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THE ERP AND CRM BUSINESS VALUE

André Martins Mestre

Dissertação apresentada como requisito parcial para
obtenção do grau de Mestre em Estatística e Gestão de
Informação



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RESUMO

O valor da adoção de Tecnologias de Informação (TI) tem sido e continua a ser uma questão crucial no que toca à decisão de adoção dessas mesmas tecnologias. Neste estudo, sugerimos e testamos um modelo que tem como objetivo definir o valor integrado de sistemas de Enterprise Resource Planning (ERP) e Customer Relationship Management (CRM). Ambos os tipos de sistemas foram analisados com base na teoria Resource Based View (RBV) e medidos pelo seu impacto no valor de negócio, tendo em consideração o peso moderador da integração de sistemas e de processos de negócio. O modelo sugerido foi testado e analisado com dados recolhidos com o apoio da Microsoft, de organizações que já adotaram sistemas de ERP e CRM. O nosso objetivo com este estudo é o de gerar novo conhecimento relativo a como sistemas de ERP e CRM podem influenciar positivamente o valor dos investimentos feitos em TI, e de como a integração dos vários sistemas e dos vários processos de negócio de uma organização podem contribuir para o valor gerado.

PALAVRAS-CHAVE

Enterprise Resource Planning (ERP); Customer Relationship Management (CRM); Resource Based View (RBV); integração de sistemas; integração de processos de negócio; valor.

ABSTRACT

The value of Information Technology (IT) adoption has been and still is a crucial question for the decision on IT adoption. In this paper we suggest and test a research model that aims at defining the integrative value of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems. ERP and CRM systems is analysed based on the Resource Based View (RBV) of the firm and will be measured by its impact on business value, having in consideration the moderation of system and process integration. The research model was tested and analysed with data, collected with the assistance of Microsoft, from firms that have adopted both ERP and CRM systems in their organization. Our aim with this research is that it will provide new knowledge on how ERP and CRM systems may positively influence value from IT investments, and how systems integration as well as process integration provides business value.

KEYWORDS

Enterprise Resource Planning (ERP); Customer Relationship Management (CRM); Resource Based View (RBV); system integration; process integration; value.

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LISTA DE SIGLAS E ABREVIATURAS

ERP: Enterprise Resource Planning

CRM: Customer Relationship Management

RBV: Resource Based View

IT: Information Technology

IS: Information Systems

PLS: Partial Least Squares

1. INTRODUCTION

Enterprise Resource Planning (ERP) systems have been applied by many firms regardless size around the world as a key part of the organizational architecture. ERP systems support day-to-day business operations and decision-making processes (Gattiker and Goodhue, 2005), and are expected to provide seamless integration of processes across functional areas with improved workflow, standardization of various business practices, improved order management, accurate accounting of inventory, and better supply chain management (Mabert et al., 2003). However, these IT resources streamline and integrate internal business processes to improve efficiency only within firm's boundaries (Davenport, 1998).

Customer Relationship Management (CRM) systems have exploded on the enterprise space in the past years, and some studies claim that they are the ultimate solution to the information exchange problem among firms (Gartner, 2013, Extraprise, 2008). CRM aims to improve the relationship between firms and customers and its main purposes are customer relationship set up, development and maintenance (Alshawi et al., 2011, King and Burgess, 2008, Goodhue et al., 2002).

CRM extend the original value proposition of ERP, allowing firms to build interactive relationships with its customers and bring together their previously separated information at very low cost (Payne and Frow, 2006, Iriana and Buttle, 2006). Whereas CRM encompass the external part of the extended enterprise, and ERP encompass the internal part (Gartner, 2013, Extraprise, 2008, Alshawi et al., 2011). That is, while CRM applications extract customer information from customer facing processes, ERP applications leverage the information to configure product offerings, scheduling, and fulfilment (Hitt et al., 2002). As more and more firms realize that they need to know deeply their customers in order to compete or survive, integrating CRM with ERP becomes a critical topic (Payne and Frow, 2005, Ryals, 2005). Integrated CRM and ERP applications automatically communicate to each other customer and process-related information (Rai et al., 2006). Therefore, ERP and CRM integration increases interdepartmental connectedness, facilitates the dissemination of market intelligence among multiple departments and locations, and improves the entire organization's responsiveness to consumer demands (Liu et al., 2013).

Although existing research have studied the importance and benefits of using ERP and CRM systems separately, they are limited in addressing the integration between these two IT resources as an important factor for firms to fully exploit the value of IT integration. Moreover, several

researchers suggests that IT value is better captured when taking in consideration moderators effects on the linkage between IT resources and business value (Srinivasan and Hanssens, 2009, Liu et al., 2013, Mishra and Agarwal, 2010). The impacts of IT on business value is placed within the business contexts where firms deploy IT, and system integration is a key factor that shapes how IT is applied to digitize business processes and generate value (Melville et al., 2004, Liu et al., 2013). As IT and business become more tightly connected than ever, a growing strand of research explores “the nature of the link between IT and performance” (Liu et al., 2013, Zhu and Kraemer, 2005). Although few, some IS researchers have identified ERP and CRM integration as one of the most important fields for future research (King and Burgess, 2008, Alshawi et al., 2011, Davenport, 1998).

However, none has investigated its integration impact in business value nor thru a theoretically rigorous framework. To respond to this, grounded in a well-established IS theory - Resource Based View (RBV) - this study develops and tests a theoretical model to measure the impact of ERP and CRM systems and moderating effects of system and process integration on business value. In doing so, we contribute to the IT value literature by examining the complementarity value of the integration of these two resources. Our work focuses on answering the followings research questions (RQs):

RQ1 – Are ERP and CRM systems drivers of business value?

RQ2 – Are systems and processes integration drivers of business value

RQ3 – Do systems and processes integration work as moderators of ERP and CRM systems in business value creation?

The remainder of the paper is organized as follows. In Section 2, we set the literature review on ERP and CRM business value, and value of IT integration, followed by an overview of RBV theory of the firm that support our research model. Next, in Section 3, we present the proposed research model and present the hypothesis. In Section 4, we explain the research methodology and operationalize the variables. Next Section 5, we present the results and analysis. Then in Section 6 we discuss the results, present the managerial implications, contributions as well as the limitations and future work. In last section we present the concluding remarks of this research.

2. LITERATURE REVIEW

In this section, we first review the three streams of existing studies that build our knowledge: (1) The ERP business value, (2) the CRM business value, and (3) the IT integration value. Then we set the RBV theory of the firm as the theoretical basis for linking the ERP and CRM integrative value to business value.

2.1. THE ERP BUSINESS VALUE

In reviewing earlier research focused on ERP and business value, researchers pointed out that most business value in ERP use are in intangible areas such as increased interactions across the enterprise, quick response time for information, integration of business process, and availability and quality of information (Ranganathan and Brown, 2006, Mabert et al., 2003). In the same line others reported that there are improvements in communications, individual productivity, user satisfaction, and management control (Rhodes et al., 2009, Gattiker and Goodhue, 2005, Zhang et al., 2005, Bradford and Florin, 2003). And others found that ERP improves coordination between different units, efficiency of business process, cost efficiency, and differentiation (Hitt et al., 2002, Nicolaou and Bhattacharya, 2006). Another stream of research investigate tangible areas of ERP firm's performance basically following the "IT productivity paradox" paradigm (Dedrick et al., 2003). Traditional cost measures such as direct operating costs (ROA, ROE, COGS, SG&A, profit margin), inventory levels and cash management (Nicolaou and Bhattacharya, 2008, Nicolaou and Bhattacharya, 2006, Hitt et al., 2002, Aral et al., 2005). There are some econometric researches that studied tangible and intangible complementarily streams and assess a positive relationship between ERP and business value (Ruivo et al., 2014, Ruivo et al., 2013, Ruivo et al., 2012, Ram et al., 2013c).

Accordingly with several ERP papers (Ram et al., 2014, Ram et al., 2013c, Ram et al., 2013b, Ram et al., 2013a, Ruivo et al., 2013, Ruivo et al., 2012, Ruivo et al., 2014, Nicolaou, 2004, Nicolaou and Bhattacharya, 2006), ERP contributes to achievement of performance when firms develop strategies and innovations around ERP technology. Still, they argue that ERP would have a superior impact on business value when complementing other IT resources. These findings resonate with earlier work by Laframboise and Reyes (2005) and Holland et al. (2001) who suggest that ERP may not be sufficient by itself to have great impact on business value, however, can provide the platform to other resources excel and so forth create a unique system aimed to fund greatly business value.

2.2. THE CRM BUSINESS VALUE

In reviewing CRM literature and business value, there is mixed evidence about the relationship of CRM applications to the overall business value (Liu et al., 2013, Aral et al., 2005, Aral and Weill, 2007, Coltman, 2007, Hillebrand et al., 2011, Reinartz et al., 2004, Payne and Frow, 2005, Payne and Frow, 2006). From some, CRM represents a system for creating value for both the firm and its customers through the appropriate use of technology, data and customer knowledge. CRM brings together people, other resources and organizational capabilities to ensure connectivity between the company, its customers and collaborating firms (Day, 2003, Alshawi et al., 2011, Chen and Popovich, 2003, Payne and Frow, 2005, Payne and Frow, 2006). Some researchers assessed the CRM value as direct measures such the success at generating revenues from new products, reduction in cost of transacting with customers and level of repeat business with valuable customers (Mittal et al., 2005, Payne and Frow, 2005, Payne and Frow, 2006, Iriana and Buttle, 2006, Ryals, 2005, Dong and Zhu, 2008, Alshawi et al., 2011). Others reported an increase on return on assets (ROA), return on sales (ROS), and return on equity (ROE) (Boulding et al., 2005, Hillebrand et al., 2011, Reinartz et al., 2004).

In the perspective of customer-facing processes whereas several studies reported efficiency gains in the front office (Albert et al., 2004, Jayachandran et al., 2005, Karimi et al., 2001, Minami and Dawson, 2008), others reported improved customer information in the back office (Albert et al., 2004, Cao and Gruca, 2005, Ernst et al., 2011, Mithas et al., 2005, Padmanabhan et al., 2006, Liu et al., 2013).

However several researchers have expressed concerns with the lack of research on the combination of IT resources such CRM with ERP systems that deliver most business value (Mithas et al., 2011, Aral et al., 2005, Aral and Weill, 2007, Bhatt and Grover, 2005, Liu et al., 2013, Alshawi et al., 2011, Chen and Popovich, 2003).

2.3. THE IT INTEGRATION BUSINESS VALUE

In reviewing IT integration literature and business value, IT integration is essential to attain the full benefits of seamless information exchange (Liu et al., 2013, Hsu, 2013b, Gosain et al., 2004,

Mithas et al., 2005, Rai et al., 2006, Elbashir et al., 2013). Accordingly with several researchers (Hsu, 2013b, Barki and Pinsonneault, 2005, Frohlich and Westbrook, 2001, Markus, 2000, Rai et al., 2006, Ranganathan and Brown, 2006) the benefits of IT integration of business applications can be attained on two levels: Systems integration and process integration. Whereas systems integration refers to the degree of linkages between different computer-based information systems and databases, process integration represents the extent to which the business process of two departments are tightly coordinated and standardized through firms information system (Hsu, 2013b, Barki and Pinsonneault, 2005, Truman, 2000, Chen and Popovich, 2003, Francalanci and Morabito, 2008). Systems integration is as a prerequisite and facilitator of business process integration, however two departments or subsidiaries might both achieve a high level of system integration, but their process integration level might vary due the reluctance in sharing information (Chen and Popovich, 2003, Hsu, 2013b, Cachon and Fisher, 2000, Markus, 2000, Rai et al., 2006). Literature argues that it is only when they are measured in conjunction that will have a positive impact on business value (Rai et al., 2006, Ranganathan and Brown, 2006, Dong and Zhu, 2008, Boulding et al., 2005).

While the existing studies have expanded the business value of ERP and CRM understanding, the results look only at these systems separately. Literature argues that with the growing of CRM systems, there should be a strong interest in assessing how integrate the CRM functionality with ERP improve business value (Francalanci and Morabito, 2008, Dong and Zhu, 2008, King and Burgess, 2008).

2.4. THE RBV AND BUSINESS VALUE

A potential framework for extending the theoretical basis of IT value is the Resource Based View (RBV) of the firm, which roots on economics and management rationales (Melville et al., 2004). The RBV claims that firm resources are heterogeneous and disseminated across firms. When the firm resources are valuable, non-imitable and non-substitutable, they can explain the differences in business value (Zhu and Kraemer, 2005, Barney, 1991). The RBV has been used in the IS literature to explain IT business value, in which firm-specific sets of resources determine the firm's performance (Caldeira and Ward, 2003, Uwizeyemungu and Raymond, 2012, Ruivo et al., 2014, Ruivo et al., 2013, Ruivo et al., 2012). Some researchers have emphasized that an IT resource, such as ERP, is likely to affect business value only when it is deployed to created unique integrative complementarities with other IT resource, such as CRM systems. (Rai et al., 2006, Wade and Hulland, 2004, Ravichandran and Lertwongstien, 2005).

Integrative complementary represents the enhancement of resource value, because a resource produces greater returns when integrated with another resource that by itself (Wade and Hulland, 2004, Melville et al., 2004, King and Burgess, 2008). These researchers state that, it is only when two resources are used in a mutually complementary way that a firm enhance its competencies, been difficulty to imitate.

Although business components such as ERP and CRM systems that go into the firm's infrastructure are commodities-like, the process of integrating these components sets a firm-specific system difficult to substitute and be understood by competitors (Bharadwaj, 2000, Lengnick-Hall et al., 2004, Zhu and Kraemer, 2005, King and Burgess, 2008).

Integrating ERP and CRM systems is firm's specific, because involves not only the firm's departments but also their customers and partners, which develops new rules and procedures like dominoes in a row. That is, each new transaction sets of a cascade of new events. For example: a marketing campaign might generate a prospect, a lead, a new sales order, which triggers inventory levels, production order, purchase order, quality orders, invoices, etc. (Ram et al., 2013c, Hitt et al., 2002, Hsu, 2013b, Alshawi et al., 2011, Bharadwaj et al., 2007, King and Burgess, 2008, Laframboise and Reyes, 2005, Stratman, 2007).

The ERP and CRM integrative business value is grounded in the above reasons: the possibility of imitation and substitution decreases because new value chains are created, increasing business value which is consistent with RBV of the firm. The present study uses the RBV as a frame of reference to develop a theoretical model to understand the extent to which ERP and CRM integration contribute to business value. Next we define the model variables and hypotheses.

3. RESEARCH MODEL AND HYPOTHESES

3.1. THE RESEARCH MODEL

Focus on the process-oriented view about the business value creation of IT (Barua et al., 2004, Zhu and Kraemer, 2005, Picoto et al., 2014), we move forward the above stream and developed a research model to understand the impact of ERP and CRM systems moderated by system and process integration on business value. Our research model is illustrated in Figure 1.

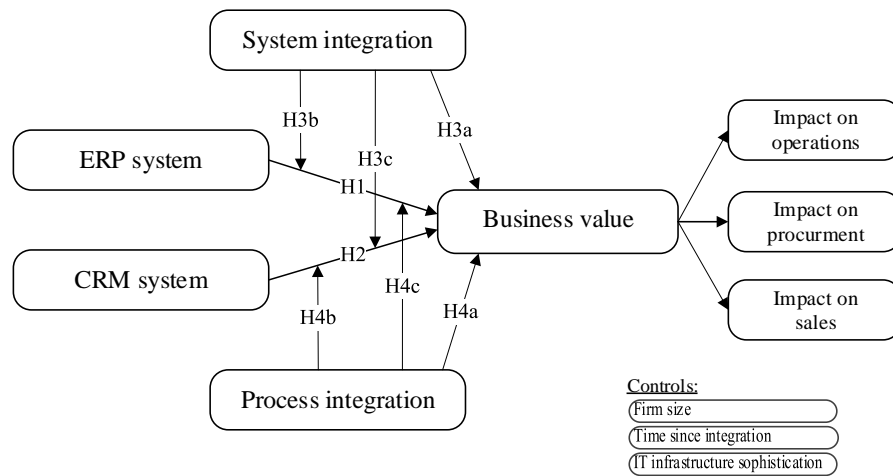


Figure 1: Research model to assess the impact of ERP and CRM value on business value

We theorize that ‘Business value’ is driven by four antecedent variables: ERP system, CRM systems, system integration and process integration, as well as moderated by two variables: system and process integration. These variables are hypothesized to measure the impact of ERP and CRM integration on business value. Business value is a second order variable that has been set of three dimensions: impact on operations, on procurement, and on sales, which are grounded in the value chain analysis that has been broadly used in the IS literature to study the business value of IT (Zhu and Kraemer, 2005, Zhu et al., 2004, Stewart and Segars, 2002, Tallon et al., 2000). Next, we present the hypotheses of the model.

3.2. HYPOTHESES FOR DIRECT EFFECTS

Taking in consideration the theoretical background presented above, whereas ERP systems focus on internal process and are expected to affect internal firm's operations by decreasing internal costs (Gattiker and Goodhue, 2005), CRM systems focus on external, intra-firm's process efficiency and effectiveness by decreasing coordination costs and reap the benefits of customer relationships (Goodhue et al., 2002). In this line we postulate the following two hypotheses:

H1: Firm's with greater ERP system functionality are more likely to generate higher business value.

H2: Firm's with greater CRM system functionality are more likely to find value from their information system.

Integrating ERP and CRM might be a technical and complex process. An ERP system generally embeds firm's business logic, where the routines, rules, procedures such as procurement, fulfillment, and approvals are made over electronic transactions that are expanded and enhanced when technically tied with other systems (Hsu, 2013b, Gattiker and Goodhue, 2005). CRM functions must generally adapt to the business logic and therefore a successful integration between ERP and CRM systems is considered to be valuable, heterogeneously distributed, difficult to be imitated and difficult to be substituted, which is in accordance with RBV rationales (Gattiker and Goodhue, 2005, Goodhue et al., 2002, Liu et al., 2013). In this line we postulate the following two hypotheses:

H3a: Firm's with greater system integration are more likely to generate higher business value.

H4a: Firm's with greater process integration are more likely to generate higher business value.

3.3. HYPOTHESES FOR MODERATOR EFFECTS

Several prior studies consider that moderating effects best explain the IT integration value (Liu et al., 2013, Melville et al., 2004, Boulding et al., 2005, Dong et al., 2009). In addition to incorporating whether ERP and CRM are integrated into the entire value chain (as proxy) we also consider that there are two moderators that will reinforce the positive relationship between ERP and CRM systems and the business value of the firm's information system; system and process integration. Whereas system integration is the IT component that creates the correct links between different information systems and databases, process integration is the extent to which the business process of the two systems are tightly linked and standardized into what could be described as a single information system. Given that ERP and CRM are strategic initiatives that involves both business and IT, its impact on a business value should also be examined in the systems and business process settings in which the firm operates specifically, because it's a richer field to build competitive advantages, which is consistent with RBV rationales. Hence, we postulate the following four hypotheses:

H3b: System integration will moderate the effects of ERP system on business value, such that it will be stronger among the firms with high system integration level.

H3c: System integration will moderate the effects of CRM system on business value, such that it will be stronger among the firms with high system integration level.

H4b: Process integration will moderate the effects of ERP system on business value, such that it will be stronger among the firms with high process integration level.

H4c: Process integration will moderate the effects of CRM system on business value, such that it will be stronger among the firms with high process integration level.

4. RESEARCH METHODOLOGY

To test our research model, a survey instrument was designed to collect data on each of the variables in the model.

4.1. DATA

A questionnaire was designed to investigate the ERP and CRM business value (see Appendix). A web-based survey was developed from the literature by choosing appropriate items. A group of five established academic researchers reviewed the instrument for content validity (Venkatesh et al., 2012). The initial questionnaire was pilot tested on 30 firms to assess any item's difficulty or ambiguity and to test the reliability and validity of the scales. Some items were revised for clarity. This phase provided preliminary evidence of the reliability and validity of the scales. With assistance from Microsoft, questionnaires were sent in September 2014 only to firm that uses both ERP and CRM systems in their daily business activities. In total, 400 firms from Portugal (150) and Spain (250) received the web-survey, and 125 valid responses were returned, resulting in a response rate of 31.25%. To ensure the generalization of the survey results, the sampling was stratified by firm size, by industry type (financial services, retail, manufacturing, professional-services, information technology, and utilities), and by ERP and CRM system's vendor. Table 1 shows the characteristics of the sample and of the respondents, such as industry and role, which indicates that they were qualified to speak about the firm's ERP and CRM value, which suggests the good quality of the data.

Table 1: Characteristics of the sample

Characteristics		(N)	(%)
Country	Spain	64	51.2
	Portugal	61	48.8
Industry type	Professional services	40	32.0
	Retail	31	24.8
	Manufacturing	23	18.4
	Financial services	17	13.6
	Information technology	8	6.4
	Utilities	6	4.8
Respondent's role	IT/IS manager	32	25.6
	CEO/owner	30	24.0
	Sales manager	29	23.2
	Manufacturing manager	13	10.4
	Logistics manager	11	8.8
	Finance manager	10	8.0
Annual Turnover (€)	<1M	20	16.0
	1M to 10M	47	37.6
	10M to 25M	28	22.4
	25M to 50M	18	14.4
	>50M	12	9.60
Firm size	<49	31	24.8
	50 to 99	28	22.4

	100 to 249	39	31.2
	>250	27	21.6
Years since integration	<1	12	9,6
	1 to 2	27	22,4
	3 to 5	75	56,8
	6 to 10	11	8,8
	>10	3	2,4
ERP system	Microsoft	46	36.8
	SAP	30	24.0
	Oracle	13	10.4
	Primavera	9	7.2
	PHC	8	6.4
	Sage	8	6.4
	PeopleSoft	3	2.4
	OutSystems	2	1.6
	ArtSoft	2	1.6
	Others	4	3.2
CRM system	Microsoft	56	44,8
	Salesforce	26	20,8
	Custom made	11	8,8
	NetSuite	7	5,6
	Oracle	2	1,6
	Sage	7	5,6
	SAP	6	4,8
	Primavera	3	2,4
	Zoho	5	4.0
	Others	2	1,6
IT infrastructure sophistication	IT architecture and standards	111	88.8
	Security and risk	99	79.2
	The latest back-end	87	69.6

Notes: N-number of responses; %-the percentage of the 125 respondents.

Next, we will operationalize the variables of the research model.

4.2. OPERATIONIZATION OF THE VARIABLES

The variables and measurement items were adapted from previously validated measures or developed on the basis of literature review discussed in the previous section. Respondents were asked to rate their perception. The variables were measured by a five-point quantitative scale, in which 1 means “low” and 5 “high”.

The *ERP system* variable, is operationalized as the extent to which ERP is being used to conduct the firm’s value-chain based activities, it refers to the scope of ERP system modules a firm use in daily business activities. The way we measure this variable is similar to previous studies (Ranganathan and Brown, 2006), more precise, this variable was measured through three item-questions that assess the extent to which a firm use ERP financial module, supply chain module, and manufacturing module.

The *CRM system* variable, is operationalized as the extent to which CRM is being used to conduct the firm's customer-oriented based activities, it refers to the scope of CRM system modules a firm use in daily business activities. The way we measure this variable is similar to previous studies (Payne and Frow, 2005), more precise, this variable was measured through three item-questions that assess the extent to which firms use CRM marketing module, sales module, and service module.

The *System integration* variable, is operationalized as the extent to which different information systems are interconnected and can communicate to one another, it refers to the extent to which information systems are technically integrated along the value-chain and customer-oriented based activities. The way we measure this variable is similar to previous studies (Barki and Pinsonneault, 2005), more precisely this variable was measured through three item-questions that assess the extent to which a firm's ERP system is integrated with firm's CRM system and business partner's IS, and by the extent is firm's CRM accessible by firm's business partners via web or other electronic networks.

The *Process integration* variable, is operationalized as the extent to which operational information is shared between firm's departments or locations, it refers to the extent to which decision making processes are based on real-time information throughout the value-chain and customer-oriented based activities. The way we measure this variable is similar to previous studies (Rai et al., 2006), more precisely this variable was measured through three item-questions that assess the extent to which a firm shares inventory levels and product information across departments or locations, and share demand and forecasting information across departments or locations.

The *business value* variable, is operationalized as a second-order construct manifested by three business value dimensions, as defined with regards to the arguments made earlier. The way we measure this variable is similar to previous studies that such a second-order approach represents a theoretically strong basis for capturing complex measures (Zhu and Kraemer, 2005). More precisely this variable was measured through six item-questions grouped into three dimensions that assess the impact on internal operations (decreased internal operations costs and improved on time delivery), impact on procurement (decreased inventory and procurement costs), and impact on sales (improved sales, and customer service and support).

4.3. THE CONTROLS VARIABLES

Prior studies suggest that ancillary factors can influence ERP and CRM business value. Firm size is used as a proxy for the resource base of the organization that may influence the firm's integrative information systems value and business value (Elbashir et al., 2013). Time since both systems were integrated was included to measure the knowledge and experience that organizations obtain from working overtime (Elbashir et al., 2013). IT related infrastructure sophistication assesses the differences in both generic and specialized systems that may affect the integrative value and impact on performance (Elbashir et al., 2013). Hence, we will use three controls: firm size, time since integration, and IT infrastructure sophistication.

5. RESULTS AND ANALYSES

In the next two sub-sections we analyze the instrument validation (measurement model and test the structural model). As none of the items in our data are normally distributed ($p < 0.01$ based on the Kolmogorov-Smirnov test), the partial least squares (PLS) is the appropriate method to use to estimate the research model (Chin, 1998, Henseler et al., 2009). We used SmartPLS 2.0 (Ringle et al., 2005) software to analyze the models.

5.1. MEASUREMENT MODEL

Measurement of the model is shown in Tables 2 and 3. We assessed indicator reliability, construct reliability, convergent validity, and discriminant validity. 1) The indicator reliability was evaluated based on the criteria that the loadings should be greater than 0.7, and that every loading less than 0.4 should be eliminated (Churchill, 1979, Henseler et al., 2009). The items are presented in Table 2, the loadings are greater than 0.7, with the exception of two items (CRM2 and ERP1), which are lower than 0.7 but greater than 0.4. Hence, no items in the table were eliminated. All the items are statistically significant at 0.001. Overall, the instrument presents good indicator reliability. 2) Construct reliability was tested using the composite reliability (CR) coefficient. Table 2 shows that the CR for each variable is above the cut-off of 0.7 (Chin, 1998). 3) Average variance extracted (AVE) was used as the criterion to test convergent validity; Table 2 shows that AVE for each variable is above the cut-off of 0.5 (Chin, 1998).

Variable	Items	Loading	t-Stat*	AVE	CR
CRM system	CRM1	0.717	10.158	0.517	0.760
	CRM2	0.628	7.151		
	CRM3	0.800	12.444		
ERP system	ERP1	0.684	7.854	0.628	0.769
	ERP2	0.888	19.493		
System integration	SYI1	0.887	36.709	0.628	0.769
	SYI2	0.890	31.019		
	SYI3	0.717	10.754		

Process integration	PRI1	0.846	28.264	0.696	0.873	
	PRI2	0.817	19.600			
	PRI3	0.839	18.013			
Business value (2th order construct)	Impact on operations	IO1	0.870	44.526	0.764	0.866
		IO2	0.878	44.006		
	Impact on procurement	IP1	0.889	47.255	0.752	0.858
		IP2	0.845	21.596		
	Impact on sales	IS1	0.926	67.193	0.849	0.918
		IS2	0.917	52.539		

Table 2: Item question loadings, CR, and AVE variables values.

4) Discriminant validity of the variables was assessed using two criteria; the Fornell-Larcker (1981) criterion and cross-loadings. For the first criterion we compute the square root of AVE (Table 3 in bold) for constructs, which are greater than the correlation between each pair of constructs (off-diagonal elements), except with regard to the correlations involving the construct “business value”, and the three constructs contributing to it (impact on operations, impact on procurement, and impact on sales). This was to be expected since “business value” corresponds to a second-order construct of “impact on operations”, “impact on procurement”, and “impact on sales”. The second criterion ensures that the loadings of each indicator are greater than all cross-loadings (Chin, 1998). The Table with loadings and cross-loadings is available from the authors on request.

Variable	Mean	SD	CRM	ERP	SYI	PRI	VAL	IO	IP	IS
CRM system (CRM)	3.536	0.939	0.719							
ERP system (ERP)	3.664	1.107	0.659	0.793						
System integration (SYI)	3.299	1.191	0.590	0.573	0.835					
Process integration (PRI)	3.093	1.130	0.573	0.519	0.705	0.834				
Integrative value (VAL)	3.568	0.933	0.536	0.573	0.654	0.621	0.809			
Impact on operations (IO)	3.656	0.954	0.505	0.501	0.599	0.596	0.916	0.874		
Impact on procurement (IP)	3.577	0.926	0.490	0.563	0.603	0.533	0.901	0.749	0.867	
Impact on sales (IS)	3.452	1.219	0.472	0.506	0.588	0.569	0.918	0.764	0.729	0.921

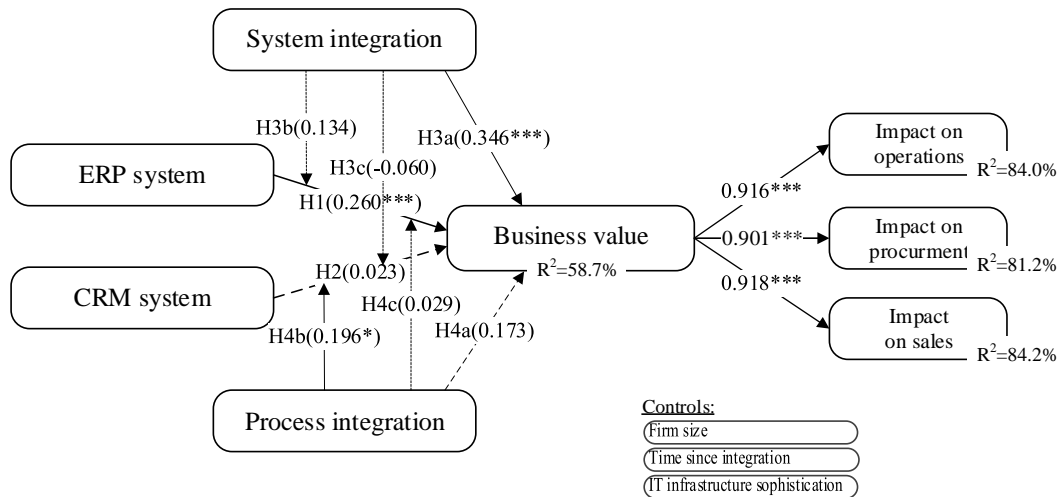
Note: Diagonal elements are square root of AVEs and off-diagonal elements are correlations.

Table 3: Descriptive statistics, correlations, and the square root of AVEs.

Consequently, our model has good indicator reliability, construct reliability, convergent validity, and discriminant validity. Thus, variables developed using this measurement model can be used to assess the structural model.

5.2. STRUCTURAL MODEL AND HYPOTHESIS TESTING

The structural model was assessed by examining the R^2 , and the level of significance of the path coefficients. The research model explain 58.7% of the business value variation, which is considerable substantial (Chin, 1998). Therefore, we believe that the variables model has significantly explained data variations for integrative value and its underlying business value dimensions. The significance of the path coefficients was derived from bootstrapping (5000 resamples) (Chin, 1998). Figure 2 shows the model results and path coefficients.



* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. To avoid a crowded graph, indicators for each construct are not shown in the graph.

Figure 2: Model results and path coefficients.

Figure 2 shows that whereas ERP systems have a positive and significant impact on business value (0.260***), CRM system shows a positive impact but is not statistically significant (0.023), hence only H1 is supported. Whereas system integration has a positive and significant

impact on business value (0.346***), process integration shows a positive impact but is not statistically significant (0.173), hence only H3a is supported.

The moderation effect of system integration on both ERP system and CRM system are not statistically significant, hence H3b and H3c are not supported. Whereas the moderation effect of process integration shows on a positive and significant effect on CRM system (0.196*), is not statistically significant on ERP system (0.029), hence only H4b is supported.

In short, H1 (ERP system), H3a (system integration), H4b (the process integration moderator of the CRM systems on business) are supported. In opposite H2 (CRM system), H3b (the system integration moderator of the ERP system on business value), H3c (the system integration moderator of the CRM system on business value), H4a (process integration), nor H4c (the process integration moderator of the CRM system on business value).

6. DISCUSSION

The empirical results demonstrated two major findings, which are: i) ERP systems by themselves are still considered an important asset to business value, whereas on the other side, CRM systems impact to business value shown not to be significant, even if positive; and ii) System integration as moderator of ERP or CRM system shown not to be significant but has a positive and significant impact on business value. For process integration we concluded that it is only significant when moderating the CRM system variable.

Our results show that ERP systems, even if considered as standardized and a commodity in previous literature (Hsu, 2013a), are still found to be valuable to companies and a key contributor to business value. ERP systems support critical parts of firm's value chains, operations, procurement and sales processes, and therefore have great impact in business value. Previous IT and ERP literature (Hsu, 2013b, Melville et al., 2004, Tsai et al., 2011) also indicates that the mere adoption of this kind of systems do not guarantee business value gains and at the same time RBV says that a resource is more likely to generate value when not widely used (Hsu, 2013a), which is the case of ERP systems – usage for several years and dependence on software vendors for configuration and functionalities. Nevertheless, we have concluded that ERP systems are critical and encompass core processes of companies to the point that, where correctly implemented, may have specificities to each firm that are difficult to imitate and contribute to competitive advantage and business value.

On the other side, CRM system shows positive but non-significant impact on business value. Enterprise software such as CRM systems, as delivered by software vendors, contain out-of-the-box functionalities that are widely used without the need of configuration or customization (Ruivo et al., 2015). According to RBV, these can be seen as easy to imitate and therefore less relevant for competitive advantage or business value, which comes in line with our findings. The moderator effect of process integration shows that CRM systems can become more impactful on business value when well integrated with firms' business processes. While in this study we could not conclude that CRM system is core in business value creation, CRM should always be seen as a business strategy that impacts technology but also people and more importantly business processes.

System and processes integration are two firm specific capabilities which, according to RBV, can affect business value (Hsu, 2013b) since technology can be easily imitated but not the

knowledge and transformation needed to integrate systems and streamline business processes. Our results show that system integration moderation effect in both ERP and CRM system is not significant but nevertheless, it proved to be significant to business value. One conclusion we might take from this results is that there might be other systems besides ERP and CRM that might contribute to business value, such as e-commerce systems, internal line of business applications, partner and supplier systems, etc.

Process integration on the other side, is not significantly impacting business value but has a positive and significant contribution in the moderation of the CRM system variable. Therefore, and in line with previous literature (Liu et al., 2013, Alshawi et al., 2011), CRM is a business strategy that impacts technology, people and also business processes and our results show that CRM system will in fact have a bigger impact in business value when deeply integrated into firms' business processes.

Managerial implications

We have reached three fundamental managerial recommendations with this study: i) ERP systems are still fundamental to business value. Previous literature (Hsu, 2013b) mentions that system and process integration would be a key factor to that even though our results are showing them as not significant (even if positive). With this, the first implication to managers would be that they should focus on first making sure that firms ERP systems are well implemented and configured and have a deep impact on the critical core processes while nevertheless not neglecting system integration and the fact that this integration can mean huge investments of time and money and involve risky projects and implementations (Hsu, 2013b); ii) secondly, our results show that system integration – that might involve CRM, ERP but also a broader set of systems – may create significant business value and therefore should also be on the list of priorities to managers; and lastly iii) the selection of a CRM system should always take into consideration its architecture and flexibility, to make sure that the CRM system will be easily integrated into firm's business processes – both technically and functionally speaking.

Contributions to theory

This study extends current literature in 4 ways: i) we include the integration of CRM and ERP applications in the analysis of value creation, ii) system and processes integration to explain business value iii) we investigate how system and process integration moderates the ERP and

CRM system to explain business value, and iv) we examine the link between information system value and business value. There was previous literature and theory around the value created by ERP and CRM systems but it was very limited when it comes to address the importance and benefits of using ERP and CRM systems integrated and as important contributors to business value. As our model was based on the RBV theory, we also addressed the moderating effect of system and process integration, since these are two very specific firm capabilities that may create competitive advantage and also contribute to business value.

Limitations and Future Work

One of the limitations of our research has to do with the sample size and variety. We had 400 firms targeted from Portugal and Spain with the questionnaire and received 125 valid responses. Future work might be based on having a bigger sample by for example expanding it to other European countries. With this study we have not made any industry-specific analysis, even though we have analyzed the industries of the respondents. The use of ERP and CRM system and also its integration with systems and processes might differ from one industry to another as for example in the modules of ERP and CRM typically used. Our results shown that CRM system is still not seen as critical to business value. According to previous literature (Liu et al., 2013), CRM systems are proved to be adopted by companies in markets where products are more differentiated or where entry costs are lower, and that at the same time it should be seen as a business strategy that impacts not only technology but also people and processes (Liu et al., 2013, Alshawi et al., 2011). This means that our sample and analysis might have been impacted by i) the role of the person responding (we had ~25% of IT/IS Managers), and/or ii) the market, strategy or type of business from the companies targeted. As a future work might be interesting in comparing for example the results from IT related roles with business roles.

7. CONCLUDING REMARKS

Our work focused on measuring the impact of ERP systems, CRM systems, systems integration, and process integration on business value. We also tested if system and process integration moderate the effect of ERP and CRM systems on business value. To test the research model proposed, the data was collected with the assistance from Microsoft. 125 valid responses from Iberian Region (Portugal and Spain) were used to test the conceptual model. According to the results and to the significance of the same, we propose that companies continue to implement ERP systems in order to create business value but at the same time do not neglect the importance that the integration between those ERP systems and the broader IT infrastructure might bring to their business value. Our results show that ERP systems still have a direct impact on business value by themselves so they should be kept as a priority to companies. Moreover, firms should take into consideration the integration between business processes and CRM systems as this same integration will definitely impact on the business value extracted from these systems. CRM systems need to be part of a broad set of business processes and not just another software where data is stored but with no impact on business processes or decision making. We found our study to be unique in the way we approached the integration between ERP and CRM systems as drivers of business value but also in the way we brought System and Process Integration to moderate the two IT resource variables. We also hope that this study and the model we developed and tested can contribute to further research in this area.

8. BIBLIOGRAPHY

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APPENDIX A - MEASUREMENT ITEMS

Variable	Indicators	Literature support
Taking in consideration the integration of ERP with CRM please rate the following questions:		
ERP system	Using a five-point scale, where 1 means 'low' and 5 'high', please rate to: ERP1 - Extent your firm use Financial module ERP2 - Extent your firm use Supply chain module ERP3 - Extent your firm use Manufacturing module	(Ranganathan and Brown, 2006)
CRM system	Using a five-point scale, where 1 means 'low' and 5 'high', please rate to: CRM1 - Extent your firm use Sales module CRM2 - Extent your firm use Marketing module CRM3 - Extent your firm use Service module	(Payne and Frow, 2005)
System Integration	Using a five-point scale, where 1 means 'low' and 5 'high', please rate to: SYI1 - Extent is your ERP system integrated with your CRM system SYI2 - Extent is your ERP system integrated with your business partner's IS SYI3 - Extent is your CRM accessible by your business partner via web or other electronic networks	(Barki and Pinsonneault, 2005)
Process Integration	Using a five-point scale, where 1 means 'low' and 5 'high', please rate to: PRI1 - Extent your firm share inventory levels across departments or locations PRI2 - Extent your firm share product information across departments or locations PRI3 - Extent your firm share demand and forecasting information across departments or locations	(Rai et al., 2006)
Business Value (impact on firm performance)	Using a five-point scale, where 1 means "increased a lot" and 5-"decreased a lot", please rate to what extent have the following increased, decreased, or stay the same in your firm as a result of using integration of ERP with CRM:	(Zhu and Kraemer, 2005)
	Impact on operations IO1 - Internal operations costs IO2 - On time delivery	
	Impact on procurement IP1 - Procurement costs IP2 - Inventory costs	
	Impact on sales IS1 - Sales IS2 - Customer service and support	
Please assess your firm's IT infrastructure sophistication (Y/N): ITAS - IT architecture and standards SRMP - Security and risk management policies LBET - The latest back-end technology		(Elbashir et al., 2013)

APPENDIX B - PAPER PRESENTED AT CENTERIS 2014 CONFERENCE

Defining the ERP and CRM integrative value

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Abstract

The value of IT adoption has been and still is a crucial question for the decision on IT adoption. In this paper we suggest a research model that aims at defining the integrative value of adoption of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems. The integrative value is described from the Resource Based View of the firm (RBV) and will be measured as impact on firm performance. The research model suggests six hypotheses that will be tested and analysed with data from a questionnaire among firms that have adopted both ERP and CRM systems in their organization. Due to the nature of the research model and the fact that it has not been tested in the past, the data analysis will be supported by Partial Least Squares (PLS). Our aim with this research project is that it will provide new knowledge on how integration between systems can positively influence value from IT investments, but also how different software such as ERP and CRM provides value to systems integration as well as process integration.

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2014 *Keywords*: ERP; CRM; RBV; integrative; value; firm performance.

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1. INTRODUCTION

Enterprise Resource Planning (ERP) systems have been applied by many firms regardless size around the world as a key part of the organizational infrastructure. ERP encompass a wide range of software products supporting day-today business operations and decision-making [1]. ERP systems are expected to provide, seamless integration of processes across functional areas with improved workflow, standardization of various business practices, improved order management, accurate accounting of inventory, and better supply chain management [2]. However, these IT resources streamline and integrate internal business processes to improve efficiency only within firm's boundaries [3].

Customer Relationship Management (CRM) systems have exploded on the enterprise space in the past years, and some studies claim that they are the ultimate solution to the information exchange problem among firms [4, 5].

In this study, CRM is an IT resource that can also be present in firm's IT portfolio as a thirty party resource. It is aimed to improve the relationship between firms and customers. The main purposes of CRM is customer relationship setting up, development and maintenance [6, 7].

Because of their lower cost and ease of implementation and its use, CRM hold the promise of enabling information made from the CRM to be consumed in ERP and across the extended enterprise. CRM extend the original value proposition of ERP, allowing firms to build interactive relationships with its customers and bring together their previously separated information at very low cost [8, 9]. Whereas CRM encompass the external part of the extended enterprise, and ERP encompass the internal part [4-6].

As more and more firms realize that they need to know deeply their customers in order to compete or survive, integrating CRM with ERP becomes a critical issue [10, 11]. Although existing research have studied the importance and benefits of using ERP and CRM systems separately, they are limited in addressing the integration between these two IT resources as an important factor for firms to fully exploit the value of IT. Although few, some IS researchers have identified ERP and CRM integration as one of the most important IS fields for future research [3, 6, 7]. However none has investigated the integration thru a theoretically rigorous framework. To respond to this, this study aims to develop a theoretical model that attempts to measure ERP and CRM integrative value using a well-established IS theory - resource-based view (RBV). In doing so, we contribute to the IT value literature by examining through an original lens - the complementarity value of the integration of these two resources. Our work focuses on the overall question: How can integrative value from ERP and CRM systems be explained?

The remainder of the paper is organized as follows. In Section two, based on the literature review we provide a definition of ERP and CRM business value, followed by an overview of resource-based view of the firm that support our research model. Next, we present the proposed research model. Finally, future steps are defined.

2. Theoretical background (abbreviated)

2.1 ERP, CRM and firm performance

In reviewing earlier research focused on ERP and firm performance, researchers such as Mabert et al. [2] and Ranganathan and Brown [12] pointed out that most value in ERP use are in intangible areas such as increased interactions across the enterprise, quick response time for information, integration of business process, and availability and quality of information. In the same line Gattiker and Goodhue [1] and Rhodes et al. [13] reported that there are also improvements in communications, individual productivity, and management control. Studies conducted by Hitt et al. [14] and, Nicolau and Bhattacharya [15] found that ERP improves coordination between different units, efficiency of business process, cost efficiency and differentiation. Furthermore, both Zhang et al. [16] and, Bradford and Florin [17] established user satisfaction as an important determinant of ERP that positively impact on firm's performance.

Another stream of research investigate tangible areas of ERP firm's performance basically following the "IT productivity paradox" paradigm (see Dedrick et al. [18] for a concise review). Traditional cost measures such as direct operating costs (ROA, ROE, COGS, SG&A, profit margin), inventory levels and cash management [14, 15, 19, 20] There are some econometric researches that studied tangible and intangible complementarily streams and assess a positive relationship between ERP and firm performance [21-24].

In reviewing CRM literature and firm performance, CRM represents a system for creating value for both the firm and its customers through the appropriate use of technology, data and customer knowledge [6, 8, 10]. Accordingly with Day and Van den Bulte [25], and Alshawi et al. [6] CRM brings together people, other resources and organizational capabilities to ensure connectivity between the company, its customers and collaborating firms. Several researchers have expressed concerns with the lack of research on the combination of IT resources such CRM with ERP systems that deliver most business value [20, 26-28]. Some researchers assessed the CRM value as direct measures such the success at generating revenues from new products, reduction in cost of transacting with customers and level of repeat business with valuable customers [6, 8-11, 29, 30].

While the existing studies have expanded the business value of ERP and CRM understanding, the results look only at these systems separately. The present study looks at the firm's IT complementarily to create unique valuable characteristics, which when used together can leverage firm's performance. Francalanci and Morabito [31] and Dong and Zhu [30] pointed out that most of the existing research on IT value focuses on the IT as a resource itself, but not on the much richer area of IT complementarily such as the integration value of ERP with CRM. They argue that with the growing of CRM systems, there should be a strong interest in assessing how to best integrate the functionality of these systems with ERP to improve firm performance [7, 30, 31].

We move forward the above stream and developed a research model to know if the business value generated by IT dependent upon the combination of complementary resources such as ERP and CRM.

2.2 ERP and CRM integrative value

A potential framework for extending the theoretical basis of IT value is the Resource-Based View (RBV) of the firm, which roots on economics and management rationales [21-23, 32]. These two perspectives provide the development of a robust model to link both the ERP and CRM firm performance literature into a single model.

The RBV claims that firm resources are heterogeneous and disseminated across firms. When the firm resources are valuable, non-imitable and non-substitutable, they can explain the differences in firm performance [21-23, 33, 34].

The RBV has been used in the IS literature to explain IT business value, in which firm-specific sets of resources determine the firm's performance [21-23, 35, 36]. The present study uses the RBV as a frame of reference to develop a theoretical model to understand the extent to which ERP and CRM integration contribute to firm performance.

Some researchers have emphasized that an IT resource, such as ERP, is likely to affect firm performance only when it is deployed to created unique integrative complementarities with other IT resource, such as CRM systems. [37-39]. Integrative complementary represents the enhancement of resource value, because a resource produces greater returns when integrated with another resource that by itself [7, 32, 38]. Accordingly with these researchers, it is only when two resources are used in a mutually complementary way that a firm enhance its business core competencies, been difficulty to imitate. Although business components such as ERP and CRM systems that go into the firm's infrastructure are commodities, the process of integrating these components do sets a firm-specific infrastructure tailored difficult to substitute and be understood by competitors [7, 33, 40, 41].

Integrating ERP and CRM systems could be particular difficult since it involves not only the local firm itself but also their customers. As the firm develops a new IT infrastructure it develops rules and procedures that goes beyond the firm boundaries [6, 7, 40, 42, 43]. The new business process that are supported by ERP integrated with CRM systems are like dominoes in a row. That is, each new transaction sets of a cascade of new events. As example - a marketing campaign generate a new sales

order which triggers inventory levels, production order, purchase order, quality orders, invoices, etc. New processes that are valuable for firms to pursuit [6, 14, 21-24, 44].

The ERP and CRM integrative value is grounded in the above reasons: the possibility of imitation and substitution decreases and new value chains are created, increasing firm performance which is consistent with RBV of the firm.

3. Model and Hypotheses

Since the RBV provides the rationales to define the ERP and CRM integrative value, we propose the following research model to investigate their effect on firm performance.

The model presented in Figure 1 aims to assess the integrative value by measuring how ERP and CRM systems are integrated and used in function of systems and processes integration.

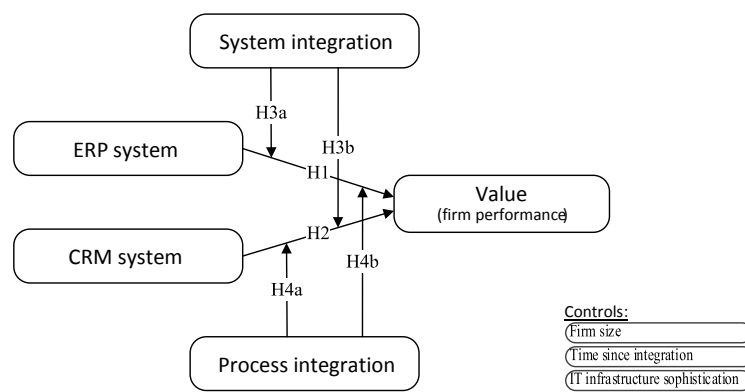


Figure 1. Research Model to assess ERP and CRM integrative value

Taking is consideration the theoretical background presented above, whereas ERP systems focus on internal process and are expected to affect internal firm's operations by decreasing internal costs, CRM systems focus on external, intra-firm's process efficiency and effectiveness by decreasing external coordination costs and reap the benefits of customer relationships. In this line we postulate the following two hypotheses:

H1: Firm's with greater ERP system functionality are more likely to find value from their information system.

H2: Firm's with greater CRM system functionality are more likely to find value from their information system.

Integrating ERP and CRM is very complex. An ERP systems generally embeds firm's business logic, where the routines, rules procedures such as procurement, fulfillment, approvals are made over electronic transactions, CRM functions must generally adapt to the logic and therefore a successfully integration between ERP and CRM systems is considered to be valuable, heterogeneously distributed, difficult to be imitated and difficult to be substituted, which is in accordance with RBV rationales [21-23, 30, 44].

Whereas system integration is the IT component that creates the correct links between different information systems and databases, process integration is the extent to which the business process of the two systems are tightly linked and standardized into what could be described as a single information system. Moreover although system integration facilitates the business process integration, by itself does not guarantee firm's high levels of business process integration. It is only when they are measured in conjunction that will have a positive impact on firm performance [12, 30, 37]. In this study we adopt the same perspective and define the moderating effect of both system integration and process integration. Hence, we postulate the following four hypotheses:

H3a: System integration will reinforce the positive relationship between ERP and the value of the firm's information system.

H3b: System integration will reinforce the positive relationship between CRM and the value of the firm's information system.

H4a: Business process integration will reinforce the positive relationship between ERP and the value of the firm's information system.

H4b: Business process integration will reinforce the positive relationship between CRM and the value of the firm's information system.

4. Controls

Prior studies suggest that three ancillary factors can influence ERP and CRM integrative value and firm performance. Firm size is used as a proxy for the resource base of the organization that may influence the integrative value and firm performance [45]. Time since both systems were integrated was included to measure the knowledge and experience that organizations obtain from working overtime [45]. IT related infrastructure sophistication assesses the differences in both generic and specialized systems that may affect the integrative value and impact on performance [45]. Hence, we will use three controls: Firm size, Time since integration, and IT infrastructure sophistication.

5. Research methodology (future work)

As the next steps for this research, we will develop an online questionnaire. Five research academics and five professional experts from ERP and CRM knowledge field will validate the content of the questionnaire. To assess constructs reliability, a pilot test with 30 firms and feedbacks will be incorporated. We plan to measure the constructs by using reflective items on a five-point Likert-type scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5).

With the assistance of IDC, a world leading source for commercial information and insights on businesses, a largescale survey will target several firms around Europe for data collection in June 2014. Due to the nature of the research model and the fact that it has not been tested in the past, the data analysis will be supported by Partial Least Squares (PLS) [46].

6. Concluding remarks

In this paper we suggest a research model that aims at exploring the integrative value of ERP and CRM systems. It is a first attempt to produce knowledge on the overall research question: how can integrative value from ERP and CRM systems be explained. To deal with this question we presented in this paper the development of a theoretical model that attempts to measure ERP and CRM integrative value using a well-established IS theory - resource-based view (RBV). In doing so, we contribute to the IT value literature by examining through an original lens - the complementarity value of the integration of these two resources. Our work focuses on explaining how integrative value is gained from the two resources ERP and CRM systems as well as the impact they have on firm's performance. This project will continue with the development of the questionnaire and then analyses of collected data through the use PLS. The research project aims at producing contributions both to theory as well as practice by producing new knowledge on how integration between systems can positively influence value from IT investments, but also how different software such as ERP and CRM provides value to systems integration as well as process integration.

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