

ERP and e-Business Systems Development, Innovation and Business Performance – An Empirical Investigation

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Abstract

There has been extensive theoretical work on the potential of information and communication technologies (ICT) to drive significant innovations, which can dramatically enhance firms' performance. However, this potential has not been sufficiently investigated empirically. This paper investigates empirically and compares i) the effects of the two most widely used types of information systems (IS), the ERP and the e-business ones, on innovation, and also ii) to what extent their effects on business performance are through (i.e. mediated by) the innovation they drive. It is concluded that both ERP and e-business IS have positive impact on innovation, with the former being a stronger driver of innovation than the latter. However, most of their positive impact on business performance is mainly through automation and support of existing processes, and only a smaller part of it (20% for the ERP and 30% for the e-business IS) is through innovation.

1. Introduction

Innovation is widely recognized as a vital element of modern economy, which is of critical importance for the competitiveness of firms, sectors and nations. Several recent OECD reports [40] – [42] state that innovation can be a significant source of growth, employment and citizens' well being, and conclude that the capability to innovate and to bring innovation successfully to market is a crucial determinant of competitiveness and profitability.

There has been extensive theoretical work on the innovation potential of information and communication technologies (ICT); it has concluded, based on a rich theoretical argumentation, that ICT have a great potential to enable and drive important innovations in business processes, products and services of firms, which can dramatically increase their business performance [43] [22] [14] [23] [7] [21] [9] [8] [11]

[12] [4] [37] [36] [17]. This theoretical literature initially was focusing on the innovation potential of the 'traditional' intra-organizational information systems (IS), defined as systems oriented mainly to the interior of the firm and supporting its internal functions and processes (e.g. accounting, financial management, human resources management, inventory management, etc.) [33]. The most advanced representative of this type of IS are the enterprise resource planning systems (ERP), which aim to support all functions of a firm and also the interconnections among them; however, since the implementation of an ERP system in a firm is a complex, costly and risky project, many firms have developed their ERP systems only to a certain degree, having implemented only some of the modules (e.g. only the ones supporting accounting and sales).

The explosive growth of Internet and e-business over it motivated an expansion of this literature and the development of a new wave of theoretical work on the innovation potential of the new 'extrovert' Internet-based e-business IS. They are defined as systems oriented to firm's external environment and enabling the online execution of all the stages of selling products and services online (e.g. online marketing, ordering, invoicing, payment, etc.) over a telecommunications network, such as the Internet [29]. It should be noted that, similarly with the ERP systems, many firms have developed their e-business systems only to a certain degree, supporting only some of the stages of a sale (e.g. only the provision of information on firm's products and services to potential customers). There has been considerable theoretical work on the innovation potential of e-business IS; it has come to the conclusion, based on a rich theoretical argumentation, that e-business IS can drive radical innovations in the business models, value propositions, products, and services of firms, and also in their internal business processes, which can result in significant increases of business performance [50] [1] [2] [56] [53] [49] [54] [48] [3].

However, the high potential of both internal and e-business IS to drive dramatic innovation that the above

theoretical literature predicts has not been sufficiently investigated empirically using large data sets. It is therefore of critical importance to examine to what extent these high expectations of the above theoretical literature are realized in 'real life': to what extent various types of IS (both intra-organizational and extrovert ones) affect this vital element of modern economy, the innovation performance of firms; and also how important these IS-driven innovations are: to what extent the impacts of various IS types on business performance are through (i.e. mediated by) the innovations they drive.

This paper contributes to filling these research gaps. Its main contribution is twofold:

I) It investigates empirically and compares the effects of the two most widely used types of IS, the ERP and the e-business ones, on innovation; in particular, it addresses two fundamental (for both IS researchers and practitioners) research questions: I1) Do these two widely used types of IS (the former being intra-organizational and the latter extrovert) have an impact on innovation performance of firms? I2) If this happens, are there differences among them as to their capacity to drive innovation?

II) Also, it investigates empirically to what extent the impacts of these two IS types on business performance are through (i.e. mediated by) the innovation they drive, and proceeds to comparisons between them from this perspective. This allows a deeper understanding of the nature of the impacts of these two IS types on business performance, addressing the fundamental research question: what part of them is through automation and support of existing processes and what part is through innovation?

This empirical study has been based on firm-level data collected from 13231 European firms through the e-Business Watch Survey sponsored by the European Commission, which have been used for estimating a structural equation model connecting these variables.

The paper is structured in six sections. In section 2 the background of this study is briefly presented. Then in section 3 the research model and hypotheses are formulated, while the data and the method of this study are described in section 4. The results are presented and discussed in section 5 and, finally, in section 6 the main conclusions are outlined.

2. Background

2.1. Information Systems and Innovation

As mentioned previously there has been an extensive theoretical research stream dealing with the innovation potential of ICT, which concludes that ICT

have a great potential as enablers and drivers of important innovations that can dramatically increase business performance [43] [22] [14] [23] [7] [21] [9] [8] [11] [12] [4] [37] [36] [17]. A rich theoretical argumentation has been developed in this direction. Its main point is that this innovation potential is due to a unique characteristic of ICT, in comparison to the other technologies that firms use: ICT are 'general purpose technologies', characterized by high flexibility and adaptability, so they can be used in numerous different ways and for many different purposes, and therefore enable important innovations in business processes, products and services of firms. For this reason ICT can change the way that human work is performed, measured, controlled and reported; also they can enable significant restructuring of the work practices, through allocation of well-defined routine tasks associated with symbols processing to computers, and dramatic transformation of tasks that require human skills. ICT enable an individual worker to have all the required information for completing a bigger part of a process, so the existing fragmentation of many processes can be significantly reduced resulting in large efficiency gains. The above theoretical literature also emphasizes that most of the existing work practices and business processes of firms have been developed in the past in the pre-ICT era, and reflect the high cost of communication and information processing at that time. Therefore, taking into account that modern ICT can dramatically reduce both these costs, they can be key enablers and facilitators of new enhanced business processes and work practices, which lead to big productivity increases; this happens initially through the reduction of costs and the improvement of output quality, and subsequently through the design of new products/services and the improvement of important intangible aspects of existing products and services, such as convenience, timeliness, quality, personalization, etc. However, a significant part of this literature (e.g. [4] [37] [36] [17]) argues that the development of these ICT-based innovations is not an easy and straightforward task, since it is influenced and shaped not only by the characteristics and capabilities of these technologies but also by the context (social, organizational, national) in which they are developed.

This first stream of theoretical work was focused on the intra-organizational IS, however subsequently the emergence of the Internet motivated a new theoretical research stream focusing on the innovative potential of the Internet/e-business. This theoretical research has concluded that e-business IS have a huge potential as enablers and drivers of radical innovations (much more disruptive than the ones driven by the intra-organizational IS) in business models, value propositions, products, services and business processes

of firms, and which can offer substantial performance improvements [50] [1] [2] [56] [53] [49] [54] [48] [3]. In [50] are described many new business models that Internet gradually gives rise to: e-shop, e-procurement, e-auction, e-mail, third party marketplace, virtual community, value chain service provider, value chain integrator, collaboration platform, information brokerage and trust services. In [48] is introduced the concept of 'business webs', which are new Internet-enabled business models; based on the dimensions of level of control and value integration they are grouped in five main categories: agora, aggregation, distributive network, alliance and value chain. In [56] are identified eleven categories of innovation opportunities that the WWW/Internet compound provides, which are associated with marketplace, universal supply-chain linkage, network of relationships, collaboration, use of forum, interactive media, goods and services delivery, high connectivity, development platforms, universal telecommunications networks and computing utility. In the same direction [53] and [54] argue that e-commerce can drive extensive innovations that change both products' core components and business model, which can be categorized into four groups: incremental innovations (no significant changes in products' core components and the business model), modular innovations (considerable changes in products' core components but not in the business model), architectural innovations (considerable changes in the business model but not in products' core components) and radical innovations (considerable changes in both products' core components and business model).

However, the high expectations of the above theoretical literature concerning the huge innovation potential of ICT in general and Internet/e-business in particular have not been empirically investigated sufficiently using large data sets. There are only a small number of empirical investigations dealing directly the effect of ICT on innovation. In [20], based on data from 6,351 firms from all sectors of the Canadian economy, it is concluded that ICT investment per worker has a positive effect on both product and process innovation. In [25], using data from 4,500 representatively chosen firms in Germany, it is concluded that ICT investment and share of employees working mainly on a computer have a positive impact on functional flexibility (employees working in teams, workgroups and quality circles) and through it on product and process innovation, while ICT has a direct effect on both types of innovation as well. In [6] is presented an empirical study focusing on process innovation; using data from 1251 German firms, it comes to the conclusion that the share of employees working mainly on a computer has a positive impact on process innovation. [18]

investigates the relationship between the use of sector-specific software (defined as off-the-shelf software designed and standardized for certain industries) and also customized software (designed and adopted to the needs of a particular firm and having unique features) on service innovation, using data from 335 German service firms of the period 2007-2009; their results showed it is the customized software that contributes significantly to innovation, while the off-the-shelf sector-specific software does not. It should be mentioned that there are also a few empirical studies investigating the moderation effect of innovation on the contribution of ICT on business performance [34] [24] [35]; they conclude that the combination of ICT investment with innovation increases the contribution of the former to business performance.

In conclusion, the high expectations of the abovementioned theoretical literature concerning the potential of ICT to drive dramatic innovation have been tested empirically only to a limited extent. We also remark that even the few empirical studies that investigate directly this effect of ICT on firms' innovation do not discriminate between different types of IS (which have different orientations, objectives and functionalities, and also pervade, support and influence to different extent all the processes, so they might have different effect on innovation). Also, they are characterized by too simple operationalization of ICT (such as share of employees using computers, which is not a good measure of the ICT, as employees' computers may offer various levels of functionality). Furthermore, they estimate regression models, and none of them proceeds to the estimation of structural equation models, so they cannot address the fundamental question what part of the impact of ICT on performance is through the automation and support of existing processes and what part is through the innovation ICT drives.

The present study overcomes the above weaknesses, making the following contributions: a) it discriminates between two types of IS widely used by firms, ERP and e-business systems, and investigates and compares their impact on innovation, b) it uses a more sophisticated operationalization of them (based on the functionality provided), c) it estimates a structural equation model, which allows us to examine for each of these IS types what part of its impact on business performance is through automation and support of existing processes it provides and what part is through the innovation it drives.

2.2. ERP and e-Business Systems and Business Performance

Several empirical studies have been conducted

concerning the impact of ERP systems, on firm performance [27] [28] [38] [39] [51] [26] with mixed results. Some of these studies provide evidence of positive impact of ERP systems on some business performance measures; however, some other studies did not find a statistically significant effect on the same or other organizational performance measures. This is interpreted as the existence of additional variables that affect this relationship. However, the mediating role of innovation in the relationship between e-business and performance has not been examined.

Also, there have been empirical studies of the impact of e-business on various non-financial measures of business performance [52] [55] [16] [45] [46] and also on some financial ones [55] [5] [30] [44]. These studies have produced considerable evidence that e-business has a positive impact on financial and non-financial business performance. Also, they have identified a number of mediating factors in this relationship, such as the development of internal and external e-business capabilities, the digitization of business activities with customers and suppliers, etc.; however, the mediating role of innovation in the relationship between e-business and performance has not been examined.

In general, there is a lack of 'holistic' empirical investigations of the whole network of relations between various IS types, innovation and business performance, which enable a better understanding of these critical relations, and also allow a comparison of different types of IS as to their impact on innovation and business performance. The present study contributes to filling this research gap.

3. Research Model and Hypotheses

The research model of this study is shown below in Figure 1.

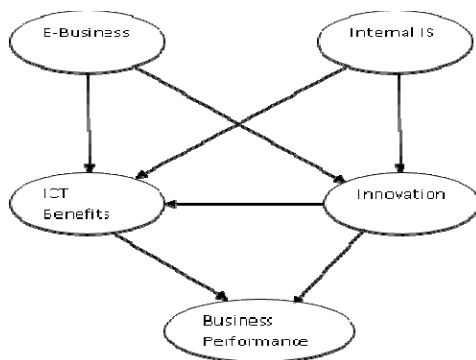


Figure 1. Hypothesized research model.

Its theoretical foundation is the abovementioned

existing theoretical background concerning the extensive potential of intra-organizational and e-business IS to drive significant innovations that enhance business performance.

The first research hypothesis concerns the mediating role of innovation in the relation between firm's degree of ERP systems development and the benefits it obtains from its ICT infrastructure. ERP systems on one hand automate important functions and processes of the firm, reducing cost and time, and support a better management of them and of the resources of the firm. Also, they support coordination and control within the firm, while they also provide reliable data for supporting and enhancing decision making. We expect that the above automation and support capabilities offered by ERP systems to firms increase the business benefits they obtain from their ICT infrastructures; higher development of the ERP systems (i.e. more modules implemented and in production mode) is expected to result in more ICT benefits for the firm. On the other hand, based on the theoretical work outlined in the first paragraph of section 2, we expect that ERP will facilitate and enable innovations in business processes (e.g. processes simplifications, improvements, abolitions, or creation of new horizontal interdepartmental processes), and also new or improved products and services, which will increase the above business benefits the firm obtains from ICT use. Higher degree of ERP development, means opportunities for innovations in more business functions, and more support to new products and services. For the above reasons our first research hypothesis is:

Hypothesis 1: *The degree of development of ERP system has a positive effect on the benefits the firm obtains from ICT, which is partially mediated by innovation.*

The second research hypothesis concerns the mediating role of innovation in the relation between firm's use of e-business IS and the benefits it obtains from ICT. E-business systems offer to the firms the capability to reach much wider geographic areas and prospective customers' groups. Also they enable the firms to provide more and better information (e.g. enriched with multimedia) to current and prospective customers on their offerings (products and services), to receive online orders for their products and services and also online payments from their customers. Furthermore, they enable offering better after-sales support and services to customers. Therefore we expect that firm's use of e-business IS will have a positive effect on the benefits it obtains from ICT. However, we expect that part of these benefits to be through automating and supporting existing processes, and another part through the business models, products,

services and processes innovations driven by the adoption of e-business, according to the theoretical work outlined in the second paragraph of section 2. For the above reasons our second research hypothesis is:

Hypothesis 2: *Firm's use of e-business IS has a positive effect on the benefits it obtains from ICT, which is partially mediated by innovation.*

Finally we expect that the business benefits generated from ICT use will result in higher business performance. Furthermore, we expect that the extent of innovation will also result to higher business performance, both directly and indirectly through the increase of ICT benefits. The development of new products and services by a firm creates new markets, which are monopolised by the firm for some time, until the competitors imitate the new product or service; also, while the substantial improvement of existing products and services provides differentiation over competitors; also, process innovation reduces costs and improves efficiency. These will result in higher business performance. Empirical research on this has found that innovation has a positive impact on business performance (e.g. [32], [15]). Also, as mentioned in section 2, innovation increases the benefits we obtain from ICT [34] [24] [35]. For the above reasons our third and fourth research hypotheses are:

Hypothesis 3: *ICT benefits have a positive effect on business performance.*

Hypothesis 4: *Innovation has a positive effect on business performance, both directly and through the increase of ICT benefits it causes.*

4. Method and Data

The data source for the present study was the e-Business Watch Survey 2006, which has been conducted by European e-Business Market W@tch (www.ebusiness-watch.org), an observatory sponsored by the European Commission. This survey was based on 13231 telephone interviews with decision-makers of firms from 29 countries, including the 25 EU Member States, the European Economic Area (EEA) and the Acceding/Candidate Countries. The population considered in this survey were all active firms of these countries that use computers and have their primary business activity in one of the following nine highly important sectors (from both manufacturing and services): Food and Beverages, Footwear, Pulp and Paper, ICT Manufacturing, Consumer Electronics, Shipbuilding and Repair, Construction, Tourism and Telecommunication Services. From this population a stratified sampling was made with respect to sector and company size (so that firms of all sizes are included).

All the five basic variables of this study, which are

shown in Figure 1, were measured as reflective constructs using several items, which correspond to appropriate questions of this survey that have extensive previous literature support (i.e. have been extensively used by other researchers), so that high levels of validity and reliability can be achieved [47] [31]. In particular:

- for measuring firm's use of e-business we have used four items (EB2-EB4), which measure whether the firm uses ICT for publishing offers to customers, answering calls for proposals or tenders, receiving orders from customers and also for enabling customers to pay online for ordered products or services,

- firm's internal IS use was measured through six items (INT1-INT6), which measure whether the firm uses ICT to enable sharing documents between colleagues or performing collaborative work in an online environment, to track working hours or production time, to manage capacity or inventories, and also whether it uses an Intranet, an Enterprise Resource Planning (ERP) system and accounting software,

- innovation was also measured through four items (INV1-INV4): two of them measure whether the firm during the past 12 months has launched any new or substantially improved products or services (product/service innovations), or has introduced any new or significantly improved internal processes (process innovations); the other two items measure whether any of these product or service innovations, or any of these process innovations, has been directly related to or enabled by ICT,

- in order to measure firm's benefits from ICT we used six items (ICTB1-ICTB6), which measure whether ICT has had positive influence, no influence at all or negative influence on revenue growth, efficiency of business processes, internal work organisation, quality of products and services, quality of customer service and firm productivity,

- and finally business performance was measured through three items (BP1-BP3), which measure whether the turnover, the market share and the productivity of the firm has increased, stayed roughly the same or decreased over the past 12 months.

Using these data the hypothesized research model shown in Figure 1 was estimated through covariance-based SEM [31], using the AMOS 6 software [10].

5. Results

Initially we examined the measurement part of the estimated model and assessed the validity and reliability of each construct. For this purpose as first step we assessed the most important dimension of

constructs' validity, the convergent validity [47], by examining the loadings of the items for each construct, which are shown in the third column of Table 1 of the Appendix. We can see that all of them are statistically significant, most of them exceed the cut-off level of 0.6 suggested by [13], and only a few items have loadings slightly lower than 0.6, which were however regarded as marginally acceptable, so they were retained. Therefore we can conclude our constructs are characterised by convergent validity. Next we assessed the discriminant validity of the constructs. For this purpose the factor structure behind the above 23 items of these five constructs was examined by performing Principal Components Analysis (PCA) with Varimax rotation using the SPSS 15.0 software. The results indicated that five factors were formed (having eigenvalues exceeding 1.0), and each of them is characterised by high loadings of all the items corresponding to one of the constructs and much lower loadings of all the other items. These results indicate the discriminant validity of these five constructs. Finally, we assessed the reliability of each construct by calculating its Cronbach Alpha using the SPSS 15.0 software, and the results are shown in the fourth column of Table 1 of the Appendix. Since all constructs have values exceeding the cut-off level of 0.7 recommended by the relevant literature [47] [19], we can conclude that all constructs are characterised by reliability as well.

Then we assessed the goodness of fit of the whole model by examining the values of its basic fit indices, which are shown in Table 2 of the Appendix. We can see that we have acceptable values, in accordance with the recommendations of the relevant literature [47] [31] [19], for both the incremental fit indexes NFI, RFI, IFI, TLI and CFI (> 0.9) and for the RMSEA (< 0.05), so we can conclude that the estimated model is characterised by acceptable fit to the data.

Having confirmed acceptable model fit and validity and reliability for all constructs we finally focused our attention on the structural model, which is shown in Figure 2 (for all paths are shown standardised coefficients). We remark that both e-business and internal IS have a positive and statistically significant effect on innovation (standardised coefficients 0.094 and 0.444 respectively). Therefore we conclude both these types of IS are drivers of innovation, with the 'traditional' internal IS being much stronger innovation drivers than the 'new' e-business IS.

Also, we can see that innovation has a positive and statistically significant effect (standardised coefficient 0.201) on the benefits firms obtain from ICT. This result is in agreement with the previous empirical literature (see 2.1) concluding that innovation increases the business benefits and contribution of ICT [34] [24]

[35]. At the same time we remark that internal and e-business IS have both a positive and statistically significant direct effect as well on ICT benefits (standardised coefficients 0.041 and 0.355 respectively); however, the 'traditional' internal IS seem to contribute much more to the benefits firms obtain from ICT than the 'new' e-business IS. From the above results it is concluded that both internal and e-business IS have positive effects on ICT benefits, which are both partially mediated innovation, so hypotheses 1 and 2 are supported.

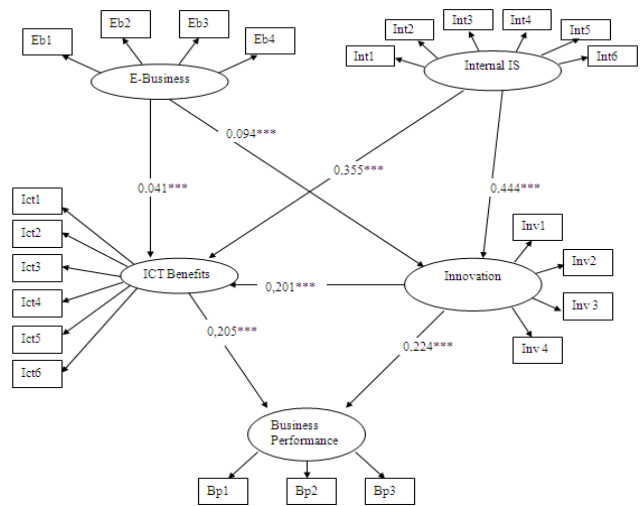


Figure 2. The estimated structural model

In particular, internal IS have a positive and statistically significant total effect on ICT benefits equal to 0.355 (direct effect) + 0.444*0.201 (indirect effect through the extent of innovation) = 0.444; this in agreement with previous relevant empirical ERP literature (see 2.2) concluding that they have a positive impact on business performance [27] [28] [38] [39] [51] [26]. We remark that 20% of this total effect (0.444*0.201/0.444) is through the innovations that internal IS drive, which enhance the benefits from ICT, while the remaining 80% is through the automation and support of existing processes and activities they provide. With respect to the e-business IS, they also have a positive and statistically significant total effect on ICT benefits equal to 0.041 (direct effect) + 0.094*0.201 (indirect effect through innovation) = 0.060, which is in agreement with previous relevant empirical literature (see 2.2) concluding that e-business has a positive impact on business performance [52] [55] [16] [45] [46] [55] [5] [30] [44]. We remark that 32% of this total effect (0.094*0.201/0.060) is through the innovations that e-business drives, which enhance the benefits from ICT, while the remaining 68% is

through automation and support of existing processes. From the above results we can conclude that the 'traditional' internal IS have a much larger effect on the level of benefits firms get from ICT than the 'new' e-business IS. However, the effect of the e-business IS on ICT benefits is mediated by innovation to a higher extent (32%) than the effect of the internal IS of ICT benefits (20%).

Finally, we remark that ICT benefits have a positive and statistically significant effect on business performance (standardised coefficient 0.205), so hypothesis 3 is supported. Also, we can see that innovation has a direct positive and statistically significant effect as well on business performance (standardised coefficient 0.224), in addition to the indirect effect though the increase of ICT benefits it drives. This leads to the conclusion that the positive effect of innovation on business performance is partially mediated by ICT benefits, so hypothesis 4 is supported. In particular, we found that innovation has a statistically significant total effect on business performance equal to 0.224 (direct effect) + $0.201 \cdot 0.205$ (indirect effect through the extent of innovation) = 0.265 , which is in agreement with previous relevant empirical literature concluding that innovation has a positive impact on business performance (e.g. [32] [15]). We remark that 15% of this total effect ($0.201 \cdot 0.205 / 0.265$) is through the increase of ICT business benefits resulting from innovation, which enhance business performance.

6. Discussion and Conclusions

Extensive theoretical work has been conducted on the potential of ICT in general and e-business in particular to drive significant innovations in firms' products, services and internal processes, which can considerably enhance their business performance. However, these high theoretical expectations have not been empirically investigated sufficiently using large data sets. So having these theoretical developments as our main theoretical foundation we have conducted an empirical investigation of the relations between the two quite different and widely adopted types of IS, the internal and the e-business IS, innovation, ICT business benefits and finally business performance. Our empirical study has been based on firm-level data from a large sample of 13231 European firms from 29 countries and 9 sectors, collected through the e-Business Watch Survey sponsored by the European Commission.

It has been concluded that both internal and e-business IS are drivers of innovation, which mediates their impact on business performance, however to a

small extent. We have found that only a smaller part of the positive impact of these two IS types on business performance is through innovation (20% for internal IS and 32% for e-business IS), while the largest part of this impact is through automation and support of existing processes and activities (80% for internal IS and 68% for e-business IS). This result on one hand provides empirical evidence that these two IS types are drivers of innovation, however on the other hand is much below the high and enthusiastic expectations of the theoretical literature that innovation can have a very strong and dominant role in ICT business value generation (i.e. that most of ICT business value will be through ICT-based innovation). This indicates that firms have not yet learnt sufficiently how to use ICT in an innovative manner, for driving important and highly beneficial process, products and services innovations, and use ICT mainly for automating and supporting existing processes and activities. Firms have not yet managed to apply and incorporate in their daily practices the great ICT-based innovation directions and ideas proposed by the relevant theoretical

Therefore the benefits from e-business come to a higher extent from innovation driven by it than the benefits from internal systems. Finally, with respect to innovation, it has been concluded that it has a positive impact on business performance, which is partially mediated to a small extent (15%) by the better exploitation of the ICT infrastructure and the higher ICT benefits that innovation drives.

with the internal systems having a strong effect on innovation (standardised path coefficient 0.444) and the e-business systems having a much smaller (standardised path coefficient 0.094). This shows that firms, having a long history and experience of using internal IS, have gradually learnt how to use them for making innovations in their processes, products and services. On the contrary with respect to e-business, despite its great potential for driving radical innovations according to previous theoretical literature, firms have not yet learnt to exploit this innovation potential; since they have a shorter history and experience of e-business. Also, we have found that both internal and e-business IS have a positive impact on the benefits firms obtain from ICT, and through them on business performance, with the internal systems having a much higher impact on ICT benefits and business performance (total effect 0.444) than the e-business ones (total effect 0.265). This can be explained similarly, taking into account that firms have more history, experience and maturity in using internal systems and much less in e-business, which results in higher efficiency, effectiveness and more business benefits from internal systems.

Our findings have interesting implication for

research and practice. The significant differences identified in this study between the internal systems and the extrovert e-business systems, as to their effect on innovation, ICT benefits and business performance, indicate that future IS research on such issues should not deal with IS in general, but should focus on particular types of IS. With respect to IS management practice, the conclusions of this study indicate that firms should combine the development of internal and e-business systems with innovations in order to get more business benefits from them and have a larger positive impact on business performance. Future research is required on the relations of other types of IS with innovation, ICT business benefits and business performance, and comparison between them from the above perspectives. Also, further research should be conducted for increasing our knowledge on Internet/e-business related innovations in products, services and processes, the business benefits they provide and also their main barriers and inhibitors.

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Appendix

Table 1. Constructs' items loadings and reliabilities.

Construct	Items	Loadings	Reliability
Internal IS	INT1	.563	.701
	INT2	.574	
	INT3	.588	
	INT4	.566	
	INT5	.584	
	INT6	.564	
E-Business	EB1	.875	.879
	EB2	.840	
	EB3	.871	
	EB4	.606	
Innovation	INV1	.615	.789
	INV2	.569	
	INV3	.884	
	INV4	.885	
ICT Benefits	ICTB1	.680	.831
	ICTB2	.718	
	ICTB3	.642	
	ICTB4	.591	
	ICTB5	.641	
	ICTB6	.739	
Business Performance	BP1	.701	.802
	BP2	.863	
	BP3	.731	

Table 2. Model fit indices

Chi-square	NFI	RFI	IFI	TLI	CFI	RMSEA
254.0	.987	.984	.989	.986	.989	.021