reject the null hypotheses that differences in organizational benefits were present between our pairs of ERP and non-ERP adopting firms (p-values were 0.61 and 0.65 respectively). Thus, organizational benefits were not significantly larger for organizations that implemented an ERP-system in the last three years than for organizations that did not have such a system. On top of this, organizations that implemented an ERP-system in the last three years did not have significantly better organizational benefits three years ago than organizations that did not implement such a system. We believe that the relatively small number of observations in our final sample cannot be 'blamed' for this outcome, as the Wilcoxon tests had sufficient power (Noether, *ibid.*).

Given the abovementioned results, one might wonder whether the ERP and non-ERP firms have undergone statistically significant increases or decreases in organizational benefits in the last three years themselves. This was checked by two other Wilcoxon paired-sample tests, using the entire sample of 21 ERP-adopting and 19 non-ERP adopting firms. In both cases, we could reject the null hypothesis that no changes in organizational benefits occurred in the 2007-2009 period (p-values were 0.01 and 0.02 respectively). Thus, both adopting and non-adopting firms had seen significant changes in organizational benefits in three years' time, the changes being positive in both cases (average organizational benefits increased from 44 to 50 for ERP-adopting firms and from 42 to 48 for non-ERP adopting firms). Although organizational benefits, both three years ago and now, were slightly less for non-ERP adopting firms than for adopting firms, they both seem to have increased by roughly the same amount in the intervening period (at least, on average). This suggests that the presence of an ERP-system in Dutch SMEs does not invoke significant performance increases for adopting firms vis-à-vis non-adopting firms (in terms of their non-financial performance), but that other reasons that affect both adopting and non-adopting organizations may be the culprit for the changes that are witnessed.

4. Conclusions and discussion

We started this paper with a quote taken from Kumar *et al.* (2002), stating that there is nothing really special to be expected (in terms of outcomes) of adopting an ERP-system. The adoption does not guarantee anything by itself (better performance, smoother business processes, highly motivated personnel, etc.). More or less, we can substantiate the authors' quote with this study. Organizational benefits, which are typically non-financial in nature (Shang and Seddon, 2002; Eckartz *et al.*, 2009), are not suddenly on the rise when ERP-systems are implemented. Although this conclusion by itself is not new (Grabski and Leech, 2007), it is new in the context of Dutch SMEs. We assert that in this type of organization, in terms of organizational benefits, nothing extraordinary changes for ERP-adopting firms vis-à-vis non-adopting firms over a three

year period. This contradicts previous literature like Hunton *et al.* (2003), Kallunki *et al.* (2011) and Liu *et al.* (2008), albeit these authors tended to emphasize the financial performance of organizations, most of them not being SMEs.

Of course, it may be claimed that our final sample was relatively small, and/or that the period of three years that we have taken into account for the "(...) lag-led re-emergence of performance gains (...)" (Nicolaou and Bhattacharya, 2006, p. 20) to start materializing, was not large enough for SMEs. Although we might concur with the latter remark, as the effects of ERP-implementations in SMEs may impact organizational conduct to an extreme extent and they may therefore need more time to recuperate (Sneller, 2010)⁸, we decline the former, as we did find significant differences in statistical terms when applying some Wilcoxon paired-sample tests on our allegedly small sample (also see Noether, 1987).

The value added of this paper, in our opinion, lies in the fact that as of yet, not much empirically supported research seems to be available for Dutch SMEs (Bernroider and Tang, 2003). Given the exploratory nature of the research (Smith, 2003), we admit that generalizable results cannot be claimed, but still, valuable insights into some of the effects that ERP-implementations might (not) realize in specific settings, focusing on non-financial benefits, have been generated. Further research, using larger samples, and also, perhaps, taking into account the presence of specific integrating mechanisms that might help in realizing the alleged integration benefits of ERP-systems (Grabski and Leech, 2007; Kallunki *et al.*, 2011; Kumar *et al.*, 2002), could yield further important insights into an, in our view, under-researched area in the ERP-related literature.

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⁸ On the other hand, Shang and Seddon (2002), in table 8 of their paper, seem to suggest that it only takes a year for organizational benefits to be reaped as a consequence of ES-implementations, in all types of organizations. This would contradict the view presented here.

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Appendix 1: Examples of survey questions⁹

I. [Based on Eckartz et al., 2009; Shang and Seddon, 2002]

Could you tell us how your organization **currently** performs on the following aspects?
Please use the scale below¹⁰.

(1= very low; 2= low; 3= somewhat below expectations; 4= as expected; 5= somewhat better than expected; 6= high; 7= very high; 8= don't know)

Current performance	Very Low Very high							Don't know
	1	2	3	4	5	6	7	
1. Employee productivity								
2. Quality of products and services offered								
3. Amount of new work processes								
4. The degree to which work activities and decision power have been relegated to other employees than managers								
5. Flexibility of work processes								
6. Order times								

II. [Based on Grabski and Leech, 2007; Hong and Kim, 2002]

When you look back at the situation in your organization **immediately after** the implementation of the ERP-system, when all employees could work with the system for the first time, how far do you do you agree with the following statements?

(1= completely disagree; 2= highly disagree; 3= disagree somewhat; 4= don't agree/don't disagree; 5= agree somewhat; 6= highly agree; 7= completely agree; 8= don't know)

Statements	Completely disagree Completely agree							Don't know
	1	2	3	4	5	6	7	
1. The ERP-system is clearly connected to the ways things are done around the organization								
2. The costs of the ERP-implementation remained with budget								
3. The functionality of the ERP-system corresponded with the functionality it purportedly had to have when it was decided to start the implementation								

⁹ For reasons of space, only parts of the actual questions used are shown.

¹⁰ This question was repeated to assess the situation in an organization three years ago. The underlying items form the main part of the analysis, as far as they pertain to what Shang and Seddon (2002) have called 'organizational benefits'.

III. [Based on Soja and Poliwoda-Pekosz, 2009]

Which role, or combination of roles, did you have during the implementation phase of the ERP-system? Please indicate this in the boxes below.

1. User of the ERP-system	yes/no
2. Tester of the system	yes/no
3. Project team member that was responsible for the ERP-implementation	yes/no
4. Other role, namely	yes/no
5. No role	yes/no