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Ronald Batenburg

Utrecht University, r.s.batenburg@cs.uu.nl

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Cumulating Conditions. An empirical analysis of the EIS adoption by European firms

Ronald Batenburg

Utrecht University, The Netherlands
r.s.batenburg@cs.uu.nl

Abstract

In this paper we aim to empirically test the relative influence of internal and external conditions for the adoption of Enterprise Information Systems (EIS). For this goal data are used from the EU-initiated E-Business W@tch survey 2002/2003 among more than 10,000 organizations from seven different European countries. It appears that organizational size, sector and country all have significant and cumulative effects on the EIS adoption by organizations. More specifically, national culture matters if we control for size and sector.

Keywords: Enterprise Information Systems, Cross-national differences, adoption and use of IS/IT

1 Introduction

Given the fact that the initial adoption of an Enterprise Information System (EIS) by organizations is often the start of an extensive trajectory of IS/IT implementation, deployment and business IT alignment, it remains remarkable that adoption decision as such is out of scope of much IS/IT research. In this paper we focus on the adoption of EIS in organizations as a decision that is taken by managers who process information about (1) alternatives and (2) consequences of that decision. Doing so, we depart from the principle of rational decision making as introduced by social psychologists (cf. Simon, 1957). The key assignment is then to specify the assumptions of this model by defining the critical conditions decision makers are confronted with (cf. Noorderhaven, 1995; Bannister & Remenyi, 1999).

Applied to EIS adoption, we will explore the relevant conditions for managers by three different angles. First, we will focus on organizational size as a basic condition for the EIS adoption decision. Secondly, industry is explored as an institutional condition of the EIS decision. And thirdly, national culture is researched as a cultural condition for EIS adoption. Conceptually, we aim to study the conditions for EIS adoption according to an cumulating ‘inside-out’ approach.

Empirically, we estimate the effect of organizational size, industry and nation on EIS adoption simultaneously, a multivariate approach that is rarely executed in the current literature.

To achieve this, a large-scale dataset is used that results from a international survey among European organizations in 2002 and 2003. This survey is conducted by order of the European Community under the label 'e-Business W@tch'. Since these data play an important part in answering the main research question we start with a short description of its application in this paper.

2 The E-Business W@tch data set

The e-Business data were collected through telephone (CATI) interviews, first in June-July 2002 in all member states of the European Union (i.e. Austria, Italy, Belgium, Luxemburg, Denmark, The Netherlands, Germany, Portugal, Finland, Spain, France, Sweden, Greece, UK and Ireland). In march 2003, the second wave of interviews was held in Norway and the new UE member states (Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Slovenia and Slovakia). With almost 20,000 cases, it is one of the largest organization surveys held in Europe. Field work was executed by national market research organizations. The standard procedure for each country was to sample enterprises that "were active at the national territory of the country", "have their primary business activity in one of the sectors specified by NACE categories" and "can be defined as a business organization of one or more establishments comprised as one legal unit" (E-business W@tch, 2004). Each national sample was stratified by economic activity (15 NACE-defined economic sectors) and size (3 classes; 1-49, 50-249 and 250+ employees).

Due to specific interest of the EU-project and practical restrictions however, not every industry was surveyed in each country. In Cyprus, Lithuania and Malta only companies from one sector (the electrical machinery and electronics industry, or the transport equipment industry) were interviewed. In other countries the number of industries varied between two and 11. Only in France, Germany, Italy, and the UK, data from all 15 sectors (NACE categories) were collected, covering all sectors from manufacturing to the social work sector. Both country and industry are crucial conditions for adoption as will be theoretically elaborated below. As we do not have specific arguments to include or exclude certain countries or sectors (in fact, the main goal is to obtain as much variation as possible on *both* characteristics), we selected the maximum number of countrysector *combinations* within the dataset that contained a substantial number of observations (i.e. 10). Doing so, a subset is created containing 7 (out of 25) countries (Estonia, Poland, Spain, France, Germany, Italy and the UK) and 11 (out of 15) NACE-coded industries (Manufacture of machinery and equipment, Insurance and pension funding services, Publishing, printing, reproduction of recorded media, Monetary and financial intermediation, Food, beverages and tobacco, Manufacture of chemicals/chemical products/rubber/plastic products, Metal products, Transport equipment, Retail, Tourism, Electrical machinery and electronics).

In total, the subset contains 11,099 out of 19,579 cases, i.e. 57% of the total E-Business 2002/2003 dataset. Given the restrictions of the dataset, the spectrum of both countries and industries appears to be sufficiently diverse to execute further analysis.

Cumulating Conditions...

The e-Business W@tch survey contains information about the adoption, use and implications of several types of EIS and applications. The definitions that we consider in this paper is determined by the use of terms in the E-Business W@tch questionnaire. Table 1 first presents the original questions from the survey that will be used in this paper for further analysis, including the overall frequency scores on the (original quoted) answer categories.

Original Question	Original answer categories	Overall frequency in % (N=10,546)
"Has your company implemented a SCM, that is a Supply Chain Management system (IF UNCLEAR, SAY: That is an Internet-based software solution that supports the management of logistics and inventory of goods and connects business partners)?"	- yes	4.2
	- no	89.0
	- do not know	5.7
	what this is	
"Has your company implemented a CRM, that is a Customer Relationship Management system (IF UNCLEAR, SAY: That is a software tool for electronic customer databanks, marketing, sales and service)?"	- don't know	1.1
	- yes	9.8
	- no	84.0
	- do not know	4.9
"Has your company implemented a special Knowledge Management software solution?"	what this is	
	- don't know	1.3
	- yes	6.7
	- no	85.6
"Has your company implemented an ERP, that is an Enterprise Resource Planning System (IF UNCLEAR, SAY: That is a software system which supports an enterprise in planning the business, accounting, stock keeping and procurement)?"	- do not know	5.9
	what this is	
	- don't know	1.8
	- yes	14.3
"Does your company sell goods or services on the Internet or through other online distribution channels?"	- no	79.2
	- do not know	5.0
	what this is	
	- don't know	1.4
"Does your company use the Internet or other online services to purchase goods or services?"	- yes	13.8
	- no	85.7
	- don't know	0.5
	- yes	39.0
	- no	60.1
	- don't know	0.9

Table 1: Original question, answers and frequencies of six types of EIS adoption in a subset of the E-Business W@tch data 2002/2003.

From Table 1, a number of critical remarks can be made. First, it appears disadvantageous that the phrasing of the questions and answer categories are of a rather general nature. As quoted in the table, the interviewer was instructed to explain the terms SCM, CRM and ERP if necessary. However, around 5 % of the respondents still provided "don't know" and "don't know what that is" as an answer. This was especially the case in smaller firms where the managing director or owner was interviewed, whereas in large enterprises the targeted respondent were mostly IT manager and the like. Given the aim of our analysis, explaining the decision making around EIS adoption, we removed the respondents that

provide these answers. Secondly, one can debate if the 'yes'/'no' answering is adequate for all respondents. With regard to ERP for instance, it might be the case that some organizations have implemented a full integrative system, while other firms have deployed one module only. In some cases CRM and SCM might be implemented as separate EIS, but also as an extension of their running enterprise software or systems. Third, it remains hidden if the EIS are tailor-made applications, product software, or hybrid forms such as best-of-breed, a distinction that can matter in terms of deployment and implications of the adoption, implementation.

At first sight, these disadvantages seems to be 'worked around' by the last two questions about purchasing and selling on/over the Internet as these are formulated in terms of activities, not systems or applications. Both questions however, similarly strengthen the notion that the E-business W@tch data only provides high-level indicators of the EIS that are in use by the interviewed organizations. Consequently, the approach of this paper is to similarly describe and explain the adoption decision process on the abstract or strategic level. We focus on the question if organizations, by the perception of the interviewed manager, indeed use ERP, SCM and other types of EIS or not. Doing so, we assume that these EIS are, in principle, known and available to be adopted by the organization, in some way, and at a certain moment in time. Consequently it should also be realized that the E-business W@tch survey took a snapshot of the organizations' situation in 2002 and 2003.

Given these important remarks, comparison of the actual percentages in Table 1 do not show remarkable results. Knowledge management and SCM are implemented in only a small minority of firms (4%, 7%), while ERP and CRM, much more known and discussed over the last decades, are implemented in 10 to 14% of the companies. The deployment of e-business, measured by the 'use of the Internet', is executed in more organizations. In particular, the on-line purchase of goods is executed by nearly 40% of the respondents.

3 A basic condition for adoption: the effect of organizational size

If we draw back on the ERP literature, the internal determinants of adoption dominate (Laukkanen et al., 2007; Light and Papazafeiropoulou, 2004). Several authors name adoption arguments as integration between business processes through integration across modules (applications) by one architecture, shift from tradition functional mode to business process mode or single uniform and coordinated information systems (Poston and Grabski, 2001; Hong and Kim, 2002; Rajagopal, 2003). Most of these adoption arguments refer to functional/technical domains, while the strategic/organizational motivations seem to be somewhat underrepresented. As Laukkanen et al. (2007) and Banker et al. (2000) have demonstrated, organizations are more likely to adopt ERP systems if coordination is critical, if they are centralized, and if a low-cost or low-price strategy and a top-down focused financial strategy is followed. Still it remains hard to find explicit links between EIS adoption and strategy, as it is strongly promoted by the concept of strategic or business-IT alignment (Henderson and Venkatraman, 1993; Benjamin and Levinson, 1993; Yetton and Johnson, 1994; Hsiao and Ormerod, 1998; Feeny and Willcocks, 1998). According to this approach, model organizations simultaneously integrate the strategic and

functional layers, as well as the internal and external domain of business and IT. The model has been elaborated, amongst others by Luftman (2000) who developed measurements to assess a company's strategic alignment maturity level. With varying success, the connection between alignment and organizational performance has been investigated (Peppard and Ward, 1999; Kearns and Lederer, 2000).

In this paper, we restrict the analysis of internal conditions on EIS adoption by focusing on the span or scope of activities the organization is dealing with. Doing so, we explore the relationship between organizational size and EIS adoption decision. We expect that larger firms benefit more from EIS because of economies of scale and their larger financial resources. In conclusion, we recall the assumption that the EIS is primarily adopted to gain efficiency in processing large transaction and information flows.

With the E-Business W@tch data, organizational size can be measured in three ways: by the (absolute) number of employees, the (absolute) number of establishments and by company turnover. As is often the case in organization surveys, respondents often do not want to mention the companies' turnover or have difficulties to do so in the case of financial or non-profit sectors. Therefore, the proportion of missing values for this variable is considerable, 52%. Table 2 shows the results of bivariate (correlation) analysis, to test if the three indicators for organizational sized are positively related to the adoption of the EIS

	Has implemented ^a :				Does ^a :		N
	SCM	CRM	KM	ERP	Purchase on-line	Sell on-line	
Employee size	.11	.14	.09	.25	.06	.06	10,039
Number of establishments	.08	.14	.11	.25	.08	.12	10,488
Turnover ^b	.10	.13	.05	.28	.05	.06	5,077

^a Coded as no=0 and yes=1, other answers are excluded from this analysis.

^b In EURO in the last financial year.

Table 2. Bivariate test of the relationship between three indicators of organizational size and six types of EIS adoption (Kendall's Tau coefficients)

The results from Table 2 clearly confirm the positive relationships between size and ESI adoption since all coefficients are significant at the 1% level ($p < .00$). The size of the correlations differ mostly between the between the ESI types. Knowledge management, e-procurement and e-sales are moderately correlated with size, while SCM, CRM and especially ERP demonstrate strong correlations (Laukkanen et al., 2007). This can be understood from the fact that KM, e-sales and e-procurement are systems cover less parts of the companies' activities compared the more integrative of ERP, CRM and SCM. As can be expected the three measurements for company size are significantly inter-correlated as well, which explains the stability of results over these three indicators.

4 An institutional condition for EIS adoption: the effect of sector

As was stated earlier in this paper, much literature on the process leading towards the EIS adoption decision tend to stress the internal, functional and technical determinants. Yet even when internal conditions are conceived of as only comprising the relatively simple reason of improving efficiency, it remains notoriously difficult to conduct reliable investment or cost-benefit analyses of EIS-adoption. As DiMaggio and Powell (1983) stress, this uncertainty about the exact effects of a decision, in our case EIS-adoption, leaves considerable room for other than internal/functional motives. Hence, interpretations, beliefs and persuasiveness of the environment come to play a role next to the organizational resources.

As the effects of EIS adoption are uncertain, following competitors appears as a safe choice. In an influential article, DiMaggio and Powell (1983) launched the idea of isomorphism, the phenomenon that organizational practices and process are often quite similar. They argue that organizations are subject to various pressures which induce organizations to become like their counterparts. These isomorphic pressures are divided into two types: competitive and institutional. Competitive isomorphism results from interaction between competitors in product markets: only effective and efficient producers may survive, as the sub-marginal ones will go bankrupt. Therewith, the nonconforming non-adopters are sorted out so that the population comes to exist of solely adopters.

Institutional isomorphism occur through three different sub-mechanisms: coercive, mimetic and normative. Coercive forces result from other organizations upon which an organization is dependent, and cultural expectations in the society in which an organization functions. Imitative or 'mimetic' forces are standard responses to uncertainty. Decision-makers often face uncertainty about appropriate responses to uncertainties. Mimicking the choices made in other organizations is a way of dealing with this: implicitly managers then assume that appropriate responses have been made elsewhere, generally by leading competitors and fashions (Abrahamson, 1996; Benders and Van Veen, 2001). Normative pressures finally, result from professionalization. Some occupations have succeeded in establishing organizations that control their profession by demarcating the field and setting enforceable norms to which professionals in the field have to comply. Via formal education and professional networks these norms are spread. Examples of such professions are certified accountants, most medical professions and, classically, those organized in medieval guilds (cf. Meyer and Rowan, 1977).

DiMaggio and Powell stress that these forces are analytically distinguishable yet not necessarily empirical (1983: 150). In other words: they often act in conjunction. It is also important to note that the strength of isomorphic forces varies. Whilst governments may particularly be enforced by their norms through legislation and legal enforcement, decision-makers in specific profit organizations might be specifically influenced by mimetic forces.

Caldas and Wood (2000) found evidence for several types of isomorphistic forces in a study of 28 ERP implementations processes in 1998. They interviewed two respondents per ERP implementation (one implementation agent and one key user) within large and mid-sized organizations in a large array of industries.

Reasons as “follow trend”, “media influence” and “influence of management gurus and consultants” were mentioned by majorities of the respondents and are examples of mimetic isomorphism.

Here, we empirically test the implication of isomorphism in EIS adoption by focusing on the institutional-competitive environment the organization is dealing with. Doing so, we will explore the relationship between sector and the adoption of EIS. We expect that the variation in EIS adoption within industries is significantly larger than between industries. Underlying this expectation, we assume that norms, standards, mimics and interdependencies within sectors primarily determine the adoption of EIS.

As was discussed above, the E-Business Watch data was originally stratified according to the NACE sector code. In our selected dataset, 11 such NACE industries are distinguished. By variance analysis it is tested if sector, as a nominal variable, is significantly related to the adoption of the EIS. Considering the results from the previous section, this analysis is performed while holding constant for organizational size. Table 3 presents the results.

As hypothesized, sector has a significant effect on adoption of all six types of EIS, in addition to the positive effect of employee size. According to the model fit statistics (F-test and Eta squared as a proxy for explained variance), sector is especially relevant for the adoption of e-sales and e-purchase. This is an interesting result, because these EIS were relatively weakly determined by size. The same holds for CRM, as here it appears that its adoption is not so much influenced by size but rather by sector. Another result shows for ERP, which is strongly correlated with both size and sector. Finally, SCM and KM are relatively weakly determined by sector, which as a result is comparable with their low correlations with organizational size.

If we inspect the sectors that are most prominent upfront in adoption per EIS, a number of patterns appear. A special case appears to be the retail sector. Independently of their size, they are the clear front-runner in e-purchase (60%), CRM (21.9%) and KM (15.6%). With regard to SCM and e-sales, the retail sector is also upfront (5.6% and 19.6%), accompanied by the transport equipment manufacturing (5.5% and 24.8%) respectively. ERP appears to be a different case in this respect. Here, the chemical, machinery and electronics industry adopted this EIS relatively often (around 20%), but are somewhat behind in the adoption of the other systems.

	Has implemented ^a :				Does ^a :		N
	SCM	CRM	KM	ERP	Purchase on-line	Sell on-line	
Food, beverages and tobacco	4.4	6.0	5.3	15.7	28.4	6.4	1,019
Publishing, printing, reproduction of recorded media	4.3	10.2	7.5	17.7	43.0	14.0	1,110
Manufacture of chemicals/chemical products/rubber/plastic prod.	3.8	10.3	7.3	21.4	46.2	10.1	954
Metal products	4.2	5.8	3.7	20.2	34.5	7.7	988
Manufacture of machinery and equipment	3.8	7.1	4.4	21.0	36.6	5.7	571
Electrical machinery and electronics	5.5	9.9	5.8	20.9	42.4	14.1	950
Transport equipment	5.5	8.3	5.6	16.2	41.3	24.8	1,017
Retail	5.6	21.9	15.6	13.7	58.4	19.6	982
Tourism	3.8	10.9	7.6	9.1	41.2	20.5	1,104
Monetary and financial intermediation	1.0	8.3	6.3	6.8	35.0	9.1	1,077
Insurance and pension funding services	2.4	7.3	4.3	5.1	29.1	8.5	716
F-value	4.11	18.61	13.37	20.97	24.31	29.20	
Df	10	10	10	10	10	10	
P	.00	.00	.00	.00	.00	.00	
Eta squared	.005	.021	.015	.023	.027	.032	

^a Coded as no=0 and yes=1, other answers are excluded from this analysis.

Table 3. Multivariate test of the relationship between sector (in 11 NACE classes) and six types of EIS adoption (means, corrected for employee size)

On the one hand, it seems obvious that the retail sector heavily uses both e-purchase/SCM and e-sales/CRM, because of its intermediate position in many supply chains. On the other hand, this specifically demonstrates the power of institutional isomorphism. Because the retail sector deals with the similar supply chain conditions (and also is able to benefit from this) they apparently became the early adopters of EIS that support their specific B2B position. There are many other sectors that are equally incorporated within 'extended supply chains' but have adopted EIS in much smaller proportions. By similar argumentation, the high adoption rate of ERP by manufacturing sectors can be understood as a type of isomorphism. There are many other sectors that have a need for extensive transaction processing, scheduling and planning, being the core functionalities of ERP. But the fact that this EIS is originally developed within the manufacturing sector – as pre-processor of material resource/requirement planning systems – apparently still determines the distinctive high level of adoption by this sector.

5 A cultural condition for EIS adoption: the effect of country

The central question we address in this section concerns the additional effect of country on EIS adoption, after controlling for the significant effect of organizational size and sector. Before suggesting answers to this question theoretically, we should note that country (similar as sector) is mostly used as a proxy for other macro conditions that are difficult to measure, here 'culture'. In principle, (sub)cultures are be divided by factors as religion, language, ethnic origin and so on (Lenartowicz, Johnson and White, 2003). It is much harder however, to subdivide geographical areas by these differences than by country borders. Because of this, many researchers in the cross-cultural field who study large amounts of the world use countries to differentiate cultures.

In this section, national culture is also used to describe differences between organizations which are based in different countries. Following Sirmon and Lane (1994), it can be argued that national culture, by norms and beliefs which are learned early on in life, go on in spite of later socialization by organizations (2004). Calori et al (1997) state that organizational cultures are systematically shaped by national culture differences through the firm's managerial legacy. This legacy can be defined as attitudes towards business procedures and priorities (Bigoness and Blakely, 1996) and managers' conceptualization of human nature, language, time, work, relationships, and space. So far, research is emerging on the effects of national culture on EIS adoption (cf. Png, Tan, and Wee, 2001 and Waarts, Van Everdingen, and Van Hillegersberg, 2002; Van Everdingen and Waarts, 2003; Van Everdingen, Van Hillegersberg and Waarts, 2003).

With regard to concrete measurements of national cultures, the most cited author in this respect is obviously Hofstede (1997) who claims that national culture explains half of the differences between managerial values, attitudes, and beliefs. Based on his classic study at IBM and later additional survey projects, Hofstede (2002) scored over seventy countries on five basic cultural: power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, and long-term versus short-term orientation. Although extensively cited and used, Hofstede's research knows many critics. For our analysis, one problem is the exclusion of the former communist block countries (here: Estonia). At least one alternative is provided by Au (1999), who builds upon the World Value Survey 1990, a cross-national study on intra-cultural variation (ICV) among 43 countries. Au brought both mean and standard deviations together for six variables related to work and change related topics from the World Values Survey conducted in 1990. These variables were 'pride in work', 'job satisfaction', 'freedom in decision making', 'change is good', 'new ideas is good', and 'welcome new ideas'.

At this stage, it is difficult to derive hypothesis that go beyond the basic expectation that the variation in EIS adoption within countries is significantly larger then between countries. With regard to ERP adoption, Van Everdingen and Waarts (2003) found that this is positively related to Hofstede's dimensions of uncertainty avoidance, power distance and masculinity. Obviously, our dataset provides an opportunity to validate this finding. However, a problem of comparison is that Van Everdingen and Waarts did not controlled for other factors such as size and sector as we do. Our results are in the following Table 4.

	Has implemented ^a :				Does ^a :		N
	SCM	CRM	KM	ERP	Purchase on-line	Sell on-line	
Estonia	2.03	11.77	10.72	8.49	34.18	11.04	376
Poland	1.46	3.24	2.93	3.95	22.05	12.03	377
France	1.69	5.81	2.37	15.05	30.37	9.28	1,695
Germany	5.59	13.95	6.64	19.47	58.97	18.80	1,622
Italy	3.20	9.70	9.36	21.72	28.83	10.27	1,724
Spain	7.83	7.93	10.98	12.57	27.39	10.05	1,228
UK	3.95	11.02	5.01	9.50	52.81	15.62	1,777
F-value	12.88	14.09	19.29	28.72	111.83	16.74	
Df	6	6	6	6	6	6	
P	.00	.00	.00	.00	.00	.00	
Eta squared	.009	.010	.013	.019	.071	.011	

^a Coded as no=0 and yes=1, other answers are excluded from this analysis.

Table 4. Multivariate test of the relationship between country and EIS adoption (means, corrected for employee size and sector)

Controlled for both sector and size, country holds a significant effect on the adoption of each type of EIS. Table 4 clearly shows that country matters most for online purchase. This country effect is considerable larger compared to the other types of EIS. Compared to the sector effect on adoption – that was more equally divided over the six EIS types – this implies that there might be a ‘special country effect’ here. If we inspect the country means, it is demonstrated Germany and the UK with over 50% adoption are far ahead of the other four countries as only 20% of the Spanish and Polish companies apply on-line purchasing. Country-differences for other EIS are indeed smaller.

Taking the different countries as an perspective, it becomes clear that Germany had a leading role in adopting all EIS types except KM. With regard to both e-sales and e-purchase Germany is upfront together with the UK, in SCM with Spain and in ERP with Italy. Both Spain and Italy have relatively many organization that use KM. If we confront these country scores with the five cultural dimensions of Hofstede, and Au’s six work value scores, a few conclusions can be drawn. First, the ordering of countries according to Hofstede’s power distance and uncertainty avoidance clearly correlates negatively with the ordering according to the adoption of e-purchase and CRM (N=6, Spearman’s rho rank order correlation). As ‘single points of evidence’, it is indeed the case that within the group of counties under consideration both Germany and the UK have low scores on uncertainty avoidance and power distance. Similarly, we find evidence that – on country level (N=7) – Au’s freedom in decision making and CRM adoption are negatively correlated. Obviously, these statistics are based on rather small numbers and limited statistics. Interesting enough however, they do support the earlier finding of Van Everdingen and Waarts (2003) that adoption of EIS coincide with national cultures that are used to take risks, freedom in decision making, limited power distances.

6 Conclusion

In this paper we investigated the relevance of different conditions for the adoption of four different Enterprise Information Systems (SCM, ERP, CRM, KM) and two E-business applications (e-sales and e-purchase). The impact of the conditions were investigated with data from the EU-initiated E-Business W@tch survey 2002/2003 among over 10,000 organizations from seven different European countries and (within these countries) 11 different sectors.

Starting with the effect of organizational size as an internal condition, it is first confirmed that scope and level of organizational activities are positively correlated with adoption (cf. Laukkanen et al. (2007)). Size of staff, establishment and turnover appears to be particularly relevant for the adoption of ERP, and somewhat less for CRM and SCM. Secondly, involving sector as an institutional condition adds additional explanation to the adoption of EIS by the surveyed organizations. In particular the retail sector takes a prominent place in the early adoption of e-sales and e-purchase, but also SCM and CRM. In contrast, ERP adoption is also differentiated by sector but here the traditional manufacturing (chemical, machinery, electronics) is ahead of the other sectors probably continuing an intra-industry tradition in the use of these EIS. Third and finally, country does play an additional role as cultural condition if we statistically control size and sector. From the six countries under concern, Germany and the UK are the two countries that lead in both e-business, and Germany with Spain and Italy in SCM and ERP respectively.

In conclusion, modeling the EIS adoption decision by conditions that accumulate from internal (organizational) to external (sector, country) does lead to a fruitful road of analysis and conclusions. The results of our multivariate analysis indicate that sector and country coincide as their interaction effects with EIS adoption is significant. Sector-specific sub-analysis merely confirms the country differences, but with some applications the country differences become more prominent. With regard to E-sales, the leading position of Germany appears to be even more prominent within the transport and electronics sector. Another differentiating EIS throughout our analysis is ERP. Here, especially the German publishing, and metal companies are 5 to 10% ahead in adoption by their European colleagues. In addition, the Italian organizations are remarkable upfront in ERP within the machine manufacturing and transport (over 10% difference with the other countries).

Much analysis can be done to further explore and interpret these countrysector effects. In particular the application of multilevel analysis seems useful in this respect to control for the hierarchical structure of the data. Moreover, other conditions might be involved in further analysis. Next waves of the E-Business W@tch survey can deliver additional data about country-sector combinations that needed to be excluded from this analysis. This is especially important to enable further analysis of the timing of EIS adoption (the year and month of EIS implementation was only including in the 2003 wave) and hence study diffusion patterns as was originally initiated by Rogers (1983).

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