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Adoption of e-Processes by Service Firms: An Empirical Study of Antecedents

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This paper investigates empirically antecedents of the adoption of web-based processes (e-processes) by service providers. We examine whether rational efficiency (expressed by expected performance benefits and access to new markets), the bandwagon effect (expressed by external pressure), and barriers (both internal and customer related) influence Internet use for transactions (e-transactions) and/or to extend the relationships between service providers and their customers (e-CRM). The findings, based on a sample of 338 service firms, show that rational efficiency and the bandwagon effect drive both types of e-processes. Conversely, only internal barriers have a negative impact on adoption of e-processes, while barriers related to customers do not have a significant impact. These findings have important academic and managerial implications, given the limited evidence regarding the implementation of e-processes in services.

Key words: e-transactions; e-CRM; e-service; technology adoption; empirical research
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1. Introduction

Despite the steadily increasing importance of the Internet in the service sector, from a managerial and an academic standpoint the field of e-services is still in its relative infancy (Rust 2001). To date, some authors have identified various "myths" around e-services such as "services have little to gain from business to business," "net-self services will reduce the need for people" or "on-line retailers are winning real loyalty" (Roth 2000). But the main characteristics of e-service management—such as enablers of value creation (Amit and Zott 2001) or drivers of e-service performance (Delaney-Klinger, Boyer, and Frohlich 2003, Boyer and Olson 2004)—are still not clear. This is an important gap in the literature, and points to the need for much needed research that provides empirical evidence of the different factors that may or may not contribute to the adoption of e-processes in services. Notably, do service providers adopt e-processes because of external pressures from sources such as competitors and customers? Or, is the adoption of e-processes the result of rational decisions made by management around expected performance improvements? Moreover, which barriers have a stronger impact on preventing service organizations from implementing e-processes? Is it internal barriers related to the company itself (such as culture, lack of skills, costs, etc.) or external factors such as customer resistance? The purpose of this study is to address these issues, both theoretically and empirically, by specifically investigating the antecedents, i.e., enablers and barriers, behind the adoption of web-based processes in service firms.

In conducting this research, we focus on both of the two major types of Internet-based processes (called e-processes hereafter). Recent research highlights, for manufacturing and service firms, the crucial role of the Internet in linking companies with their customers (Bowersox et al. 2000, Van Hoek 2000), both for relationship and transaction-based activities (Zemke and Connellan 2001, Reichheld 2001, Swift 2001). For instance, the use of web-based processes between service providers and their customers enables companies to be much more efficient in terms of many routine *transactions* such as order taking, billing, payment and order tracking (called e-transactions hereafter). In ad-

dition, the Internet enhances a service firm's ability to keep, improve and extend its *relationships* with customers. Collecting the right information lets a firm develop accurate customer profiles, launch targeted marketing campaigns, provide better after-sales support, and overall, be much more successful at Internet-enabled customer relationship management (called e-CRM hereafter).

The importance of e-transactions and e-CRM is not only of interest to academics but also of critical concern to managers as demonstrated by a recent IDC survey. The study found that in 2002, e-transactions and e-CRM absorbed respectively 37% and 13% of the total investment in new Information Technologies at a typical company. Indeed, it is difficult to think of a service company today that does not have at least some type of presence on the Internet. While some still have information-only websites, many have already taken the next step and introduced either e-transactions and/or e-CRM. By the end of this decade, it is hard to believe that few (if any) service-providers will be able to survive without some form or other of e-processes.

Towards that end, the rest of the paper is organized as follows: in the next section we discuss the concept of Internet-enabled processes in a service context and the drivers and barriers of adoption of e-processes. Then we discuss our sample, measures and statistical results. Finally, we discuss our findings and conclude with managerial implications.

2. The Theoretical Background of Technology Adoption

Over the past several decades, technology adoption has been widely addressed in the organization theory, information systems, economics and technology management literature. At the firm level unit of analysis, game theory and option value theory model technology adoption as the outcome of rational decision making given certain market structures, competing agents, and varying levels of information. Reinganum (1981) and Kalish and Lilien (1986) analyzed possible adoption scenarios when firms make a choice between an early adoption decision (thus potentially exploiting technology leadership advantages) and deferring it in order to obtain better information. Davis, Bagozzi, and Warshaw (1989) built the Technology Acceptance Model (TAM) using employee "motivation" to explain technology adoption and use. Miller and Folta (2002) considered the conditions under which technology adoption coincides with the purchase of a "call option" on the technology's future developments. Other studies have similarly investigated firm-level resources and capabilities that have the potential to enable technology adoption. Suitable "factors" have been identified, for instance, with respect to a firm's technological opportunism (Shawarmy et al. 2002), technological orientation (Gatignon and Xuereb 1997), organizational innovativeness (Deshpandè, Farley, and Webster 1993), technology portfolio (March and Sproull 1990; Swanson 1994), and absorptive capacity (Cohen and Levinthal 1990). At the environmental unit of analysis, theorists in the population ecology, institutional ecology, economics and industrial organization literature have largely "denied" that a firm's rational decisions or cognisant choices matter in technology adoption. Instead, they argue that external or environment pressures mainly drive organizational "change." In this instance, differences in "technology adoption" across firms are seen as the result of the emergence of new organizations that pioneered emerging technologies (Hannan and Freeman 1977) or as the outcome of random luck or "blind variation" processes that firms undertook to search for better organizational routines (Nelson and Winter 1982). Others in this stream of research view technology adoption mainly as a reaction to industry and market "structures" (Porter 1980; Reinganum 1981; Hannan and McDowell 1984). For example, Mendelson and Pillai (1999) explained technology adoption within firms as driven mostly by the "industry's clock speed" and the rate of obsolescence of existing technologies.

Paralleling the idea of conceptualizing technology as an environmental dimension, a growing literature has investigated the relationship between technology-related characteristics and technology adoption. Studies have outlined the role of concepts such as technology S-curves (Christensen 1992), general purpose technology (Bresnahan and Trajtenberg 1995), competence enhancing vs. competence destroying nature of the technology breakthrough (Anderson and Tushman 1990), technology trajectories and dominant design (Abernathy and Utterback 1978; Dosi 1982; Suarez and Utterback 1995), sponsored vs. un-sponsored technologies (Katz and Shapiro 1986) or network externalities (Schilling 1998, 2002; Katz and Shapiro 1985; Farrel and Saloner 1985). Similarly, other studies have investigated the relationship between technology adoption and the channels to "communicate" the innovation (Rogers 1983), management fads (Abrahamson and Rosenkopf 1993), changes in resources in the organizational environments (Pfeffer and Salancick 1978; Tushman and Anderson 1986; Suarez and Lanzolla 2003), socio-cultural forces (Mokyr 1990), social incentives (Katz and Shapiro 1986), and the effect of local and national networks of innovators (Von Hippel 1988; Nelson 1993).

More recently, a new hybrid or co-evolution approach has attempted to more formally examine firm variables along with environmental variables in a single study to better explain business events (Lewin and

Volberda 1999). Although it is easier to study either firm or environmental variables in relative isolation, in actual practice they are rarely independent of each other. Abrahamson and Rosenkopf (1993) was perhaps the first study to recognize this fact, and their pioneering paper summarized these somewhat conflicting firm-related and environment-related approaches and argued that companies adopt new "practices" for both rational efficiency (i.e., firm) and "bandwagon" (i.e., environmental) reasons. As described in the next section, our study rests upon the underlying theories of the co-evolution perspective of technology adoption. Notably, both firm-level rational efficiency forces as well as environmental bandwagon effects are the predicted antecedents of adoption of e-processes by service firms.

2.1. Rational Efficiency and e-Processes Adoption

The Internet has the potential to reduce the costs of coordination, communication and information processing between and within service firms and their consumers, thus dramatically changing the way in which service providers serve their customers (Voss 2000, Boyer, Hallowell and Roth 2002; Yip 2000, Rust 2001, Feeny 2001). At the same time, because it is based on a freeware communication protocol (i.e., TCP/IP), the Internet makes it easier to reach a larger number of potential customers. Drawing upon these intrinsic characteristics of the Internet technology, the rational efficiency literature provides two powerful explanations for the adoption of web-based processes; namely expectations of improvement in business processes' *performance* (Frohlich and Westbrook 2002), and/or expectations of having *access to new markets* (Yip 2000, Vollmann et al. 2000).

According to Abrahamson (1996), the more organizations that adopt a technique, the greater the knowledge about the innovation's efficiency and benefits throughout that business sector. As a result, more and more non-adopters will rationally adopt the new practice through technology diffusion because of its demonstrated benefits (Rogers 1983, Mansfield 1985). Good examples of this include the rush to emulate pioneering companies such as Amazon in terms of online retailing and Dell for speed of delivery and mass-customization in the supply chain. Along similar lines, the adoption of e-transactions is expected to be a main enabler of both efficiency and effectiveness in service supply chains (Rust 2001). Classic examples of this phenomenon include the recent stampedes in the insurance and travel sectors to set up real-time quotes and online bookings, and the fact that almost every major bank now offers an online banking service to compliment its traditional branch, ATM, and mail channels. Similarly, Dow Chemical created myaccount@dow using e-CRM that both improved its overall online customer service productivity as well as the business's bottom line performance.

Based on the rational efficiency arguments of co-evolution technology adoption, along with the previously introduced notions of e-CRM and e-transactions, we thus posit:

H1a: An increase in expected performance benefits leads to an increase in the adoption of e-CRM.

H1b: An increase in expected performance benefits leads to an increase in the adoption of e-transactions.

In the same way, rational expectations about greater access to new market should play a positive role towards the adoption of e-CRM and e-transactions respectively. Ingersoll-Rand adopted e-CRM to share customer information across its 30 operating units and was able to generate $6.2 million in extra revenue by cross-selling products into new markets. Alternatively, online insurance companies such as Geico Direct are now able to offer car insurance quotes in markets that they never traditionally sold in. The same goes for online mortgage companies such as Wells Fargo and East/West Mortgages that adopted e-transactions to expand out of their traditional local niche markets in California and Massachusetts to take on a more national presence. Hypotheses 2a and 2b follow:

H2a: An increase in expected access to new markets leads to an increase in the adoption of e-CRM.

H2b: An increase in expected access to new markets leads to an increase in the adoption of e-transactions.

2.2. External Pressure and e-Processes Adoption

The other main driver of new practice adoption is the so-called "bandwagon" effect. Bandwagons are diffusion processes whereby organizations adopt innovations, often without using any rational efficiency assessment of the practice, but because of external pressure caused by the large number of organizations that have already adopted (or are considering adopting) the new technology (Tolbert and Zucker 1983, Reinganum 1981). Recent examples of this sometimes misguided bandwagon effect include the attempt to conduct every transaction online as pioneered by Cisco. Similarly, Heineken Ireland was forced to implement e-CRM in the face of intense competition from rivals and emerging liquor brands. Walmart.com is another example. In the face of upstart competition from companies such as Amazon, even the "King Kong" of traditional retail was forced to adopt e-transactions for online retailing. A little closer to home, business schools are another good example of the external pressure of the bandwagon effect. How many business schools rushed to introduce online learning course and/or degrees in the late 1990s only to subsequently discover that there was little or no market for it

among students that mostly wanted face-to-face instruction on-campus? To sum up, adoption of e-CRM and e-transactions occurs not only as a result of a rational assessment of the business implications of the new technology, but also as a response to the *external pressure* that makes management afraid of being perceived by customers, suppliers, investors and competitors as lagging behind competition. Hence, bandwagon effects are predicted to be important drivers of e-processes, which lead to hypotheses 3a and 3b:

H3a: An increase in external pressure leads to an increase in the adoption of e-CRM.

H3b: An increase in eternal pressure leads to an increase in the adoption of e-transactions.

2.3. Internal and External Barriers

It is well documented in the literature that all organizations, resist change and revert to previous ways of doing business (Coch and French 1948, Hannan and Freeman 1978, Olson and Boyer 2002). Some examples of internal barriers are rigid organizational arrangements and procedures, hierarchical and formal communication structure, conservatism, lack of vision, lack of motivation and skills or even uncertainty about the new technology. Despite the fact that changing often gives a firm greater competitive advantage, an organization may nevertheless resist change (Kotter 1995). An organization's status quo ("inertia") is equilibrium between the barriers to change and the forces driving change (Pfeffer and Salancick 1977, Kwon and Zmud 1987, Cooper and Zmud 1990). Some difference in these forces, either a weakening of the barriers to change or a strengthening of the forces driving change, is required to produce a transformation (Piderit 2000). If service firms decide to implement web-based processes that affect both them and their customers, then it follows that each of the two parties can be a barrier to change; i.e., internal barriers and customer barriers.

Once again, many universities experience internal barriers—the vested interests in the typical school's admission office are reluctant to adopt e-CRM and continue to rely on the traditional college catalogue and application process of essays, letters of recommendation, and copies of transcripts. Similarly, 3M likely has more SKUs than any other company in the world, but the company is reluctant to offer any e-transactions because it could upset the vast global dealer network that distributes and sells their products. This leads to the following set of hypotheses:

H4a: An increase in internal barriers leads to a decrease in the adoption of e-CRM.

H4b: An increase in internal barriers leads to a decrease in the adoption of e-transactions.

Likewise, customers can be very skeptical about the implementation of web-based processes (Cachon and Fisher 1997) and refuse to integrate with their service providers due to feared costs, service disruptions, or confidential data issues (Corbett et al. 1999). Recent Internet examples include the reluctance of many people to purchase autos over the web or for students to readily accept on-line education. Vauxhall (a U.K. subsidiary of General Motors) launched Vauxhall.com in 2000, and despite its best effort to target online customers using e-CRM, was only able to sell a handful of vehicles before it abandoned the program. Similarly, only 1–2 percent of all grocery customers have ever tried an online grocery service because most people prefer to do such shopping themselves. Along the same lines, the passage of the European Data Protection act in 1999 was motivated by tens-of-thousands of people complaining about how their personal data was being treated by firms using e-CRM. Even in the U.S., many customers are concerned about online security and are therefore reluctant to cooperate with online businesses that offer e-CRM services. For these reasons, we posit:

H5a: An increase in customer barriers leads to a decrease in the adoption of e-CRM.

H5b: An increase in customer barriers leads to a decrease in the adoption of e-transactions.

3. Methods

3.1. Data Collection

The survey was developed in three stages. In the first stage, relevant measures of e-processes and adoption antecedents were identified in the literature and were included in the instrument. The second stage consisted of a series of meetings with managers to assess the content and face validity of the instrument. In the final stage, the survey was pre-tested with 30 firms to further evaluate its content validity and overall readability.

Data were collected from a stratified random sample of service companies from across the UK during the second half of 2001 (after the Internet bubble had burst). The study was coordinated with the Confederation of British Industry (CBI) and surveyed their membership. The CBI, founded in 1965, is the largest business association in the UK and represents small and large companies from all sectors of the UK including manufacturing, retailing, agriculture construction, finance, transportation, and consulting (see www.cbi.org.uk for more detail). It is also worth noting that the CBI is a not-for-profit organisation self-funded by its members.

Most of the service organizations included in the sample target both individual and business customers, with the exception of consulting firms. The research design proportionally represented large and small

companies, and we sampled from all 13 regions of the UK, including Scotland and Wales. In terms of external validity, the UK is the world's fifth largest economy (behind the U.S., Japan, Germany, and France) and the nation's e-business adoption rate generalizes well to North America and continental Europe. By sampling an entire country, the research design also controlled for many confounding factors like telecommunication infrastructure, technology costs, government programs and the overall economy cycle.

Typical respondents were VPs of Service Operations or General Managers and therefore, the data were collected from managers with enough seniority to know about their companies' e-services and performance. The data collection was completed according to Dillman's (1978) total design method. In total, 338 service firms are included in the sample. The response rate was 21% (338 responses out of 1,600 surveys mailed). The industry breakdown of the sample is shown in Table 1.

Two of the most common potential threats to survey research are non-respondent bias and common method bias. In order to assess non-response bias we compared a matched random sample of 60 responding and non-responding companies and found no differences ($P < 0.05$) in terms of size, age, location or industry.

Since a single respondent rated integration drivers and performance, this may have led to common-method bias. We used Harmon's one-factor test (Podsakoff and Organ 1986) to check whether common method bias was present. Seven factors with eigenvalues greater than one were extracted from all the measures in this study and in total accounted for 68% of the variance. The first factor accounted for 19% of the variance. Since a single factor did not emerge and one-factor did not account for most of the variance, this suggested that the results were not due to common-method bias.

Table 1 Sample Descriptive Statistics ($N = 338$)

Sector	Number	Percent
Banking/insurance	88	26.0
Entertainment/tourism	13	3.8
Hospitality/travel	10	3.0
Healthcare services	23	6.8
Consulting services	98	29.0
Retail/merchandising	26	7.7
Telecommunications	18	5.3
Transport/distribution	39	11.5
Utilities	23	6.8
Total	338	100.0

Full-time employees	Percent	Company Age	Percent
<100	29.0%	<5 years	12.8%
101–500	24.8%	6–10 years	7.3%
501–2000	13.1%	11–20 years	15.2%
>2000	33.1%	>20 years	64.7%
	100%		100%

Geographic Location	Percent
Wales	3.5
Scotland	4.5
Northern Ireland	3.2
Northern England	3.2
Yorks & Humberside	3.2
North Western	4.1
West Midlands	3.5
East Midlands	3.5
Eastern	1.9
South Western	3.2
Southern	3.2
South Eastern	9.2
Greater London	20.4
UK multi-region	33.4
Total	100.0

3.2. Scale Development

Respondents were asked to rate on multi-item scales (Appendix) their degree of implementing e-processes with their customers and the adoption drivers and barriers of e-processes. These scales were grounded in the literature (O'Leary-Kelly and Vokurka 1998). Although few studies had at the time of this study developed multi-item scales measuring e-business constructs, there were abundant cases and anecdotal examples in managerial journals such as *Sloan* and *California Management Review*. For example, Coltman et al. (2001), Winer (2001, and Willcocks and Plant (2001) described customer and internal e-business barriers at companies ranging from Levis and PeaPod to Schwab and Tesco. Similarly, the benefits of e-business were widely reported in managerial journals for companies such as Dell (Holweg and Pil 2001), Cisco (Barua et al. 2001), and Onstar (Venkatraman 2000), and we used these to help structure the scale for expected performance. In the same way, we used insight from managerial journals and cases to create multi-item constructs for the other measures in this study.

Prior to survey administration, the face validity of these scales was evaluated in a series of meetings between the research team and managers actively involved in e-business. Also in attendance at these meetings was a representative from the UK government responsible for diffusing Internet practice as well as an e-business Partner at a leading consulting firm. These meetings not only improved the survey's readability, but also helped ensure that the instrument was reliably measuring what we intended it to. After the data was collected, factor analysis was also used to check reliability (Kim and Mueller 1978). All scales were unidimensional using principal components as shown in the Appendix. The scales were averages of the measurement items and reliability (Table 2) was ac-

Table 2 Descriptive Statistics and Construct Reliabilities

	Mean	Standard deviation	% Variance explained[a]	Cronbach's alpha
e-CRM	2.1432	.9757	66.29	.739
e-Transactions	1.8720	.8904	59.53	.822
Expected Performance Benefits	2.8554	1.0599	71.12	.897
External Pressure	2.0556	.7787	46.04	.600
New Markets	1.7094	.8289	63.96	.679
Internal Barriers	2.9110	.9776	57.41	.847
Customer Barriers	2.8791	.9821	58.29	.817

Note. Principal component analysis confirmed that each of the constructs is unifactorial.

[a] Indicates the % of variance explained by the one factor extracted for each construct.

ceptable (Nunnally 1968). Table 3 also shows the measures' Pearson correlations, while Figure 1 shows scatter plots of e-CRM versus of e-transactions for each industry group. Figure 1 confirms the existence of a positive correlation between e-CRM and e-transactions, (as shown in Table 3), for all industry groups.

Construct validity was established by testing whether the items in a scale all loaded on a common factor when within-scale factor analysis was run. The Appendix shows that the eigenvalues all exceeded the threshold of 1.0, which supports each scale's dimensionality (Hair et al. 1995). Discriminant validity was tested in two ways. Bivariate correlations were checked between each of the scale's measures and other potentially confounding variables included in the instrument such as location, company age, lack of previous demonstrated benefits and there were no significant correlations ($P < 0.05$), which helped establish that the scales were not measuring other unintended constructs. Second, the Cronbach alphas were greater than the average inter-scale correlations, which provide additional evidence of having acceptable discriminant validity (Flynn et al. 1995).

3.3. Statistical Analysis

We used hierarchical regression analysis to test our hypotheses. In Model 1, we include the control variables (service industry, company size and age), in model 2a (b) we add the adoption drivers (barriers), and model 3 is the full model including control variables, drivers and barriers. The full regression model (model 3) for the adoption of e-processes is as follows:

$$\text{e-Process Adoption} = b_0 + b_a * \text{logCompany size} + b_b * \text{logCompany Age} + b_{ci} * \text{Service sector}_i + b_1 * \text{Expected Benefits} + b_2 * \text{Access to Markets} + b_3 * \text{External Pressure} + b_4 * \text{Internal Barriers} + b_5 * \text{External Barriers}$$

The same model is used for both dependent variables (e-CRM and e-transactions). Figure 2 presents the empirical model and summarizes the hypotheses.

We included in our model three control variables covering company size, company age, and service sector industry. These control variables helped account for effects whose importance has been well documented in the existing literature on the adoption of innovations.

In this study, we operationalized company size in terms of full time equivalent employees. There are competing theoretical arguments to explain the role of size in technology adoption (Nohria and Gulati 1996). On the one hand, larger organizations are more likely to have "slack" resources (resources in excess) that should make them more likely to be early adopters of a new technology. On the other hand, larger companies could be trapped in their " structural inertia". Empirical research, however, seems to show "conclusive" evidence that larger firms are earlier adopters of new technologies (Swamidass 2003) since they can both better afford new technologies plus absorb the negative impacts of inadvertent failures.

We measure company age in terms of number of years occurred from the company foundation. Stinchcombe (1965) argues that age should inversely influence the adoption of innovations, because organizations are "frozen" at birth. Consistently, March and Sproull (1990) and Swanson (1994) find that the age of the "technology portfolio" affects negatively technology adoption.

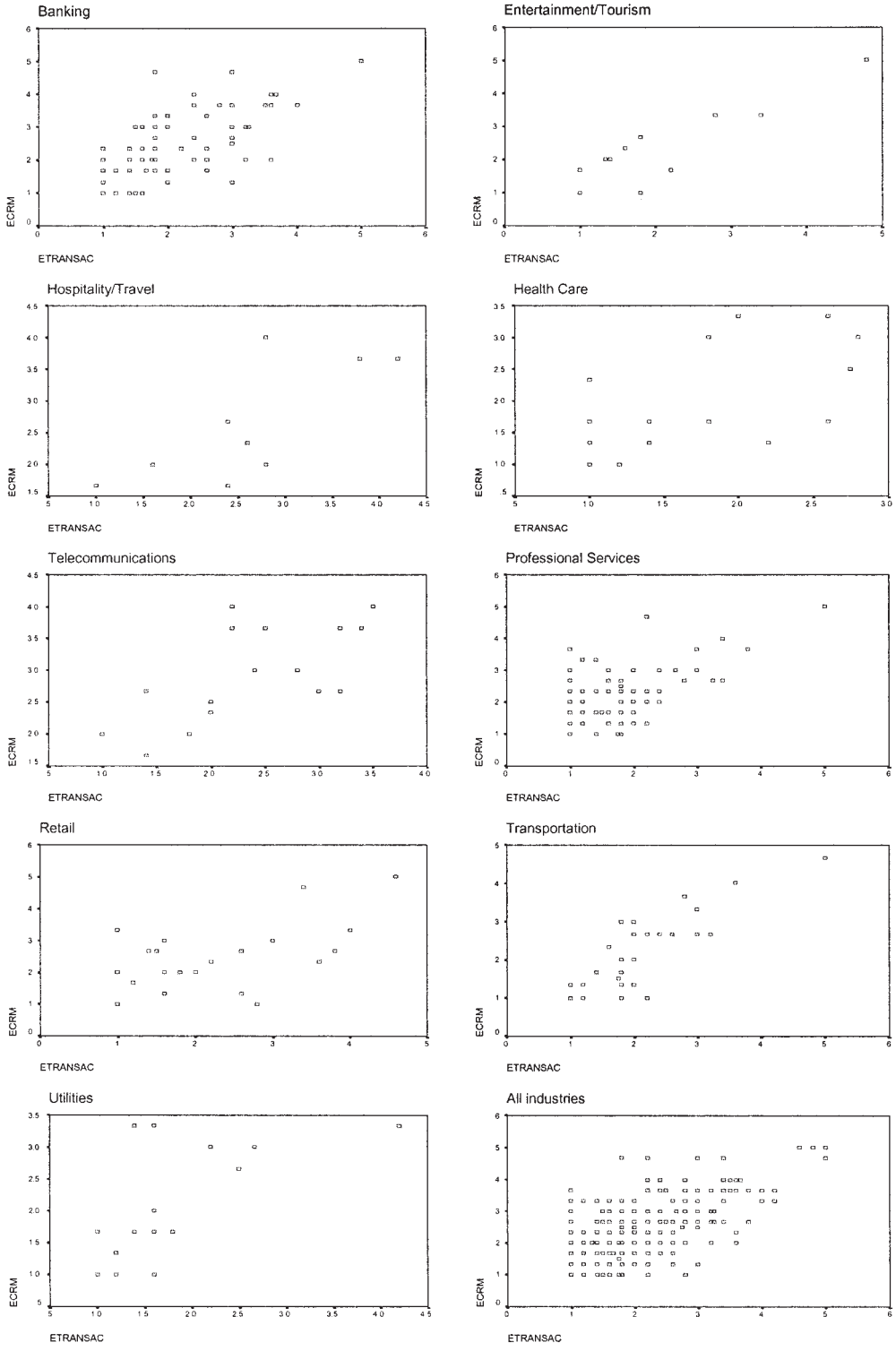
The inclusion in our control variables of service

Table 3 Correlation Matrix

	e-CRM	e-transactions	Expected benefits	External pressure	New markets	Internal barriers	Customer barriers
e-CRM	1.000						
e-Transactions	.726**	1.000					
Expected Benefits	.460**	.403**	1.000				
External Pressure	.346**	.355**	.497**	1.000			
New Markets	.362**	.394**	.514**	.500**	1.000		
Internal Barriers	−.322**	−.247**	.085	.236**	.135*	1.000	
Customer Barriers	−.079	−.101	.091	.195**	.134*	.567**	1.000

Note. * denotes significance at the 0.05 level (2-tailed), ** at the .01 level.

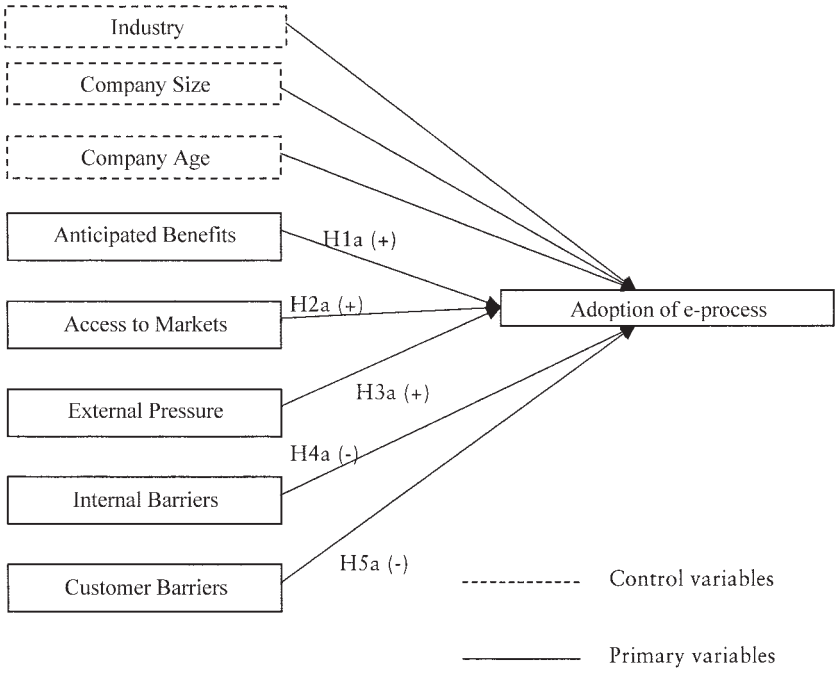
Figure 1 Scatterplots (e-CRM vs. e-transactions) Per Industry Group



sector (measured with dummy variables) is motivated by the need to capture sector-related effects, such as sector complexity, maturity or network of relationships (see Lanzolla and Tsikriktsis (2003) for a comprehensive study on the role of the firm's industry environment in technology adoption timing).

Finally, in all subsequent regression models, the variance inflation factor for all independent variables was below the threshold of 5; hence there is no evidence of multicollinearity (Hair et al. 1995). Also, the normal probability plots of the standardized residuals showed no violation of normality.

Figure 2 Empirical Model



4. Results

Tables 4a and 4b summarize the results of the multiple regression analyses. Overall, the full models (models 3) explain 28.7% and 27.2% of the variation in e-CRM and e-transactions respectively. For e-CRM, expected performance benefits (H1a), external pressure (H3a) and internal barriers (H4a) were significant at the 0.05 level and in the direction expected, while access to new markets (H2a) and customer barriers (H5a) had no significant effect. Finally, neither size nor company age have any significant impact.

The results for e-transactions are somewhat different than those for e-CRM. Specifically, expected performance benefits (H1b), access to new markets (H2b), external pressure (H3b) and internal barriers (H4b) were significant at the 0.05 level and in the direction expected, while customer barriers (H5b) had no significant effect. Company size is positively related to

Table 4a Results of Hierarchical Regression Analysis. Dependent Variable: e-CRM

	Model 1 (M1)	Model 2° (M2a)	Model 3° (M3a)	Model 2b (M2b)	Model 3b (M3b)
Constant	1.805[a,**]	.662***	.900**	1.757**	.900**
Banking	.592**	.342	.357	.557*	.357
Entertainment	.476	.192	.162	.443	.162
Travel	.859*	.791*	.756*	.807*	.756*
Health Care	.037	.127	.101	.047	.101
Professional Services	.300	.151	.147	.284	.147
Retailing	.301	.112	.035	.184	.035
Telecommunications	.990**	.782**	.860**	.996**	.860**
Transportation	.157	.105	.111	.143	.111
Log (Size)	.514*	.232	.368	.424*	.368
Log (Age)	−.549	−.365	−.209	−.466	−.209
Expected Benefits		.239**	.230**		.230**
Access to Markets		.090	.052		.052
External Pressure		.251**	.256**		.256**
Internal Barriers			−.226**	−.196**	−.226**
Customer Barriers			−.099	−.128	−.099
R^2 adj.	.051	.252	.287	.099	.287
∇R^2 adj.		.201** (M1 to M2a)	.035* (M2a to M3a)	.048* (M1 to M2b)	.188** (M2b to M3b)

Notes. [a] Unstandardized Coefficient, * $p < .05$; ** $p < .01$

Table 4b Results of Hierarchical Regression Analysis. Dependent Variable: e-transactions

	Model 1 (M1)	Model 2[a] (M2a)	Model 3[a] (M3a)	Model 2b (M2b)	Model 3b (M3b)
Constant	1.404[a,**]	.427	.599*	1.291**	.599*
Banking	.509*	.309	.336	.472*	.336
Entertainment	.537	.228	.212	.522	.212
Travel	1.117**	1.306**	1.257**	1.224**	1.257**
Health Care	.147	.189	.169	.159	.169
Professional Services	.334	.197	.192	.313	.192
Retailing	.453	.352	.296	.363	.296
Telecommunications	.734**	.497*	.648*	.712*	.648*
Transportation	.373	.289	.294	.358	.294
Log (Size)	.729**	.529**	.650**	.689**	.650**
Log (Age)	−.586*	−.438	−.345	−.562*	−.345
Expected Benefits		.114*	.109*		.109*
Access to Markets		.188**	.142*		.142*
External Pressure		.226**	.224**		.224**
Internal Barriers			−.173**	−.195**	−.173**
Customer Barriers			−.105	−.114	−.105
R^2 adj.	.081	.240	.272	.123	.272
∇R^2 adj.		.159** (M1 to M2a)	.032* (M2a to M3a)	.042* (M1 to M2b)	.149** (M2b to M3b)

Notes. [a] Unstandardized Coefficient, * $p < .05$; ** $p < .01$

the adoption of e-transactions while company age has no significant impact.

In both Tables 4a and 4b, the incremental explanatory power from model 1 to model 2a (adding the adoption drivers to the control variables) is highly significant as indicated by the increase in adjusted R^2, while the transition from model 2a to model 3a (adding barriers to drivers and control variables) provides less incremental explanatory power. On the other hand, the transition from model 1 to model 2b (adding barriers to control variables) provides less incremental explanatory power than the transition from model 2b to model 3b (adding drivers to barriers and control variables). Overall, the results indicate that adoption drivers have more explanatory power than adoption barriers, (as indicated by the increase in adjusted R^2) both for e-CRM and e-transactions. This analysis suggests that the drivers pushing the adoption of e-services vastly outweigh the barriers preventing it. In other words, subject to further research, the forces driving companies to implement e-services are most likely greater than the obstacles preventing it.

Finally, only a few industry control variables were significant. Specifically, the travel and telecommunication industries demonstrated higher adoption of both e-CRM and e-transactions compared to the rest of the industries.

In Table 5, we compare the means of e-CRM and e-transactions for each industry group. The results show that there are significant differences in the adoption levels of e-CRM between telecommunications on the one hand and health care, professional services, retailing and utilities on the other hand. With regard to e-transactions, there are significant differences between travel on the one hand and health care, professional services and utilities on the other hand, while

Table 5 Mean Comparisons (Tukey) of e-CRM and e-transactions adoption level across industries

Industry E-process	(1) Banking	(2) Entertainment	(3) Travel	(4) Health Care	(5) Professional Services	(6) Retailing	(7) Telecommunications	(8) Transport	(9) Utilities	F-test (sign.)
e-CRM	2.37	2.15	2.63	1.77[a] (7)[b]	1.97 (7)	2.19	2.89 (4, 5, 8, 9)	1.98 (7)	1.83 (7)	3.534 (.001)
e-transactions	2.02	1.93	2.62 (4, 5, 9)	1.57 (3)	1.66 (3)	2.05	2.29	1.92	1.59 (3)	3.159 (.002)
MANOVA (Wilks' Lambda)										.884 (.001)

[a] mean.

[b] denotes the group(s) from which the specific group differs at the .05 level of significance.

there are no significant differences for the remaining industries. Finally, Table 6 summarizes the results of our hypotheses testing.

5. Discussion and Conclusions

In this research, we have empirically investigated the role that rational efficiency, external pressure, firm's internal and external barriers have had in e-process adoption across service firms after the burst of the Internet bubble. Despite the fact that the outlined explanatory variables are deeply rooted in the existing technology adoption literature, there is limited empirical evidence (mainly anecdotal), addressing their role in e-processes adoption in the context of service firms (Voss 2000, Yip 2000, Feeny 2001, Zemke and Connellan 2001, Reichheld 2001, Swift 2001, Rust 2001). Based on a sample of 338 service firms, our empirical results confirm the enabling role of rational efficiency and external pressure, and the hindering role of firm's internal barriers in adoption of e-processes. Our research study's contributions are on several levels. First, our research provides further empirical evidence of the relevance of rational efficiency and external pressure as enablers of technology adoption, specifically e-process adoption, in the context of service firms. Second, this study moves us closer to understanding in as scientific a manner as possible the drivers and barriers behind which was arguably the most important business "revolution" (i.e., the Internet) to hit business since electrification in the early 20th century. We find that even after the Internet bubble burst, external pressure played an important role in e-processes adoption. This result prompts us to argue that the Internet enabled "revolution" in the business context has been not only driven by the quest for business performance improvements but also by strong (maybe even stronger) socio-cultural pressures and incentives (Moyr 1990). In fact, from a historical perspective, much of the Internet story involves a "gold-rush" mindset to adopt online technologies regardless of their practical application, customer appeal, or potential payoff.

Table 6 Summary of Hypotheses Testing Results

Hypothesis	Empirical support
H1a: An increase in expected performance benefits leads to an increase in the adoption of e-CRM.	Yes
H1b: An increase in expected performance benefits leads to an increase in the adoption of e-transactions.	Yes
H2a: An increase in expected access to new markets leads to an increase in the adoption of e-CRM.	No
H2b: An increase in expected access to new markets leads to an increase in the adoption of e-CRM.	Yes
H3a: An increase in external pressure leads to an increase in the adoption of e-CRM.	Yes
H3b: An increase in external pressure leads to an increase in the adoption of e-transactions.	Yes
H4a: An increase in internal barriers leads to a decrease in the adoption of e-CRM.	Yes
H4b: An increase in internal barriers leads to a decrease in the adoption of e transactions.	Yes
H5a: An increase in customer barriers leads to a decrease in the adoption of e-CRM.	No
H5b: An increase in customer barriers leads to a decrease in the adoption of e-transactions.	No

Third, our findings contribute to the literature addressing the management of the service supply chain by addressing some antecedents of "downstream" integration in service firms raised by others, such as Frohlich and Westbrook (2002). Focusing on two typical downstream processes (i.e., e-CRM and e-transactions), we found that downstream integration is jointly enabled by rational efficiency and competitive bandwagon effects (again confirming the dual business and socio-cultural nature of the Internet "revolution").

Finally, when considering each of the tested hypotheses, we gain several specific insights on how rational efficiency, external pressure, internal and external barriers have affected the adoption of e-transactions and e-CRM. These insights, in turn, enlighten future management decisions dealing with the adoption of e-CRM and e-transactions. Our findings show that the factors affecting adoption of e-processes vary depending on the type of e-process. Specifically, expected performance benefits drive both e-CRM and e-transactions while access to new markets drives only e-transactions. This provides valuable insight for managers that will no doubt continue to implement e-processes across the rest of this decade. When it comes to implementing e-CRM (and getting the organization to buy into the necessary changes), managers should concentrate on emphasizing the inherent performance benefits of the new system to others in functions such as operations, marketing, and customer service. Alternatively, highlighting access to new markets appears to be the most effective way to champion e-transactions inside an organization.

Our findings also show that external pressure is a significant driver of both e-CRM and e-transactions. The finding that access to new markets does not drive e-CRM suggests that managers seem to not have taken it on "blind faith" that electronic customer relationship management is the key to opening up new markets and winning fresh customers. Instead, our results suggest that managers consider e-CRM to be more valuable for building and reinforcing relationships with existing customers. This is consistent with the emerging evidence that e-CRM is primarily a customer retention tool as opposed to a customer acquisition tool (Zemke and Connellan 2001, Reichheld 2001, and Swift 2001).

Conversely, the principle driver behind e-transac-

tions adoption is access to new markets, which suggests that managers perceive that while *current* customers may be satisfied with the ways that existing transactions are conducted, *new* customers want different (and often more sophisticated) electronic ways of transacting business. We have already discussed earlier the reasons why external pressure played a strong role on both e-CRM and e-transactions adoption. We find that adoption barriers are the same for both types of e-processes (e-CRM and e-transactions). However, it is interesting to note that while, as expected, internal barriers have a significant negative impact on adoption of e-processes, barriers related to customers, quite surprisingly, do not seem to play an important role in it. Also, as noted above, our study shows that rational efficiency and external pressure (adoption drivers) played a larger role in e-processes adoption than barriers. It is also worth mentioning the relatively few differences found among the service sectors surveyed in this study. The only two sectors that adopted both e-CRM and e-transactions more than the rest were the travel and telecommunications sector. These sectors have relatively low complexity compared to sectors such as health care and professional services (i.e., consulting or accounting) and, furthermore, their core services such as travel booking or online quoting are easily digitizable, unlike those of most other service sectors.

This study is subject to several limitations. As shown in Table 2, the mean scores for adoption of e-CRM and e-transactions are 2.14 and 1.87 respectively on a 5-point scale. This, in conjunction with the standard deviations (0.98 and 0.89 respectively), leads to the conclusion that quite possibly most of the respondents had little or no adoption or e-processes while relative few were high adopters. With relatively little variance below the mean, it is not too surprising then that adoption barriers are not that significant when compared to adoption drivers, as shown in Table 5. This could also possibly explain the lack of significance with regard to customer barriers. Specifically, firms that experience significant customer barriers would decide not to adopt e-practices, which would only make them slightly lower in scale measurement than the general survey population (a score of 1 as opposed to a mean of 2). Also, in terms of measurement, the "External Pressure" construct has marginally acceptable psychometric properties (Cronbach's alpha was 0.60 and the percent of variance explained was 46%).

Finally, the timing of data collection (late 2001) has implications for the generalization of our findings beyond the specific time frame, given the evolution of the field of e-service. This point is actually related to our above limitation as well. As more and more service firms adopt e-processes, this would result in higher scores and subsequently more variance. Having stated this as a limitation, it is worth noting that *despite* the limited variation present in this study of largely e-process earlier adopters, there were still numerous significant relationships uncovered in the data. If anything, this means that in future such studies, when the variation in practice and the resulting measures naturally increase, we will likely see the same relationships uncovered in this study return with even greater significance.

Overall, this study demonstrates the need for continued academic research into the stream of e-services. Future research could investigate, for instance, the question of why don't customer barriers influence the adoption of e-processes by service providers? Or, alternatively, how does the role of external pressure diminish in the technology adoption decision when the business implications of the Internet become clearer? Future research is needed as service companies continue to explore ways of using the Internet to improve their performance. Now that the relative novelty of using the Internet to conduct business was worn off, the real challenge remains ahead. Namely, we as a community of research need to help managers begin figuring out which e-process strategy is optimal depending upon various contexts.

Appendix: Scales

1. Barriers of web-based integration

What were the major barriers inhibiting the implementation of web-based processes in your organization? (1 = highly insignificant, 5 = highly significant)

1.1. Internal Barriers

	Factor loading	Alpha without item
1. Our Culture of resistance to change	.779	.817
2. Our Lack of management skills	.862	.798
3. Our Lack of technical skills	.811	.810
4. Our Technology costs	.669	.839
5. Our Benefits not demonstrated	.664	.841
6. Our IT systems integration	.741	.823
Eigenvalue	3.44	
% Variance Explained	57.41	
Cronbach's alpha		.847

1.2. Customer Barriers

	Factor loading	Alpha without item
1. Customers' Culture of resistance to change	.745	.787
2. Customers' Lack of technical skills	.863	.740
3. Customers' Technology costs	.796	.770
4. Customers' reluctance due to Benefits not demonstrated	.758	.786
5. Customers reluctance due to IT systems integration	.639	.814
Eigenvalue	2.92	
% Variance Explained	58.29	
Cronbach's alpha		.817

2. Drivers of web-based integration

What were the main factors driving your web-based integration? (1 = not at all, 5 = fully)

2.1. Expected Performance Benefits

	Factor loading	Alpha without item
1. Improving speed of response	.854	.872
2. Improving reliability and delivery	.890	.861
3. Improving service quality	.865	.868
4. Anticipated cost reduction	.772	.894
5. Improving after sales support	.830	.877
Eigenvalue	3.56	
% Variance Explained	71.12	
Cronbach's alpha		.897

2.2 New Markets

	Factor loading	Alpha without item
1. Access to European single market	.834	.632
2. Access to global markets	.752	.706
3. Lack of local partners	.725	.714
Eigenvalue	1.92	
% Variance Explained	63.96	
Cronbach's alpha		.679

2.3. External Pressure

	Factor loading	Alpha without item
1. Threat from traditional competitors	.753	.451
2. Pressure from customers	.729	.503
3. Pressure from suppliers	.667	.545
4. Peer pressure "to get onboard"	.546	.599
Eigenvalue	1.84	
% Variance Explained	46.04	
Cronbach's alpha		.600

3. e-Processes

To what extent have you implemented web-based processes for any of the following with customers: (1 = not at all, 5 = fully)

3.1. e-CRM

	Factor loading	Alpha without item
1. Targeted marketing/customer profiling	.775	.713
2. Electronic catalogue/product info	.811	.665
3. After sales support	.855	.569
Eigenvalue	1.99	
% Variance Explained	66.29	
Cronbach's alpha		.739

3.2. e-Transactions

	Factor loading	Alpha without item
1. Order taking/receipt	.785	.780
2. Billing	.861	.745
3. Electronic payments	.707	.812
4. Order tracking	.794	.780
5. Integrated demand/forecasting	.699	.813
Eigenvalue	2.98	
% Variance Explained	59.53	
Cronbach's alpha		.822

Note. All of the above scales are unidimensional (based on factor analysis).

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